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NOVEMBER 1982

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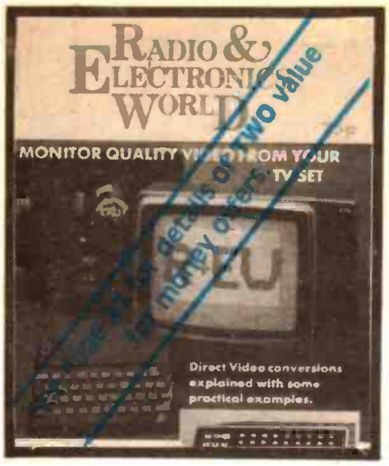

R&EW

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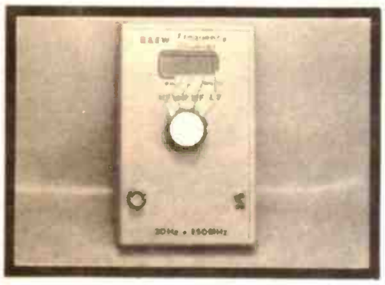

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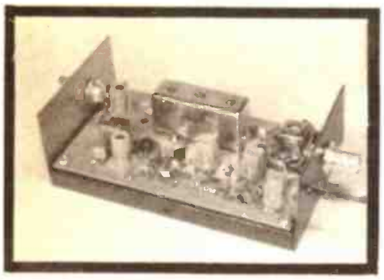

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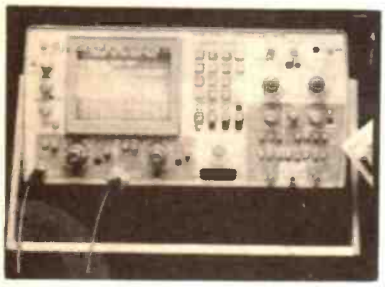

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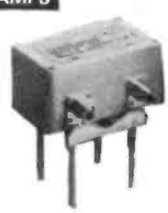

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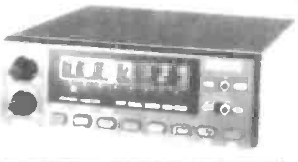

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Comment

WHERE ARE WE NOW?

If you can overlook the small matter that our cover date and appearance date do not tally too closely, then this is the grand CB anniversary issue. Excuse us if we don't go too wild with excitement or enthusiasm.

Those who saw CB as the long awaited licence to print money have had an unpleasant awakening - and those who smugly declared it would all be a terrible commercial debacle have been glowing with self-satisfaction. But as usual, the situation is not quite so simply assessed and dismissed.

The lucky few who had rigs for sale on the first day made a killing, and the rest didn't. A predictably narrow minded approach to the use of the CB channels brought about exactly the sort of mindless garbage that everyone expected to hear - although those with enough vision to see past the 'rubber ducks' have made CB work with the use of devices such as selective calling.

The unecessary obscenities and excesses with illegal power amplifiers have permitted the Home Office Jonahs to gleefully mumble 'told you so'....and the CB fraternity has been in general disarray trying to decide whether or not to go legal, or stay on AM.

A once-in-a-lifetime golden opportunity has been missed to establish a brand new manufacturing and service industry. Our balance of payments has suffered, the CB using public has done itself very little good, serious PMR users have been inconvenienced, many companies have suffered ruin, and the HO has coined in a few bob on the licence fee. Not much of a cause to celebrate, eh?

FOR WHOM THE BELL TOLLS

In case you didn't see the financial pages following the report of British Telecom's annual results, most commercial organisations would have been inclined to account in a slightly different manner, which shows BT's profit to have been £999 million for the year. It's a matter of the type of cost accounting system employed, and the amount you set aside for capital write-offs.

And yet the 'phone charges were still going up. Despite the fact that every other high technology electronics industry has been watching costs tumble and prices collapse, BT manage to weep crocodile tears and increase their costs. However, in the areas where they have been flung open to competition, it is very enlightening to see how they have actually managed to cut their costs and compete without any public arm twisting.

Are they now going to subsidize their competitive activities from the one area where they still possess their licence to print money, and thus compromise those others not so fortunate?

Is it bells of cash registers that ring in the ears of Sir George Jefferson, and not those of reasonably priced telephones? The ignominious about-face as a result of the hue and cry raised by the press and public following the rattle of BT's till, goes to show that even that awful mutant canary can get its wings clipped now and again. The insensitivity displayed by BT management in the process is disquieting, to say the least.

WELCOME TO THE FOLD

The listing of editorial staff on this page shows that the position of Assistant Editor advertised in our September issue has been filled by Paul Coster. Paul joins us, having left his job as an Editorial Assistant on Hobby Electronics. The injection of new blood into the editorial team will mean that the rest of the staff won't have to sweat it each month, in order to produce the magazine. It will also give us the ability to expand our coverage and to add more depth to our existing features.

All this can only mean bigger and better issues of **R&EW** in the future. Watch out for a number of first rate projects and some 'scoop' features scheduled for the months to come.

NEW PRODUCTS

MOTOROLA SELLS EXORset

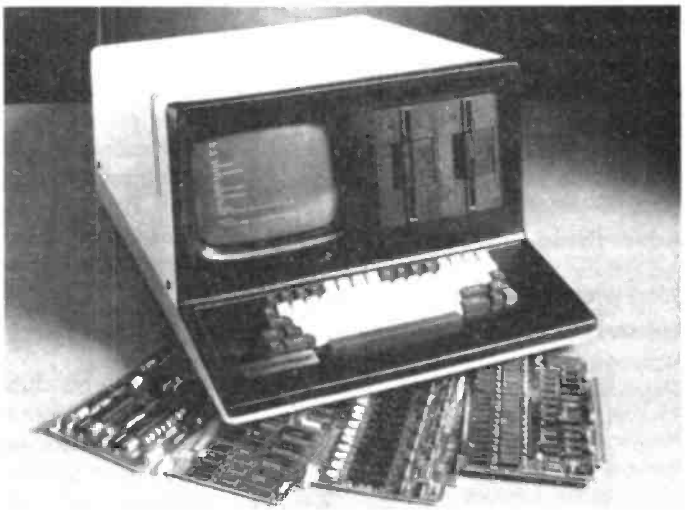
Expanding its line of packaged microcomputer systems, Motorola's Semiconductor Products Sector has followed up the introduction of its VMC 68/2 16/32-bit system with a new 8/16-bit desk-top controller. Called the EXORset 35, the new controller is a versatile system that can be connected for a variety of industrial and lab automation, data acquisition and analysis applications.

This one compact, desk-top unit offers not only high performance for control and data manipulation, but also has a complete user interface plus optional mass storage on floppy disks.

The EXORset controller is based on the new generation 8/16-bit dynamic RAM and three strappable sockets that can be configured for 1K, 2K, 4K, or 8K ROMs. A fourth socket (normally containing the 4K EXORbug firmware) can be configured for a user-designed monitor routine. The EXORset 35 memory map is defined by PROMs, allowing the user to easily re-configure the architecture of the system.

The EXORset 35 provides, as on-board I/O devices, an asynchronous serial communications port, a 16-bit parallel port and a triple 16-bit programmable counter/timer device.

The serial communications port has strap-selectable interface options of RS-232C, RS-422 or RS-423 and can be configured as a terminal or



microprocessor MC6809. The expanded instruction set, addressing modes and architecture, make execution of software particularly efficient and allow sophisticated programming techniques such as structuring, position independent coding, re-entrant routines and real-time operations. These capabilities make the MC6809 microprocessor suitable for high-level language program development.

With the EXORset 35, the user has a complete man/machine interface consisting of a full-size ASCII keyboard and 16 user-assigned function keys. Also, a high resolution 9" CRT display capable of displaying 22 lines of 80 or 16 lines of 40 upper or lower case characters and simultaneously a full 320 x 256 dot graphic image.

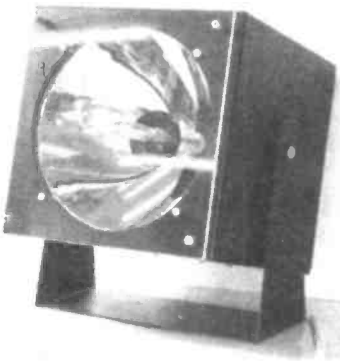
The EXORset 35 controller allows for flexibility in the type and amount of memory to be used in the application. Three versions are available: the 351-0 with no floppy disk drives;
351-1 with one double-sided mini-floppy disk drive for 164K bytes of mass storage, and 351-2 with two disk drives for 328K bytes of mass storage.

All three versions include 2K bytes of dynamic RAM for CRT character refresh, 56K bytes of a modem. The baud rate is software programmable from 110 to 19.2K baud. For additional flexibility, the asynchronous device can be replaced with an SSDA device for synchronous communication application.

The parallel port has four handshake lines in addition to the 16-bit data port. This port consists of a fully buffered PIA device with a pin-out that is compatible with a standard Centronics printer type interface.

A four-slot card cage with bus connectors for installing additional EXORbus compatible modules available from Motorola, amongst others, is offered by the EXORset 35 controller. With the wide selection of I/O functions available on EXORbus, the EXORset unit can be tailored to fit a variety of user applications of differing I/O requirements such as IEEE 488 instrumentation control, serial communications, analog I/O functions, parallel digital I/O or high-speed arithmetic functions. In those versions that have a disk drive, one of the four slots is occupied by the floppy disk controller module.

Further information contact:
Motorola,
88 Tanners Drive,
MILTON KEYNES.



A FLASHER FOR XMAS

A new High Power Strobe suitable for the home and disco use has been made available by Argon Electronics. The kit contains everything; even solder and a 13 amp plug! Construction is very straight forward due to the legenda PCB and idiot-proof instructions. The flash rate is variable from 1.5 - 13 flashes per second, with an output of 40 watts at 13 FPS. The Strobe features a fully isolated supply, with 120/240 V AC input and a highly polished reflector and vented steel case, which is finished in durable black resin, together with a swivel stand for floor or ceiling mounting. An etched black aluminium panel label gives the Strobe that proffessional finish which most kits seem to lack.

A kit for a Remote Triggering Unit is also available for use with the Strobe. This has variable flash rate and single flash operation. Both the Strobe and Remote Trigger unit are compatible with most other commercially available units and each kit carries a conditional one year guarantee.

Prices are:

Strobe £72.50 and Remote Trigger Unit £14.50 (including VAT and P&P)

Argon Electronics,
P.O. Box 326,
CHELMSFORD, CM2 OYR.

MINIATURE TRANSFORMERS

Recently released onto the electronics market is a range of miniature PCB mounting transformers. Manufactured by Avel-Lindberg, these power transformers will find their main application in equipment where space-saving is an important consideration. Each device is made using separately wound bobbins for the primary and secondary, thus ensuring maximum isolation and low inter-winding capacitance. Another result of this construction is the toroidal characteristics produced, with low radiated noise and high efficency.

The transformers can be supplied for any load in the range 2- 30VA and work from 230V or 115V AC mains input. Output voltages are determined, by either series or parallel connection (5-48V), from a set of tappings.

The complete range are cased in resin-filled thermoplastic with PCB pin connectors. A secure mount is ensured by using four screws through the corners of the case. All transformers undergo rigorous testing to conform to national and international safety standards.

For further information contact:

Avel-Lindberg Limited,
South Ockendon,
ESSEX, RM15 5TD.

LOW COST LCD COUNTERS

The LE-C7224 family of panel-mounting liquid crystal counter modules, recently announced by Lascar Electronics, have ultra-low current consumption of typically 100 micro-amps. A small depth behind the panel is required, ensuring ease of use within portable instruments. A mounting bezel is also supplied.

The 4.5 digit display is incorporated for applications such as high resolution event counters, timers and frequency meters. Standard features include programmable decimal points, store, enable and reset controls.

For further information:

Lascar Electronis Ltd.,
Reeves Way,
South Woodham Ferrers,
ESSEX, CM13 5XQ.

NEW PRODUCTS

TEST GEAR FROM TORQUAY

Following a manufacturing agreement with a major electronics company in Japan, Sifam Ltd., of Torquay--Britain's leading manufacturer of panel meters and control knobs--is now marketing a range of own-name test instruments and accessories. The first group to include bench and hand-held multimeters and a digital logic probe.

Sifam claims that the equipment offers outstanding technical specifications, quality and performance at prices from 10 to 40 per cent less than similar units. The company believes that the cost/performance characteristics will be attractive to professional users for production line, laboratory, research, repair and maintenance applications, as well as to semi- professional, DIY and amateur radio enthusiasts.

The DMM2200B is a hand-held 3.5 digit multimeter, with 21 ranges in five modes (DC & AC voltage and current, and resistance) and basic accuracy of 0.3 per cent (DCV). The instrument will operate continuously for 1000 hours from a standard 9V radio-type battery, and has overload protection, auto-zero and auto-polarity facilities as well as over-range and low-battery indications.

Robustly constructed--two rotary switches provide clear and simple colour-coded selection of measurement mode and range--the read-out is by 12mm high LCD digits. It measures 165 x 110 x 43mm, weighs 360 grammes with battery, and is supplied complete with test leads, spare fuse, battery and operators' manual. Price is £43.43 plus VAT.

The bench version of this meter is the DMM2500. With 24 ranges in the same five DC/AC measurement modes/and the same order of accuracy and operational features, but having push-button function/range switching, 2000 hours battery life and circuit- breaker overload protection. It has a built-in bench stand/handle, measures 155 x 120 x 57 mm and weighs 383 grammes with battery. It is supplied with test leads, battery and manual and costs £66.04 plus VAT.

The third of this group is a Digital Logic Probe, model DLP50, compatible with DTL, TTL and CMOS standards. It offers exceptional value for money, has an input frequency range of DC to 50 MHz with a minimum detectable input pulse width of 10 nanosecs and high input impedance of 10 megohms. The power range is 4.5 to 30V DC with input protection (including an audible warning) up to + 120V DC or AC.

There are three-colour LEDs, which signal high (red), low (green), open-circuit/bad level (yellow) and pulse/memory (red) states. The audible alarm sounds if an input signal exceeds the operating voltage of the circuit under test, or when a voltage in excess of 30V DC is applied to the probe input.

The probe is fitted with an 800 mm long power lead, and has a consumption of 50 mA maximum at 5V DC. Supplied in a moulded carrying case, it comes complete with ground and IC clip leads and operating manual. Price is £39.09 + VAT.

Further information contact:

Sifam Limited
Woodland Road,
Torquay,
DEVON, TQ2 7AY.

FOR SALE

Two new catalogues have just landed on the news desk: one is the Eagle product lines for 1982-83 and the other the latest electronic components and hardware catalogue from Ambit. Both have glossy full-colour covers, Eagle sporting their famous 'Eagles Head' logo and Ambit displaying a selection of popular projects.

The Eagle catalogue includes intercoms, PA equipment, mics and mixers, hi-fi, test equipment and audio accessories. All the pages are in colour with accompanying descriptions and specifications.

For further details contact:

Eagle International,
Precision Centre,
Heather Park Drive,
Wembly, HAO 1SU.

The catalogue from Ambit costs 70p and is packed full of components, hardware, test gear and just about everything the electronics constructor would ever need. With 128 pages, complete with photographs and diagrams, it's well worth a browse- especially since they've added several new products.

Send to: *Ambit International,*
200 North Service Road,
Brentwood,
ESSEX, CM14 4SG.

SINCLAIR GETS SOFT

Sinclair Research marked its appearance at the 1982 Personal Computer World Show by announcing a range of twenty- one office, educational and games cassettes for the ZX Spectrum.

With over 40,000 Spectrums already sold since the launch and world-wide sales of 400,000 predicted in the next year, the new software is the first step in Sinclair's planned development of a complete library of professional and general programs--the first series has been developed for Sinclair by ICL and Psion.

From Psion, two full-feature games cassettes, Space Raiders and Planetoids, the latter including 'Missile', both prices at £4.95; the subtle and amusing cartoon style Hungry Horace at £5.95; two substantial business programs, Vu-File and Vu-Calc, both at £8.95; Vu-3D, a graphics program for design applications at £9.95; a ten-level ability Chess cassette and an enhanced version of the popular ZX81 Flight Simulation program, both at £7.95

ICL's 'Games' series contains five cassettes, each at £4.95, ranging from the variety of Games 2, with Galactic Invasion, Drop a Brick, Silhouette Colour Doodle and Train Race, to the powerful Star Trail program which occupies Games 5.

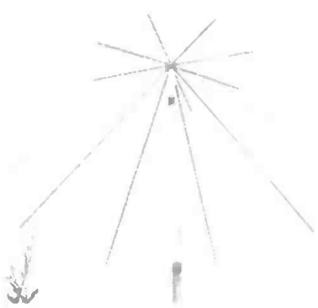
Eight further ICL cassettes complete the new range; five - English Literature, Inventions, Music, History and Geography forming the 'Fun to Learn' series, each at £6.95; two, the 'Pastimes' series, both at £4.95; and lastly a Biorhythms program, at £6.95, which enables the preparation of a chart of an individual's physical, emotional and intellectual highs and lows.

Prices are inclusive of VAT and all cassettes can be used with both 16K and 48K Spectrums, except Flight Simulation, Chess and Games 5 which require the full 48K. Most new cassettes are immediately available (mail order only) from:

Sinclair Research,
Stanhope Road,
Camberley,
SURREY.

● ●

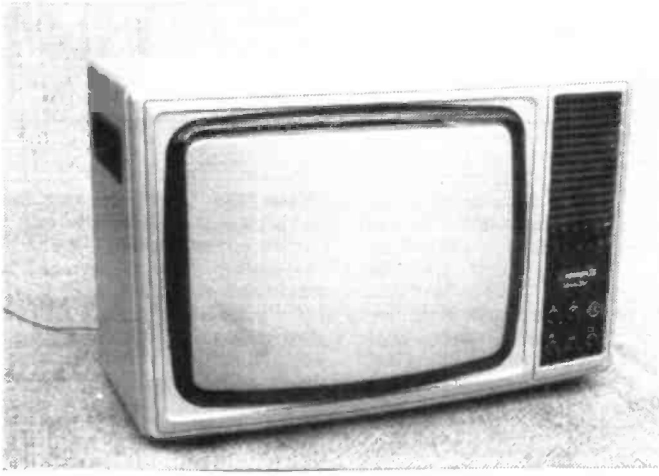
REVCO ANTENNA



Specially made for use with the SX-200-N Scanning Receiver is the Revcone 2050 broadband Antenna. Manufactured by Revco and marketed by Garex Electronics, this aerial is of lightweight construction and covers the full VHF-UHF bands. It is made using weatherproof chromed-alloy and includes a 1.1/4" stub mast and SO239 connectors. Total length is 40" and the price is £24.95 including postage and VAT.

Garex Electronics,
7 Norvic Road,
Herts. HP23 4LS.

DIRECT VIDEO INTERFACING



A couple of designs that allow two widely available television chassis to be converted for direct video entry - monitor quality at a budget price. Designs by A.S. Warne, T. Eng. CEI, Msert, G4EXO (Thorn TX9) and Roger Ray (Amstrad CTV 1400).

It is becoming common practice for video tape recorder and home computer manufacturers to provide video output as well as RF output sockets on their equipment. The majority of VCRs and computers are used in conjunction with a standard 625 line UHF television which can be directly connected to the RF sockets on this equipment. Although picture quality is reasonable using this method, a direct video output connection will give a far better definition.

Figure 1 shows the difference in signal path between the direct video interface and the RF interface. By introducing an RF modulator into the computer or VCR the composite video signal can be superimposed onto a vision carrier and driven to the television aerial socket.

When the signal reaches the television, RF amplification and down conversion is carried out by the UHF tuner giving a 39.5 MHz intermediate frequency. Further amplification and detection then re-establishes the video signal.

Processing the video signal in this way can sometimes give undesirable effects. For example:

1. Patterning due to intermodulation products in the RF modulator and TV tuner, or adjacent channel interference from high power local stations near to the modulator output frequency normally channel 36 or 37 (591.25 MHz and 599.25 MHz).
2. Regular retuning of the TV caused by poor oscillator stability in the modulator.
3. Reduced definition as a result of bandwidth limitation in signal processing and detection.

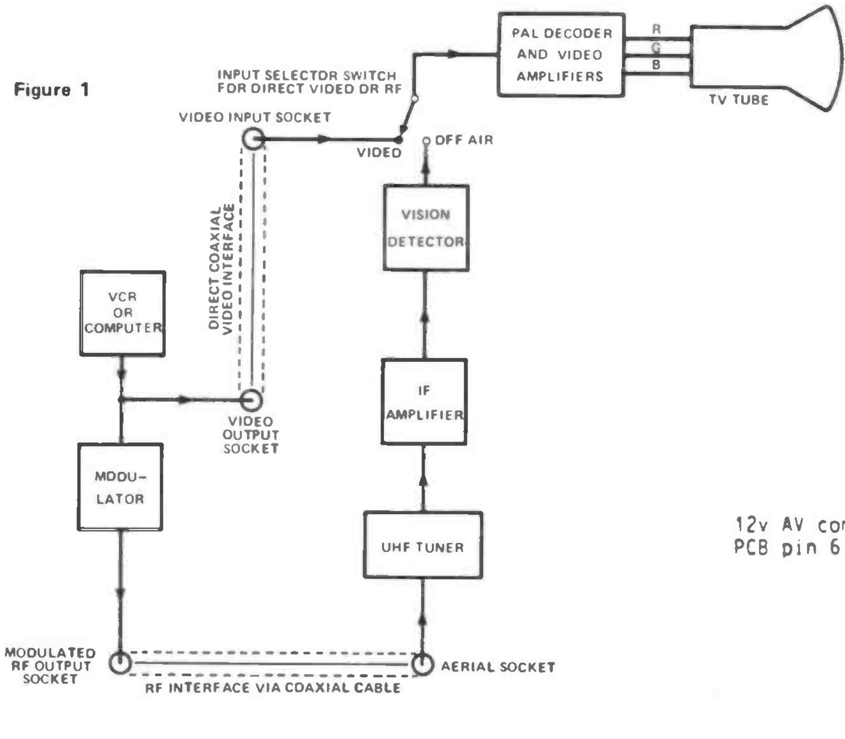
Direct video interfacing overcomes these problems and the **R&EW** interface boards allow two commercially available televisions to be easily modified for direct video and still maintain normal off air facilties.

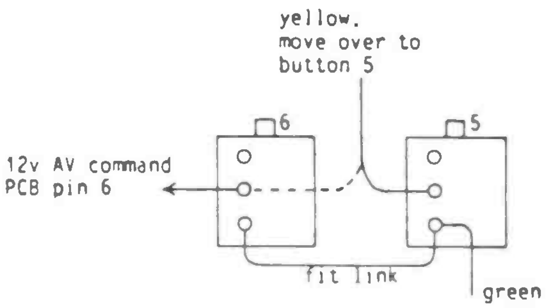
TX9 CONVERSION

The thorn TX9 chassis is used in a wide variety of sets with differing screen sizes. The conversion for this set provides the following facilities.

1. Operation with an upconverter for amateur television having the ability to synchronise the weakest of signals when looking for DX.
2. Video/Audio output sockets to record off air broadcast and amateur transmissions.
3. Video/Audio input sockets to operate as a PAL colour monitor to display colour camera, VCR and computer pictures.
4. A simple switching system to switch from off air to monitor without modifications to cabinet exterior and using the existing switch already available on the channel selector assembly.
5. Small screen size, good picture quality with low power consumption and using the most up to date circuit techniques and a possiblity of 12 volt operation.

The Ferguson 14' 'Movie Star' portable, incorporating the TX9 chassis was chosen as the basis for modification. It will operate satisfactorily from the mains with input voltages of between 185 and 265V. No mains input adjustment is required, and the set consumes only 58 watts when displaying a normal picture. As an optional extra, an inverter to operate the set from 12 or 24v DC supplies is available.



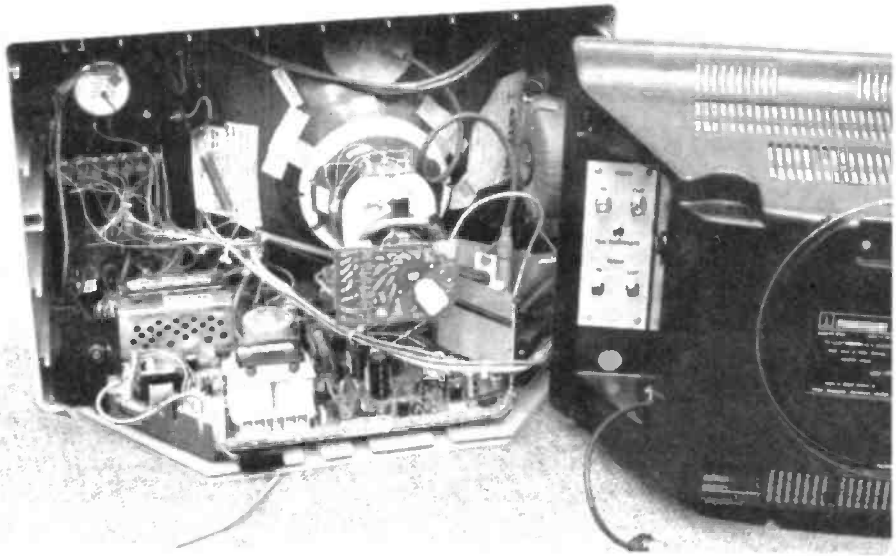


When used with an up-converter, the set works superbly and the sync circuits respond very well under weak signal conditions. If the set is to be used for the shack only, the UHF tuner can be modified to cover the 70cm band, but in this case a good pre- amplifier should also be used.

To convert the set to a video/sound monitor, the receiver must first be fitted with a small mains isolating transformer ILP electronics manufacture a range of such transformers (see ref. 1,2.). This transformer can mount inside the cabinet on the right hand side (from rear) or, if a DC unit is fitted, inside the rear cover.

The video/sound interface board may be fitted to the spare blank panel in the receiver's back cover. A bracket may be made to support the PCB and to form a metal panel for mounting the input/output sockets and video terminal switch.

Button 6 on the channel selector is already marked 'AV' (Audio Visual) and may be used to change over to video



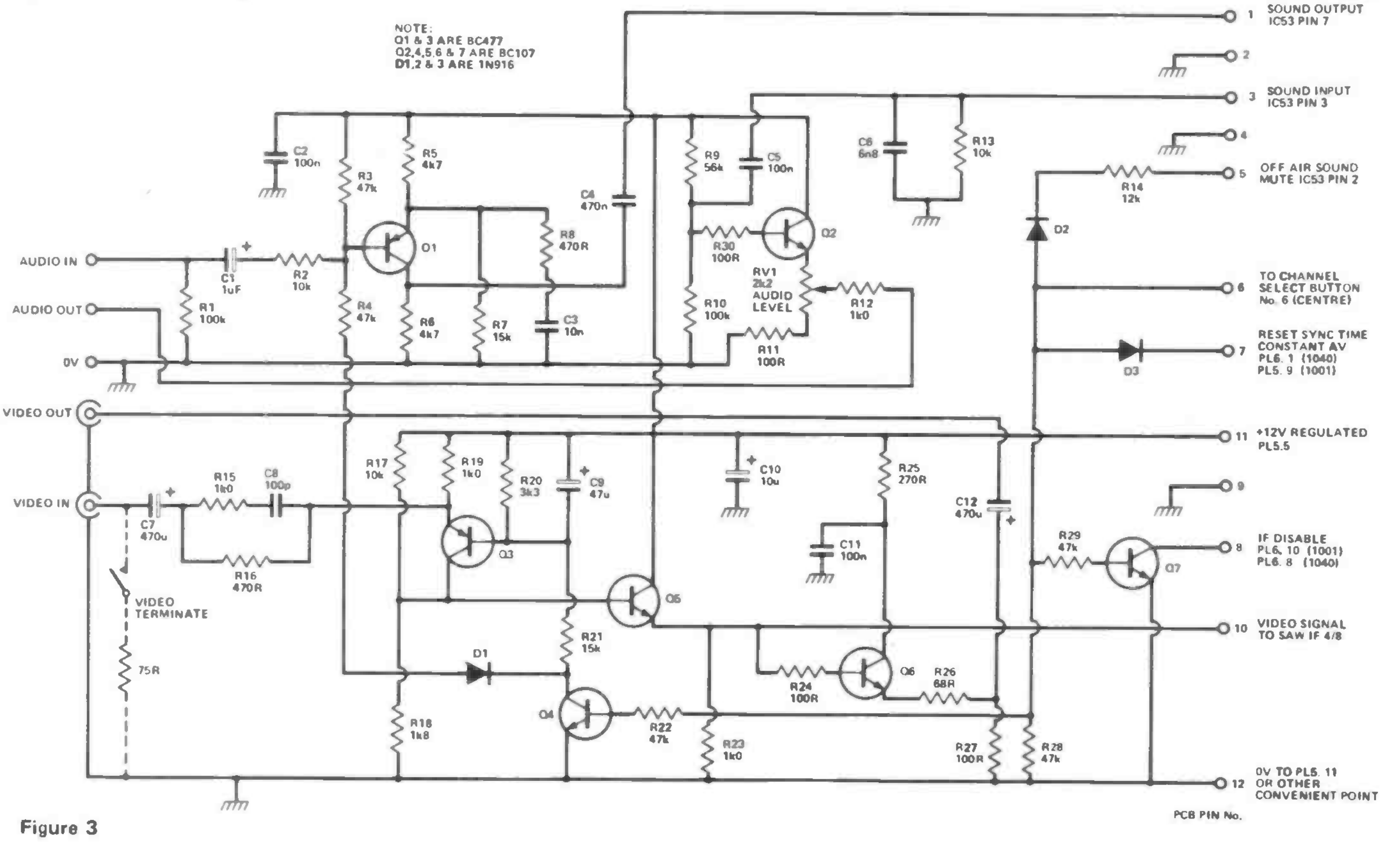


Figure 3

TX9 AUDIO VIDEO MOD

When receiving a normal off air signal via the aerial, video signals are extracted from the TX9 PCB via connector 10. On the interface board to R25. Emitter follower transistor Q5 buffers the signal to the video output socket.

A low level sound signal is available at IC53 pin 3 on the main board and is fed to emitter follower 6. RV1 forms part of the emitter resistor network of 6 and enables a level adjustment of the output audio signal to be made.

To use the receiver as a video monitor the channel selector button marked AV (audio visual) is pressed resulting in;

1. D3 conducting and applying a mute voltage via R32 to IC53 pin 2 disabling any off air or spurious sound signals entering the sound I.F. and demodulator (connector 5).

2. TR7 switches hard on, effectively grounding (connector 8) the receiver A.G.C. line. Off air picture and random patterning or noise are prevented from reaching the vision detector.

3. D2. conducts pulling pin 9 of IC54 high (connector 7) disabling the automatic phase gain switching circuit which provides AV compatible sync operation.

4. Also acts as a switch which enables 1 and 2 by grounding R4 via D1 and R22. As 1 ans 2 are enabled, audio input signals via C2, R2 are amplified by 1 and coupled via C3 to a low level audio input on IC53 pin 7 (connector 1) 2 is connected in grounded base and video input signals applied through C7,R16,R17,C8 to the emitter. The amplified signal at the collector of 2 is then fed to the base of emitter follower 4.

TR4 buffers the video signal between the interface board (connector 10) and video input of VT51 luminence amplifier because R25 is also connected to TR4 emitter the R28 and C12 to the video output socket giving loop through facilities i.e. provision for connecting a series of monitors together to display the same picture. Loop through of sound signals are also available as audio input signals which have already arrived at IC53 pin 7 via 1 are retrieved at pin 3 and fed to the audio output socket via 6.

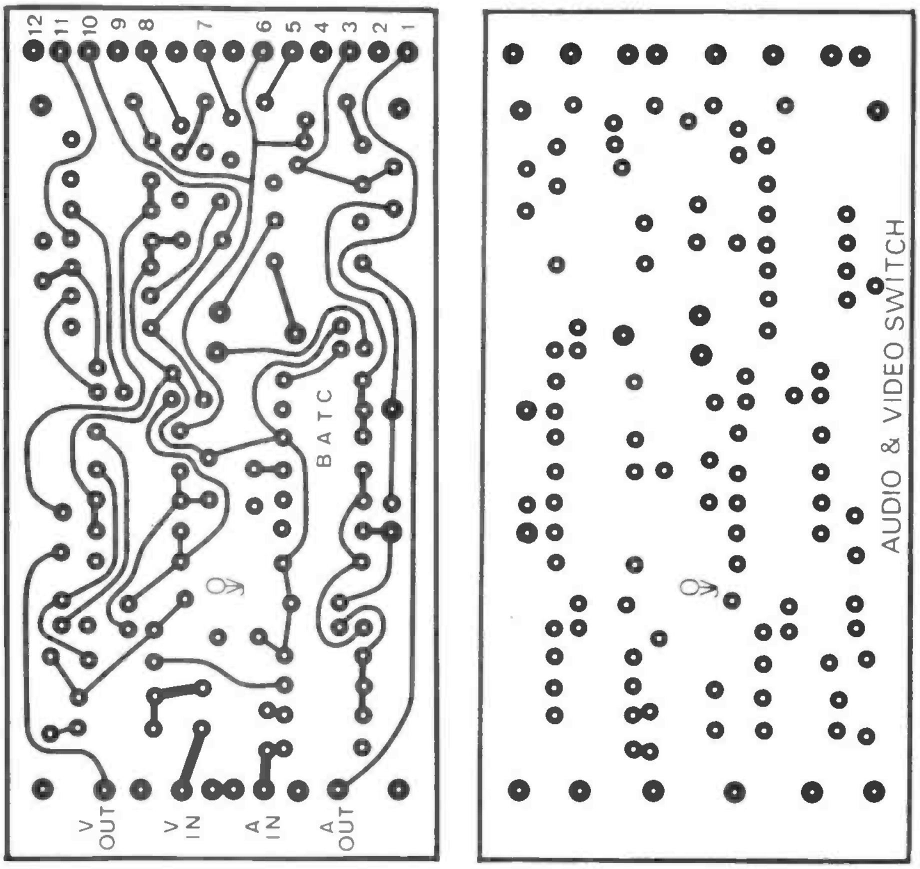


Figure4. PCB foil pattern.

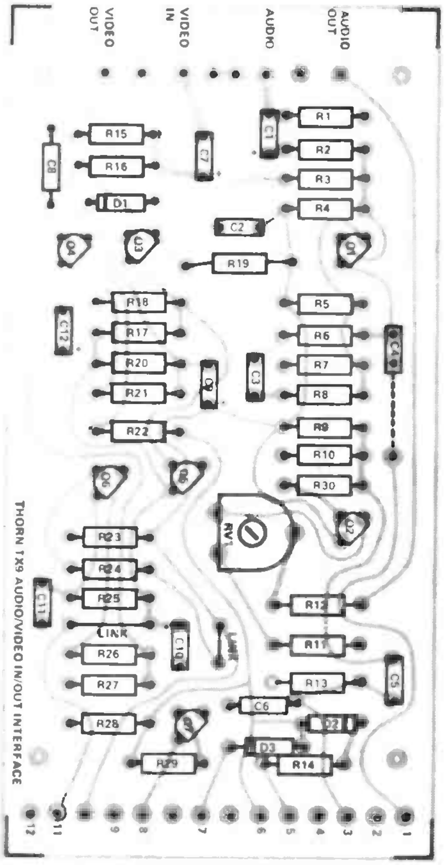
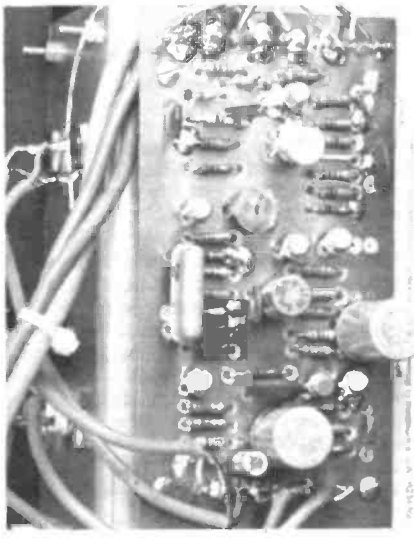


Figure 5 Overlay.

monitor when depressed. The normal function of this button, apart from channel selecting, is to switch a 12v supply via R207 to pin 9 of the TDA9503 sync IC. This alters the time constant providing sync correction when using video tape recorders. By utilising this 12v feed it is posible to electronically switch to video.

To maintain the VCR input facility with a UHF input, spare 'AV' contacts on button 5 should be wired as shown in *fig. 2*. This means that button 5 now takes on the previous function of button 6.

Sound may be carried via the interface board using the unused connections of the



sound IF and audio output IC - TDA10355.

There are two versions of the TX9 main chassis at present in production. The early type is fitted with an NEC Luma-Chroma Processor - uPC1365C. This chassis is coded 1001. The later type is fitted with a Mullard processor - TDA3560 and is coded 1040. Interface details are given for both types where differences occur.

Figure 3 shows the complete circuit of the interface which is contained on a single printed circuit board. Connections to the board are also shown. Be sure to use 75 R coax cable and screened audio cables where indicated. *Figure 4* shows the print pattern of the PCB (not full size) and the component layout is shown in *Fig. 5*.

The modification may proceed in the following order:-

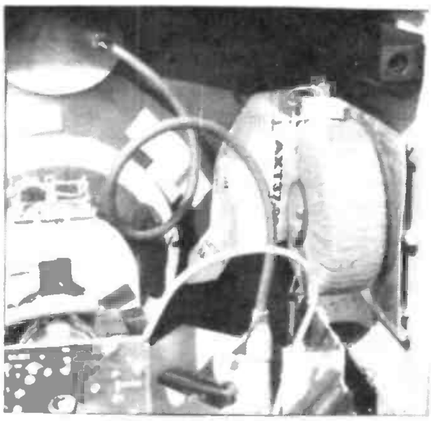
1) Fit the mains isolating transformer and check that the receiver operates correctly.

2) Remove the yellow wire from the centre pin of No. 6 channel selector and connect it to the centre pin of channel 5 button (*Fig. 2*).

3) Fit a green link wire between the rear pin of No. 6 channel selector and the rear pin of No.5 channel selector, leaving the existing green wire in place.

4) Attach suitable length leads to the PC board noting the colours used as an aid to identification.

5) Fit the PC board to a bracket and fit the assembly to the rear cover.



Mounting details of Isolating Transformer

6) Connect board-pin 6 lead to the centre pin of No. 6 channel selector.

7) Pin 3 of the sound IC (IC53) should be disconnected from ground. This may be accomplished either by cutting the PC track around that pin or by withdrawing the pin from its hole and bending it out clear of the main PCB.

8)Connect the audio input and output cables to the IC pins as indicated (*Fig. 3*). The braiding need not be connected at the IC end.

9) Connect all other leads to the receiver PCB as indicated (*Fig. 5*).

0) Connect leads to the input/output sockets on the rear panel.

1) Terminate the video input in 75 R and

COMPONENTS LIST

Resistors (All ¼W, 5%)

R1,10	100k
R2,17,13	10k
R3,4,22,28,29	47k
R5,6	4k7
R7,21	15k
R8,16	470R
R9	56k
R11,24,27	100R
R12,15,19,23	1k0
R13	10k
R14	12k
R18	1k8
R20	3k3
R25	270R
R26	68R

Capacitors

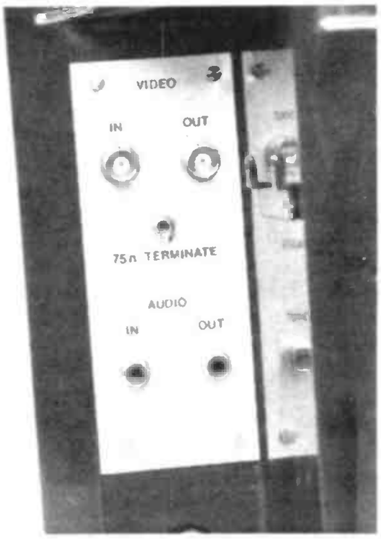
C1	1uF 16V elec
C2,5,11	100n poly,
C3	10n poly
C4	470n poly
C6	6n8 poly
C7,12	470u 16V elec
C8	100p ceramic
C9	47u 16V elec
C10	10u 16V elec

Semiconductors

Q1,3	BC477/BC307
Q2,4,5,6,7	BC107/BC237
D1,2,3	1N4148

Miscellaneous

PCB, wire etc.
Transformer



connect a composite video signal to the input socket.

2) Depress channel 6 button and switch on the receiver. Check that a picture is displayed correctly.

3) Connect the video output to a monitor or an oscilloscope and ensure that a correct picture/waveform is obtained.

4) Check the audio system by applying a low-level signal to the input and then extracting an audio signal from the output - adjusting the level with the pre-set control as required. A VCR or audio tape recorder may be used for these checks.

5) Dress the wires and clip them neatly together to form a cable loom.

All leads which are to connect to the underside of the RX PCB may be routed through an existing hole near to IC53, this hole (which may be covered by a round sticker) may need enlarging.

To assist in wiring the channel select buttons, two screws may be removed from the rear of the front panel (*Fig. 7*) to allow the panel to drop out making it easier to work on.

REFERENCES:

1. 3X030, 80VA, 240v secondary. ILP Electronics Ltd., Graham Bell House, Roper Close, CANTERBURY, Kent. CT2 7EP.

2. VT24825 isolating transformer. St. Ives Windings Ltd., Industrial Estate, Somersham Road, St. Ives, Cambs. (possibly only in small or large quantities).

ACKNOWLEDGEMENTS

M.T. Crampton and J.L. Wood, British Amateur TV Club for their assistance with printed board and documentation. Thorn EMI Ferguson, Bradford Engineering Centre for their technical assistance.

FOOTNOTE

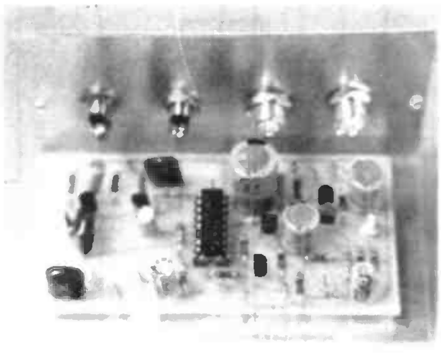
The complete service manual for the TX9 may be obtained from: Thorm EMI Ferguson Ltd., Service Division, P.O. Box 121, Lea Valley Trading Estate, Angel Road, Edmonton, London, N18 3BP.

AMSTRAD CTV1400

The recent introduction of the Amstrad CTV1400 ,available for £150,makes available a good TV receiver at a very reasonable price. The sets' usefulness can be enhanced by converting it for use as a monitor with video/audio in/out sockets. The requirement for these modifications is made clear in the accompanying article covering modification of the Thorn TX9 chassis. Video input can be taken from a VCR, computer, camera, TV game etc, and applied directly to the video circuitry of the CTV1400. Thus removing stages of modulation and demodulation from the system usually employed.

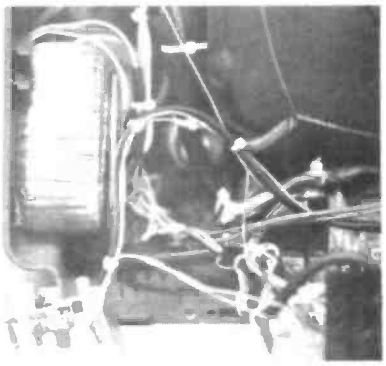
The first requirement when modifying a colour TV for use as a monitor is to provide isolation from the mains. To simplify the power supply most TV sets connect mains neutral to the chassis. Because of this a direct connection from any circuitry on a conventional TV to the outside world cannot be made due to the potential difference between mains neutral and earth. A lethal hazard exists if the mains plug has been wired the wrong way around, with this system.

Isolation from the mains is made by use



of a toroidal transformer which gives 240V A.C. out for 240V A.C. in. Mains live and neutral connections are routed to the transformer's primary winding via the sets' 2 pole on/off switch. The 240V A.C. supply for the TV is now taken from the transformer's secondary and the chassis connected to mains earth. Once isolation from the mains has been accomplished any low voltage signals within the TV set can be brought out for use externally.

This modification to the CTV1400 chassis makes use of a CMOS switch to switch between off-air sound/vision and an external sound and vision input. Off-air signals are always available externally



whether the set is being used conventionally or as a monitor. Switch-over to monitor is activated by depressing the 'VCR' button on the front panel of the TV set.

CONSTRUCTION

The switching circuitry is built on a single sided pcb etched as shown in *Fig.*7 . Assemble the components as shown on the overlay *Fig.*8 Use an I.C. socket for ICI and take care to insert the electrolytic capacitors and transistors the right way around. Vero pins are used in positions where wires are connected to the board.

The assembled PCB is mounted on an L-shaped aluminium bracket bent as shown in *Fig.* , using 6 B.A. screws. The two BNC and two phono sockets are mounted directly on this bracket and wired to the board. The assembled bracket mounts on the back cover of the TV set. An aperture for the sockets is made by very carefully cutting out a rectangle moulded into the cover, by using a Stanley knife (see photograph). The bracket is mounted on the inside of the cover using self tapping screws to allow the cover to be removed leaving the bracket in place.

Connections between the switching board and TV chassis can now be made. Identifying the correct positions and components on the chassis is the most difficult part of the operation, although this is made easier by Amstrad providing a legend on both sides of the chassis.

Remove the five screws holding the channel switching panel, and solder a wire into a spare hole on the track between D402 and SW401 (A). The panel can now be screwed back in place. Next remove the negative lead of C606 mounted next to IC601 in the back left- hand side of the CTV1400 chassis. Connect a wire to the capacitor (C) and a wire to the hole left in the board (B), these go to the audio input/output pins on the switching board. Remove the R627, L604, CF602 end of R647 (330R) from the chassis, and connect the end of (D) to the centre of a length of minaiture coax, connect a similar length of coax to the remaining hole from where the end of R647 was removed (E). The braid of the coax can be connected to any convenient earth position. Connect the cables to the switching board the wires going to video out/in respectively.

The original sync circuitry is disconnected by lifting the end of R621 connected to the emitter of Q602 (note* this resistor is wrongly marked as R703 on the Amstrad circuit). The lifted end of the resistor (F) is now connected to the sync output from the switching board.

Connect an earth between the board and chassis and a 12V supply (conveniently connected to non-I.C. end of R688) and the interconnections are complete.

COMPONENTS LIST

Resistors (All ¼W, 5%)

R1	75R
R2	68k
R3	22k
R4	1k
R5	470R
R6,7,16	560R
R8	220R
R9,11,14	100k
R10	10R
R12,13	1k2
R15	4k7
R17	68R
R18,21	330R
R19,20	47K

Capacitors

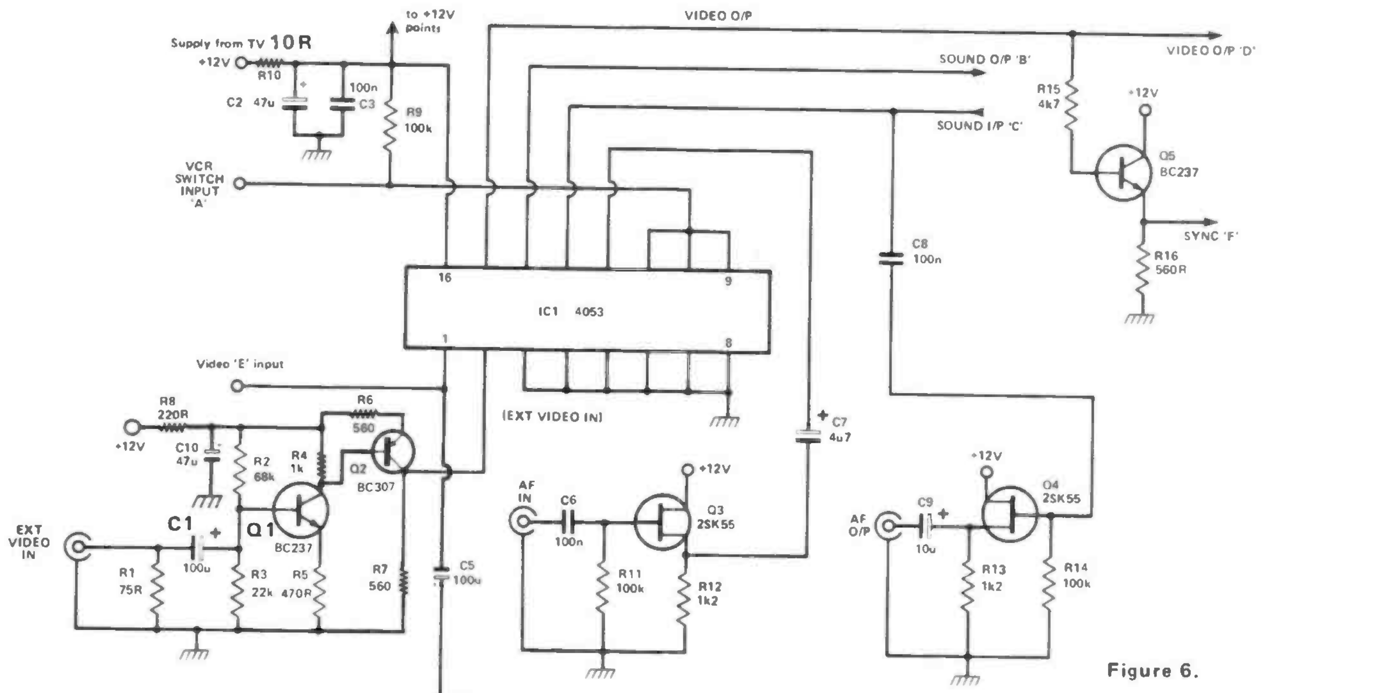
C1,5	100n 16V
C2,10	47u 16V
C3,6,8	100n Mylar
C4	470u 10V
C7	4u7 16V
C9	10u 16V

Semiconductors

Q1,5,6	BC237
Q2	BC307
Q3,4	2SK55
IC1	4053

Miscellaneous

2 BNC sockets, 2 phono sockets, PCB, wire, IC socket (16 pin), aluminium bracket, toroidal transformer 240V/240V 120VA (I.L.P. 42030).



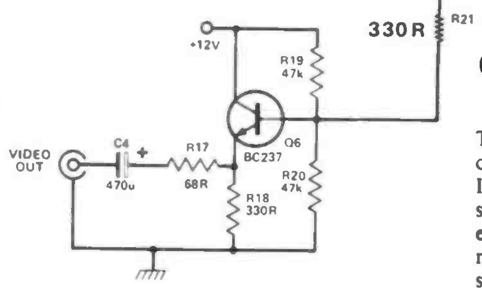


Figure 6.

CIRCUIT DESCRIPTION

The circuit diagram is shown in *Fig* 6 . The heart of the system is a three pole change- over switch IC1. This CMOS switch selects either off-air sound and vision signals or those applied externally. The logic inputs of the switches are normally held high by R5, however when the set's 'VCR' button is depressed the inputs go low. In the logic 'high' position off-air video applied to pin 1 IC1 is routed to pin 15 and hence to the monitor portion of the TV set. At the same time off-air audio on pin 13 is routed to the audio amplifier via pin 14.

Off-air video is buffered by Q2 which provides a 75R output, while off-air audio is buffered by source follower Q4. External video is applied to Q1,R1 a 75R terminating impedance, provides while the transistor forms an amplifier with a gain of 2 to bring the signal up to the required 2Vp-p. Q3 turns the inverted video back up the right way and provides the correct DC conditions for driving the monitor circuitry via IC1.

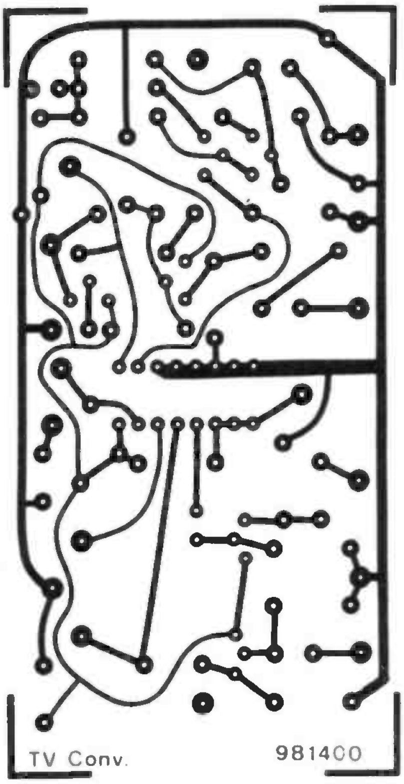


Figure 7 PCB foil pattern

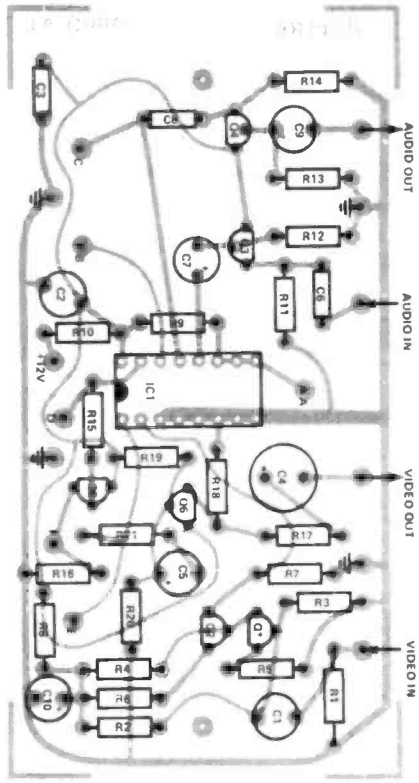


Figure 8 Overlay

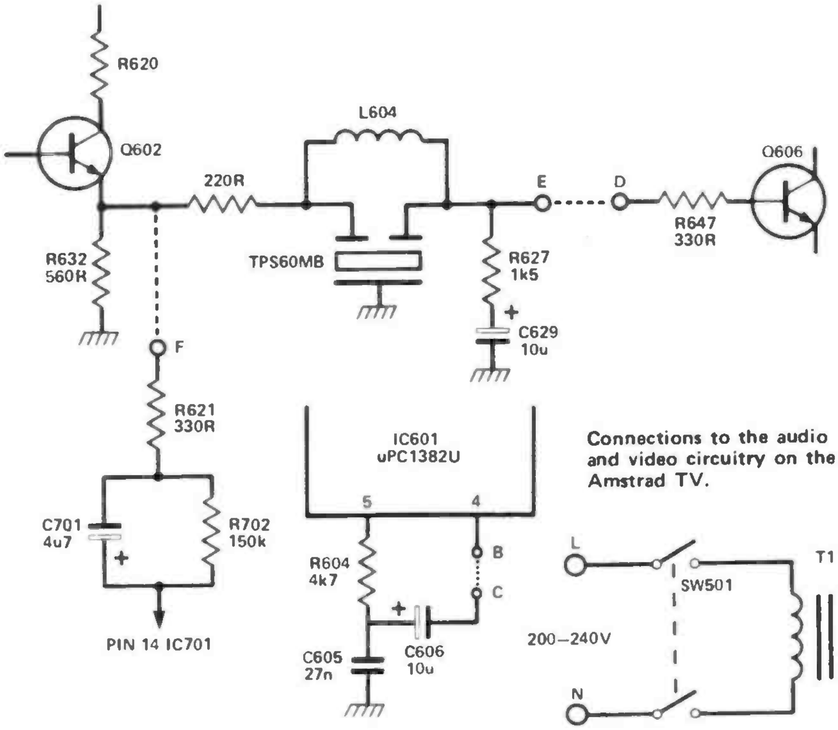
USING THE TV/MONITOR

When any channel 1-7 is selected the TV works normally. When the 'VCR' channel is selected the set becomes a monitor taking sound and video from the sockets on the rear panel.

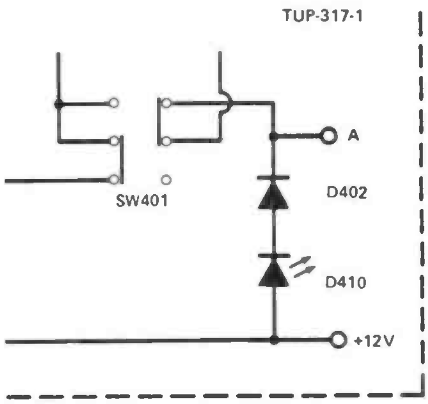
When the set is being used as a monitor off-air sound and vision is still available on the rear panel. To tune to a station when in the 'VCR' position, it is necessary to use an external link between Video IN and OUT. Video outputs and the required video input conform to the usual IV p-p standard.

POSTSCRIPT

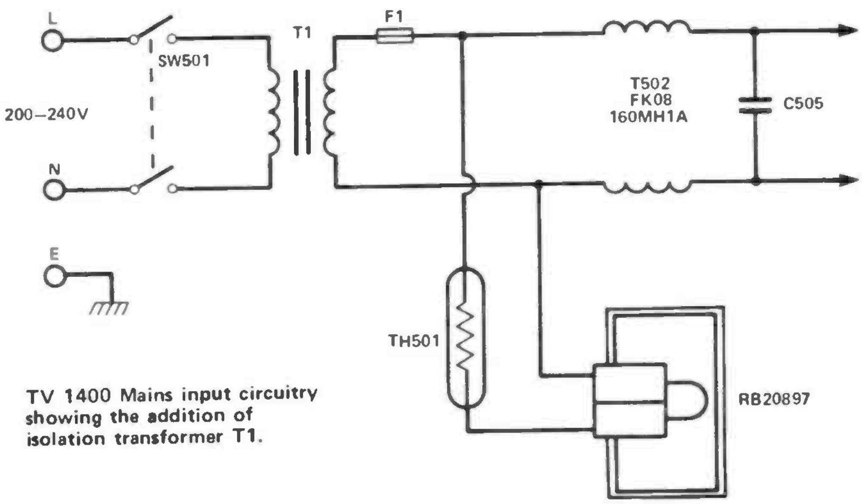
The modified TV was used at the recent Personal Computer World show at the Barbican and generated a good deal of interest. Several BBC computer owners asked about RGB - input modifications as the computer's video output is black and white only! Our experiments showed that colour video output could be accomplished with the addition of one small capacitor. Still RGB monitors provide better resolution, so to this end in forthcoming **R&EW's** we will be featuring: 1)a high resolution RGB monitor project, 2)RGB input modification to the CTV1400, and 3)direct video input to the large Thorn TX10 TVs (without the need to buy an expensive isolation transformer).



Connections to the audio and video circuitry on the Amstrad TV.



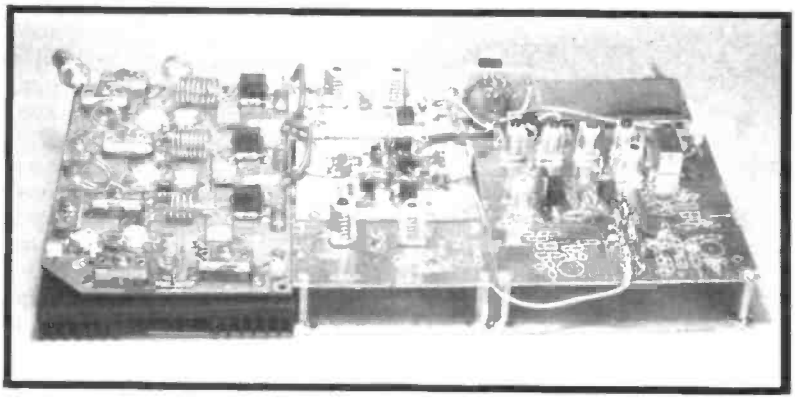
Connection to the VCR button.

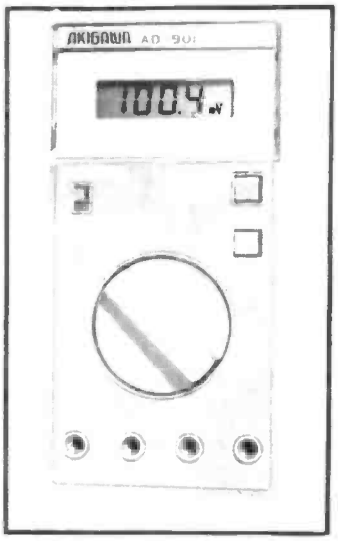


TV 1400 Mains input circuitry showing the addition of isolation transformer T1.

External audio is buffered via Q3 and connected to pin 12 of IC1. When the logic input to IC1 is low the external inputs are routed to the monitor parts of the CTV1400 chassis. Q5 is a sync buffer stage used to drive the Amstrad's sync separator. The sets sync take-off has to be moved from before the sound trap to after the switching circuitry to allow for synchronisation of external inputs. The buffer stage Q5 is required to prevent loading of the switched video output.

Featured in December's R&EW.





UK FIRST

R&EW 6M TRANSVERTER.

With the possible release of the 6 meter band to UK amateurs we present a transverter which provides 50 watts output at 50 MHz with a 144 MHz drive source.

The design is modular and is based around the multiband up- converter published in the August issue of **R&EW**.

The broadband techniques employed mean that the basic modules can also be used to form a 2 metre to 10 metre band transverter.

SPECIAL OFFER

An auto ranging, 10A digital multimeter for **£49.95!** no we're not joking, **R&EW's** vast buying power has enabled us to secure yet another bargin to offer our readers.

This highly accurate and robust instrument offers a high degree of accuracy on all ranges. It features an easy to read LCD display and features a built in buzzer for continuity testing - no need to keep an eye on the meter.

An incredible offer, available only to readers of **R&EW**.

INSIDE TV CAMERAS

Our in depth analysis of video recorders featured in the June issue proved very popular.

Next month we delve into colour TV cameras explaining the principles behind single tube systems, examining the advantages of three tubes and along the way explaining indexing electrodes and saticon photoconductive layers.

REWTEL

Next month we present the first in a series of software packages that will enable the more popular micro computers to be configured as a REWTEL terminal.

Next month the software for the BBC Micro is explained in detail.

Z8 ASSEMBLER

An assembler for our Z8 TBDS - this package vastly increases the power of the power of the system - at a stoke.

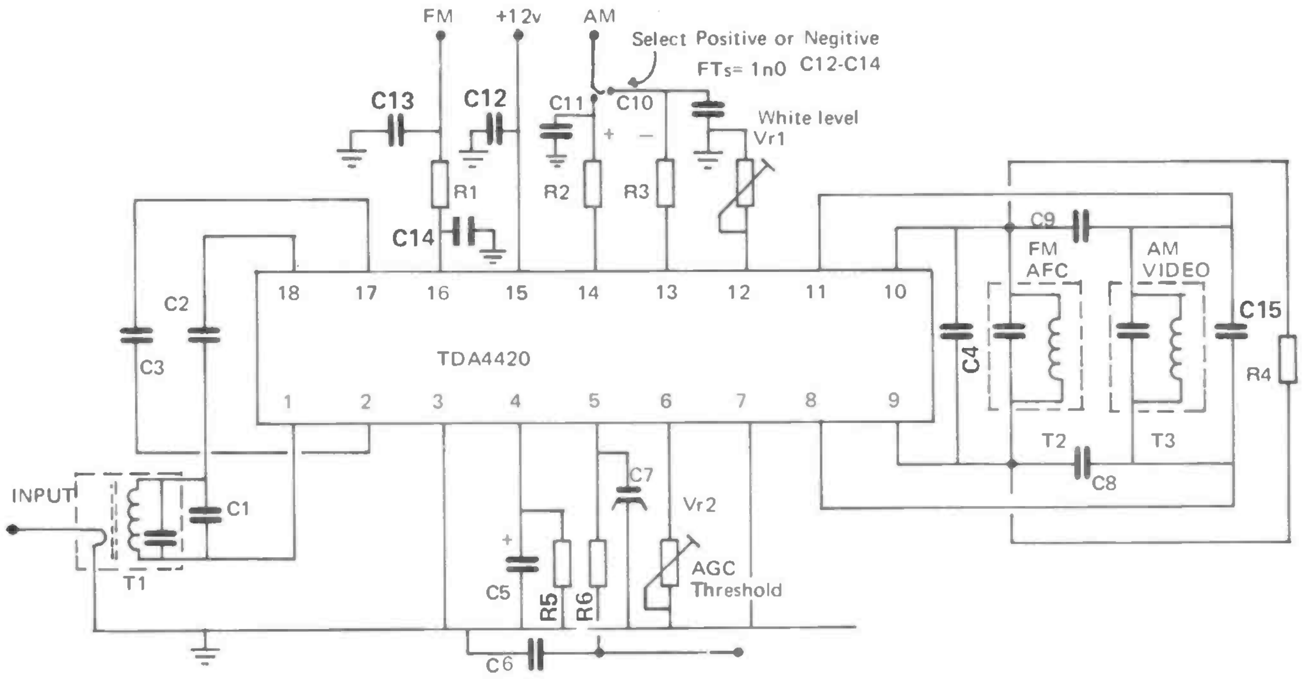
R&EW THE COMPLETE ELECTRONICS MAGAZINE
- COMMUNICATIONS, VIDEO, COMPUTING, AUDIO, NEWS, FEATURES, DATA ....

Articles described here are scheduled for the December issue, however circumstances may dictate changes to the final content.

Reserve a copy of December's R&EW NOW

R&EW Data Brief

TDA4420

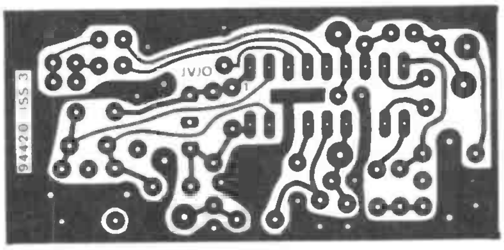


		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
	Capacitors	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Frequency	6MHz	120p	10n	4n7	120p	4u7	4u7	10n	22p	22p	10n	10n	100n	10n	1n	120p
	10.7MHz	na	10n	4n7	22p	4u7	10n	10n	2p2	2p2	10n	10n	100n	10n	1n	22p
	27MHz	22p	10n	4n7	22p	4u7	10n	na	2p2	2p2	100p	100p	100n	100p	1n	22p
	35MHz	15p	10n	4n7	15p	4u7	10n	na	2p2	2p2	100p	100p	100n	100p	1n	15p

	Resistors 1	2	3	4	5	6	Vr1	Vr2	IFTS: 1	2	3
6MHz	4k7	4k7	4k7	180E	56k	1k	25k	25k	KALS4520A†	KALS4520A	KALS4520A
10.7MHz	4k7	4k7	4k7	•	56k	2k2	25k	25k	KALS4520A†	KALS4520A	KALS4520A
27MHz	1k0	1k0	1k0		56K	2K2	5k	5k	KXNK3335	KXNK3335	KXNK3335
35MHz	1k0	1k0	1k0		56K	2K2	5k	5k	KXNK3335	KXNK3335	KXNK3335

† or alternative to match input to filter.

•Discriminator damping resistor



Specifications : video at 35MHz	
Supply voltage	10-15v DC
Supply current	40-65mA
Neg. video DC op	5.5v
Pos. video DC op	5.6v
AGC control current	15mA 10dB after threshold level
Composite video	3.3v
AGC range	50-60dB
Video bandwidth	8-10MHz
Input voltage	100-200uV
Communications : 10.7MHz	
AM input	10-12uV for 20dB S/N
FM input	20-30uV for 20dB S/N
Audio outputs (100uV input)	AM 30% mod 1v FM 5kHz dev. 300mV

GENERAL

The 4420 is another example of a communications building block module.

It is designed as an ultra versatile simultaneous AM/FM IF and demodulator-being suitable for both voice TV reception.

The main IC is in fact a comprehensive TV vif subsystem that incorporates both a synch. AM demodulator (for picture), and an FM discriminator for AFC, together with AGC and selectable polarity AM outputs.

FM OPERATION

The FM output also contains the DC AFC information, which must be separately decoupled via a standard RC network - or the AFC will act to cancel FM modulation.

MULTIBAND CAPABILITY

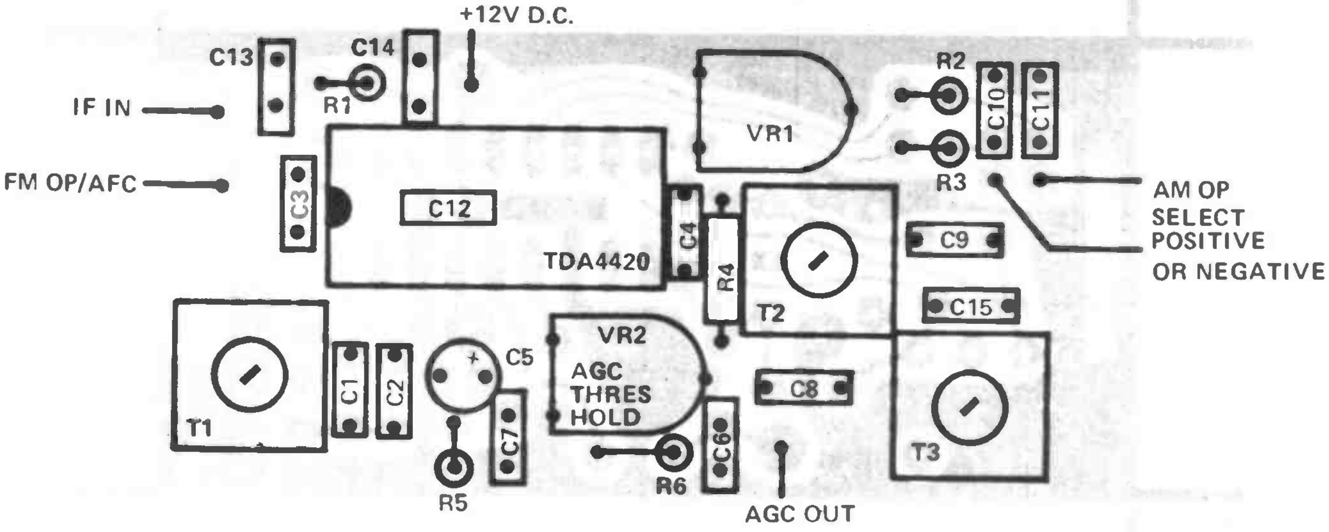
The component value tables list the various bands for which 'stock' solutions exist. The basic IC will function from 100kHz to 50MHz and so other frequencies of IF may be covered simply by selecting the appropriate tuned circuit components.

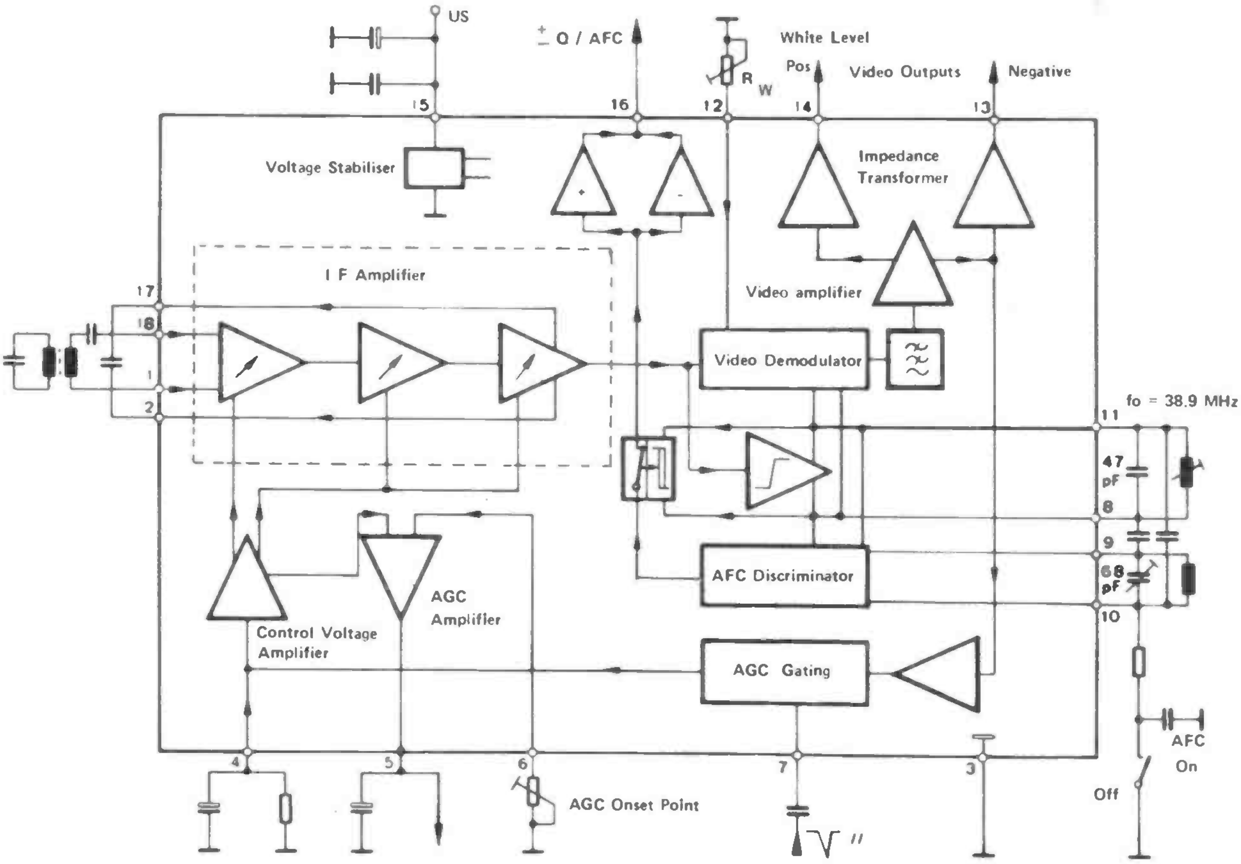
At 10.7MHz, NBFM may be resolved with approx. 50mV/kHx deviation. Wideband FM requires a suitable value of R4 to be fitted to damp the FM detector primary. (2k2 typ).

As a communications IF, the input required for 10dB SINAD is approx 9uV/AM, 25uV/FM. TV operation requires 150uV input.

The difference between the TDA4420 and TDA4421 is in the AGC action. The AGC pin on the TDA4420 requires a resistor (@ 4k7) to the positive supply rail. With no signal the AGC output is high. With signal increase the AGC output tends towards ground. Therefore the TDA4420 sinks current with increasing signal strength. On the other hand the TDA4421 sources current with increasing signal strength. With no signal the AGC output is low and goes high with increase of signal.

COMPONENT OVERLAY





INTERNAL BLOCK DIAGRAM

Absolute maximum ratings

	Pin No.		
Supply Voltage	15	15	V
Open Loop Voltage	5	15	V
Video D.C. output current	14	5	mA
White level control	12	-1...+3	V
External Voltage	4	4	V

SX200 SCANNING MONITOR

The ultimate scanner? J Camm investigates.

The Revco SX200 is a scanning receiver operating between 26 and 514MHz with a gap between 180 and 380MHz. Sixteen different memory channels are available, all, or some of which can be scanned sequentially. AM or FM transmissions can be resolved on any programmed frequency, the selection of mode being controlled by a front panel switch.

As is the usual practice with equipment coming into the R&EW Lab for review, the covers of the SX200 were removed straight away to see the quality of construction. The SX200 produced quite a shock - it was built exceptionally tidily - in stark contrast to the familiar Bearcat scanning receiver, where the components appear to have been thrown in by a left-handed gorilla (hanging upside down from a tree in a tropical rainforest, no doubt!). In fact, the construction of the SX200 puts to shame most of the commercial amateur equipment on the market.

Ten printed circuit boards are used to carry the receiver's circuitry. One main PCB carries the majority of the frequency synthesiser and is the mother board for the rest of the receiver. The RF sections of the receiver are mounted in a screened can on the top side of the motherboard. RF decoupling of the supply leads is accomplished by the liberal use of feedthrough capacitors and the receivers telescopic rod aerial is screwed directly into a base in the RF section. The aerial passes through holes in the screening can and lid while an external socket of the car aerial type. This caused a good deal of trouble trying to measure the receivers performance; whether the socket on the SX200 or the adaptor to PL259 was to blame, it is difficult to say (certainly the contact between the two was very poor, and one wonders why this type of socket should be chosen for such a quality scanning receiver).

A pin diode local/dx attenuator is used and works only on the external aerial input. Underneath the motherboard the VCOs (voltage controlled oscillators) are housed in another screened box and wax is used to stop the frequency-determining components from moving around. The front panel keys and fluorescent display are all directly mounted on a PCB behind the keyboard.

AROUND THE CIRCUIT

The circuitry of a synthesiser receiver spanning several hundred megahertz is, of course, quite complex. The block diagram of *Fig. 1* gives a good idea of what is involved. Starting at the aerial end, there are three separate RF amplifiers; a bipolar (common base) for 380-514MHz with 2 tuned stages, a dual gate MOSFET for 108-180MHz with 3 tuned stages, and another MOSFET for 26-88MHz using 2 tuned stages. A pin diode coil switch further splits up the 108-180MHz range into 108-140MHz and 140-180MHz, while the 26-88MHz range is split into three 26-45MHz, 45-58MHz and 58-88MHz.

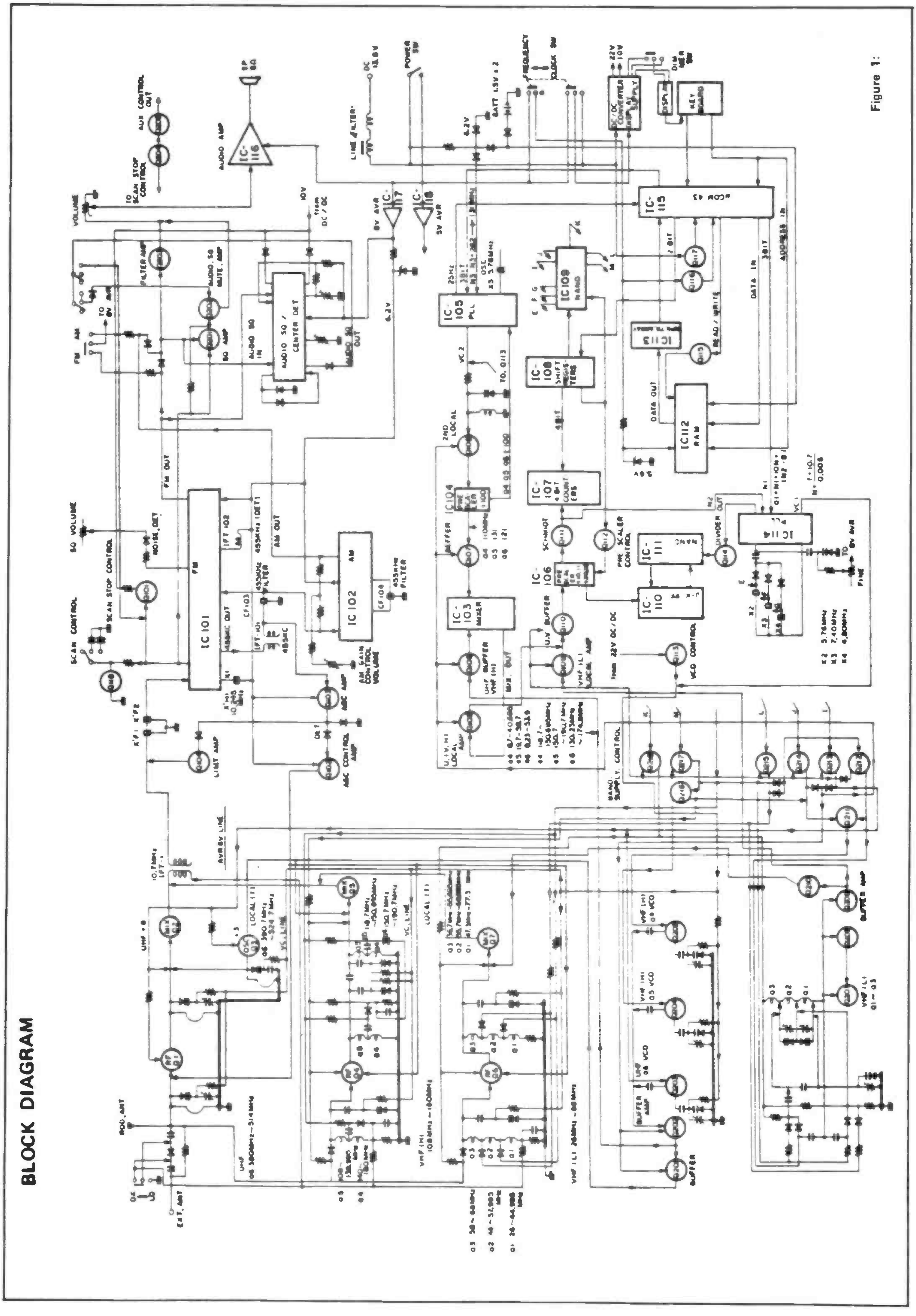
All this is an attempt to provide good front-end selectivity to provide high sensitivity and good image performance (to find out whether it works, see the test results later on). Separate bipolar mixers are used for all three conversion stages, with separate oscillator inputs from the VCO section. The UHF converter differs from the others in that a times three multiplier is housed in the RF section, so that the VCO signal enters the box at local oscillator/3 frequency. Additive or subtractive mixing is used, dependent on the band, and it is very useful to know which is used for each band to assess image response. Information is given in a table - *Fig. 2*.

An initial IF of 10.7MHz is used, the filter consisting of a pair of 2/4 pole sections in series. This use of a pair of filter sections in series, could well further improve the selectivity of CB receivers that have been modified for a single two-pole crystal filter. Input to the filters is from a 10.7MHz transformer, while the ubiquitous 3357 FM IF system provides the correct terminating impedance of 3K for these filters (*Fig. 3*). A transistor noise limiter clamps the input to the first filter under noise pulses.

The first mixer in the 3357 is used for both AM and FM conversion down to 455kHz, where selectivity is provided by a 20kHz wide ceramic filter. From past experience this mixer 'limits' under relatively low signal inputs and would appear a poor choice especially for AM. AM amplification and detection at 455kHz is carried out in IC102 (LA1201) with a second narrower (8kHz wide) 455kHz filter used within this IF section.

There are two different squelch circuits used in the receiver, a conventional noise squelch, around the 3357, and an audio derived squelch. The use of these is governed by a rear panel switch giving the three different squelch/scan stop options.

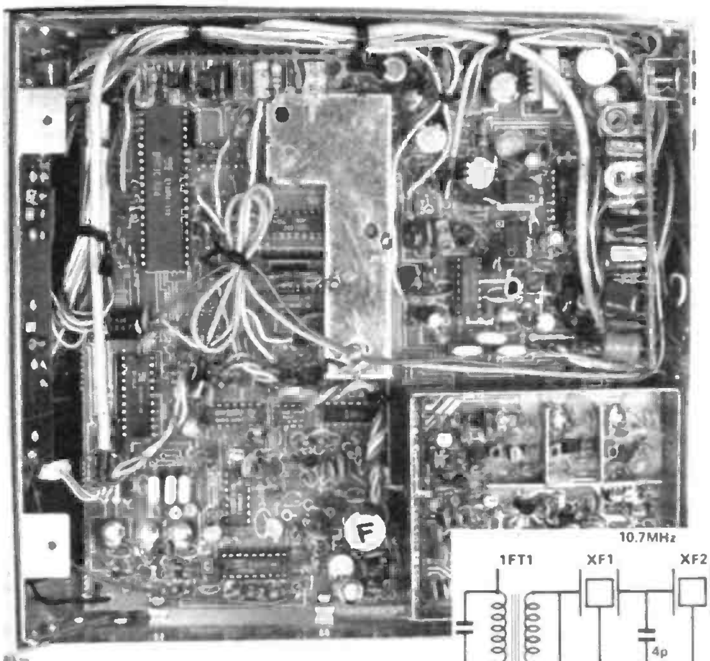
The synthesiser circuitry is at first sight fairly daunting, as two separate control loops are used. Further inspection shows that one loop is, in fact, only supplying three different frequencies. This loop comprises IC105 (the reference oscillator/divider and phase detector) and IC104 (a SP8629 divide by 100 prescaler) to loop synthesise three frequencies; 110, 121 and 131MHz, these being used for mixing within the oscillator section to derive the LO signal required for use between 140 and 514MHz. The main synthesiser consists of IC114, IC111, IC110 and IC106 together with its buffer stages. IC114 is the reference oscillator/divider and phase detector. Three separate reference crystals are diode-switched depending on whether 5kHz, 12.5kHz or 12.5kHz/3 channel is required. The fine-tune control produces a DC voltage


BLOCK DIAGRAM
Figure 1:
IC 101
IC 102
IC-103 MIXER
IC-105 PLL
IC-107
IC112 RAM
IC-115
IC-116
AUDIO AMP
VOLUME
SCAN CONTROL
SCAN STOP CONTROL
SQ VOLUME
AUDIO SQ / CENTER DET
FM OUT
AM OUT
AVR 8V LINE
DISPLAY
KEY BOARD
DATA IN
DATA OUT
ADDRESS IN
READ / WRITE
BUFFER AMP
BUFFER
VCO CONTROL
LIMIT AMP
AGC AMP
AGC CONTROL AMP
AM GAIN CONTROL VOLUME
POWER SW
CLOCK SW
DIVIDER

which alters the capacitance of a varicap diode, pulling the crystals a few hertz either way.

Between 26 and 88MHz, the VCO frequency is connected directly to the prescaler, IC106. On the other ranges, the VCO is first mixed with one of the three frequencies from the other loop. As an example; suppose the received frequency is 145MHz, the local oscillator frequency is 145 + 10.7 = 155.7MHz. The LO signal is mixed with 131MHz from the first loop, to give 24.7MHz as input to the dual modules divider, IC106. The prescaler's output is connected to the divide-by-N counter, within IC114, where it is divided down and compared to the reference.

The data for control of the phase locked loops is derived by a NEC 4-bit microprocessor, IC115. Data from the keyboard is directly entered into the processor, while memory channels are stored in RAM chip IC112.



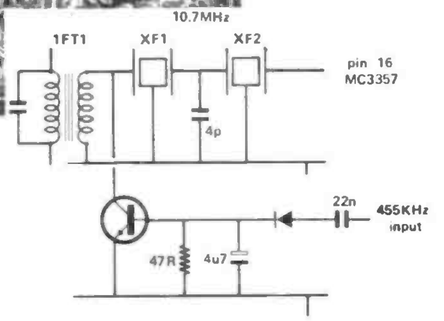


Figure 2: Receiver 10.7MHz I.F. filtering and noise blanker.

PULLING THE SIGNALS IN

Programming frequencies into the SX200 is fairly straightforward, although it is necessary to refer to the manual the first couple of times. The sixteen memories can be frequencies anywhere within the range of the receiver. Two different scan functions are available; SCAN-A scans all 16 channels, while SCAN-B scans any selected from the 16 available. As well as this, the SX200 will 'seek' between two frequency limits or simply UP or DOWN from the programmed frequency. When in this mode, frequency is incremented or decremented at the channel spacing. Channel spacing is 5kHz for 26-58 and 108-180MHz, and 12.5kHz for 58-88MHz and 380-514MHz. It is not possible to obtain 12.5kHz steps at 160MHz (for example); which is a disadvantage when covering the amateur and PMR sections of the band.

On the air, the receiver performed very well appearing to be sensitive and accurate in its frequency readout. When used on the airband, however, it did appear to be off frequency - it was not clear where the fine frequency control should be set for normal (centre frequency) reception. In band transmissions can be ±7kHz from the centre frequency, so that may have been the problem. Certainly, to scan all of the possible transmissions with the air band (118-136MHz) the fine frequency control needs to be used.

The three different squelch/scan stop modes were found to be very useful. Position 1 of the rear panel squelch switch causes scanning to stop when a carrier is detected and the mute opened. Position 2 causes scanning to stop, on a carrier, by the mute not opening until audio is present. Position 3 does not cause scanning to stop on the 'mute opened' until a signal is recived with modulation (speech data etc.) on it. The third squelch option is particularly useful in avoiding the scan stopping on unmodulated carriers.

The front panel squelch sensitivity control appeared to have a very limited range, this was borne out in subsequent measurement, the difference between 'squelch open' and 'tight squelch' being less than 5dB. The only way to stop the scanner responding to a relatively weak signal is to use the rear panel local/dx switch, although this is very coarse, adding around 15dB of attenuation.

The one really annoying feature of the SX200 is that a programmed frequency does not remain on the front panel for more than 5 seconds before the display reverts back to its clock display. It is possible to 'trick' the processor into displaying frequency continually, by making it scan one frequency only - the clock display is inhibited while the SX200 is in any dynamic process. Even so, this non-continual display of frequency is a real pain.

MEASUREMENTS

The table (*Fig. 4*) shows the results of our measurements. The receiver performed to its specification, except that the AM bandwidth was only ± 10kHz to about 40dB down. The usual measurement techniques employed may however not be giving a true picture due to limiting, within the 3357, inside the bandwidth of the 10.7MHz filters.

Image response was very wisely left out of the SX200's performance specification. Image response in the 30dB region is poor for a VHF receiver, while the 13dB figure, when used at UHF explained why the Police, appeared to have taken over the 70cm Amateur Band. Although the image response is inadequate, it is relatively good compared to some other scanning receivers. The scanning receiver performs well its function of being able to monitor one or several frequencies, and some image interference must be accepted in a receiver of this type.

Many thanks to Garex Electronics for supplying the SX200 for review.

Figure 3: Specifications

1. Type	FM & AM
2. Frequency Range	a) 26 ~ 57.995 MHz Freq. Space 5 KHz
	b) 58 ~ 88 MHz " " 12.5 KHz
	c) 108 ~ 180 MHz " " 5 KHz
	d) 380 ~ 514 MHz " " 12.5 KHz
3. Sensitivity	FM a) 26 ~ 180 MHz 0.4 uV S/N 12 dB
	b) 380 ~ 514 MHz 1.0 uV S/N 12 dB
	AM a) 26 ~ 180 MHz 1.0 uV S/N 10 dB
	b) 380 ~ 514 MHz 2.0 uV S/N 10 dB
4. Selectivity	FM More than 60 dB at ±25 KHz
	AM More than 60 dB at ±10 KHz
5. Audio Output	2 Watts
6. External Speaker Impedance	4 ~ 8 ohms
7. Power Supply	AC Adaptor (Output DC 12V) or DC 12V Power Supply
8. Antenna Impedance	50 ~ 75 ohms
	Whip or External Antenna with LO/DX Control (20 dB ATT.)
9. Frequency Stability	26 ~ 180 MHz Within 300 Hz
	380 ~ 514 MHz Within 1 KHz (at normal temperature)
10. Clock Error	Within 10 sec /month
11. Memory Channel	16 Channels
12. Scan Rate	Fast 8 Channels/sec
	Slow 4 Channels/sec
13. Seek Rate	Fast 10 Channels/sec.
	Slow 5 Channels/sec
14. Scan Delay Time	0 ~ 4 sec.

TEST RESULTS

Figure 4:

Frequency	Sensitivity AM	Sensitivity FM	Image
30MHz	1.00uV	0.35uV	-35dB
50MHz	0.79uV	0.26uV	-39dB
70MHz	0.80uV	0.25uV	-45dB
145MHz	0.72uV	0.22uV	-33dB
172MHz	0.75uV	0.25uV	-23dB
432MHz	0.96uV	0.32uV	-13dB
500MHz	1.35uV	0.47uV	-3dB

Your Reactions..........	Circle No.
Immediately Interesting	143
Possible application	144
Not interested in this topic	145
Bad feature/space waster	146

FT680 Review

Graham Leighton looks at one of the few 6m Band Transceivers available in this country.

WITH THE INVITATION from the RSGB to all class A amateur licencees to apply for a special permit to use the 6m band prompted us to review one of the few 50MHz transceivers available in the UK. The Yaesu FT680R is part of a complete range of VHF/UHF multimode transceivers. It is almost identical to the FT480 (2m) and the FT780(70cm) in appearance and operation. The only major differences apart from the frequency coverage are the repeater shift (±1MHz), the FM channel spacings, and the inclusion of AM instead of lower sideband circuit.

The two loop synthesiser, scanning, priority channel and memory functions are controlled by a four bit NMOS processor. The frequency coverage is 50 to 53.99999MHz in steps of 1KHz, 100Hz and 10Hz on SSB, AM and CW and 100KHz, 20KHz and 1KHz on FM. A useful feature which has been included is a control called 'F- SET' which sets the frequency to the nearest exact step. The other front panel controls are reasonably self explanatory. Underneath the front panel on the right hand side are three switches: scan mode, repeater shift and 'SAT'. The latter switch allows the operating frequency to be changed whilst transmitting. These controls are quite inconveniently placed and it is easy to forget the modes selected by the switches.

CIRCUIT

Unfortunately we haven't got the space in this issue for an in depth analysis of the circuit but here are one or two points worthy of note.

In order to cover the full range of 50-54MHz Yaesu have used varicap tuning of the receiver front end. This can cause severe problems in the presence of strong signals, but they seem to have got it just right judging by the IMD performance. Slight mistracking is evident in the changes which occur in the sensitivity between each 1MHz segment. The main RX selectivity block is a three stage 'resonator unit'. The mixer is immediately followed by an 10.81MHz crystal filter which is used as a roofing filter on all modes. Each mode has its selectivity determined by a further filter. On SSB this is at 10.81 MHz and for FM and AM at 455KHz. Most of the IF stages are made up from discrete devices. The AM facility which has been provided for the American market seems a bit of a waste of space. It looks, from the gaps in the PCB, as if this could be replaced by a lower sideband option.

The test results show that the performance is better than a lot of 144MHz radios but not quite up to the 100dB dynamic range claimed for some HF transceivers. The 50-54MHz coverage is an ideal IF for UHF/microwave work especially for contest operation where there might be a high power 2m station nearby.

We didn't get a chance to try this radio out or transmit properly on 6m but we have no doubts about the audio quality. On receive the set performed very well. During the test period the ZB2VHF beacon was monitored 24 hours a day for a month and the signal level recorded on a chart. It was interesting to note that a signal was present for some time on 24 out of 30 days. The receiver ended up getting an extended life test probably equivalent to two year's normal use.

As a 6 metre band transceiver the FT680 performs most of the tasks required of it competently. It would also be very useful when used with a transverter for 70cm or above. We look forward to the investigation in Europe of the 6m band which, despite the decline in the sunspot cycle, promises to offer some of the most interesting propagation of any frequency.

Thanks to SMC for the review sample.

Transmitter			
Power Output	50.00MHz	14.5W	
	53.98MHz	13.5W	
Intermodulation Distortion (at 10W PEP output)		-33dB	3rd Order
		-38dB	5th Order
Spurious Output	2nd Harmonic	-69dB	
	3rd Harmonic	-76dB	
	All other spurii	<-70dB	
FM Deviation		4.5KHz	
Receiver			
Sensitivity	50MHz	52MHz	54MHz
(Level required for 12dB SINAD)	SSB 0.13uV	0.14uV	0.17uV
	FM 0.15uV	0.12uV	0.27uV
IMD Rejection	79dB		
Adjacent Channel Rejection	SSB 62dB		
	FM 70dB		
Image Rejection	69dB		

TEST RESULTS

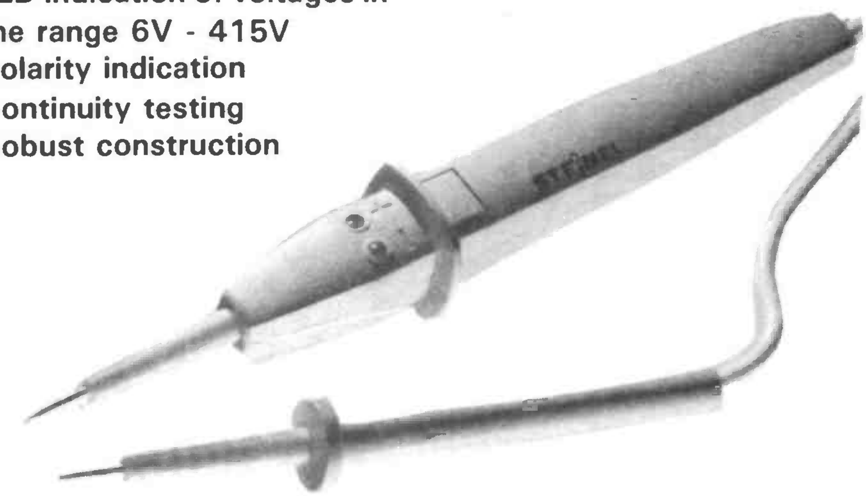
MULTI- CHECK TEST PROBE

This handy device is a perfect complement to a multi-meter.

The multi-check provides LED indication of both AC and DC voltages in the range 6V to 415V - in the case of DC voltages, polarity is indicated.

An internal battery also means that the device can be used to check a circuit's continuity (in the range 0 to 20k). The robust construction of the tester means that it is perfect for use in the field, it's also useful for bench use if the precise indication of a multi-meter is not required.

* LED indication of voltages in the range 6V - 415V
* Polarity indication
* Continuity testing
* Robust construction



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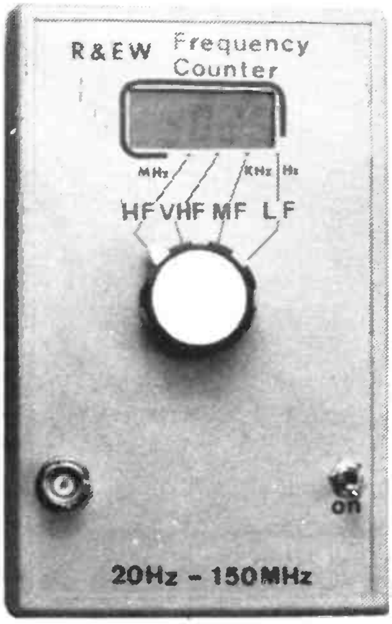
HAND HELD FREQUENCY COUNTER

DESIGN BY ROGER RAY



A simple 5 digit hand-held frequency counter covering from 20Hz to 150MHz, featuring low power consumption and fast audio response.

By using a ready built LCD frequency counter the construction of a versatile general purpose frequency counter is greatly simplified. The FC177 module generally intended for displaying received signal frequency, can be used as straight counter up to 3.9999MHz directly. As the resolution is 100Hz a multiplication technique is employed for displaying frequencies between 20hertz and 10KHz. By using a ÷ 10/ ÷ 100 prescaler operation up to 150MHz is accomplished. To keep power consumption to a minimum a count and hold technique is used when measuring frequencies above 4MHz.

CONSTRUCTION

This project is built on a single sided PCB, which is mounted on the four way switch S1. Components are mounted on the board according to the overlay of *Fig*.4 I.C. sockets are used for all the integrated circuits. The usual care should be taken in mounting the transistors, I.C.'s, tantalum and electrolytic capacitors. Do not forget the ferrite bead on the lead of R24.

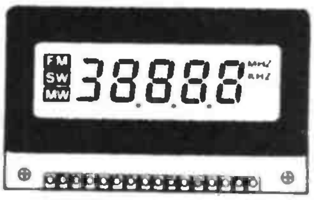
The FC177 display module is connected to the assembled PCB using short flexible wire links. The case is drilled to take the two switches, the B.N.C. input socket and an aperture cut for the display. The FC177 module is fixed behind the aperture using a minimal amount of glue (Bostik etc). Fitting S1 in place also holds the printed circuit board in position. The input socket is connected directly to the back of the switch (Sla) using a short length of minature co-ax. Finally connect the battery connector via switch S2 to the PCB and construction is complete.

FC177

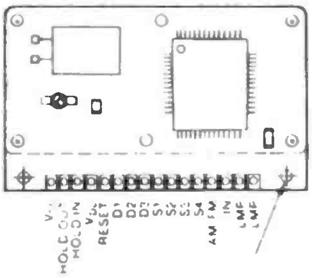
LCD DIGITAL FREQUENCY COUNTER MODULE

FEATURES :

- 5 digit display, 0.35 inch digit height
- 26 selectable IF offsets
  - AM (MW/LW) : 6 frequencies
  - SW : 4 frequencies
  - FM : 16 frequencies
  - Zero offset for ordinary frequency or event counter
- MW, SW, FM, KHz and MHz annunciators
- CMOS and LCD ideal for low power applications
- Prescaler for SW and FM operation available
- Incandescent backlight



Connection details of FC177 module



MSM 5527

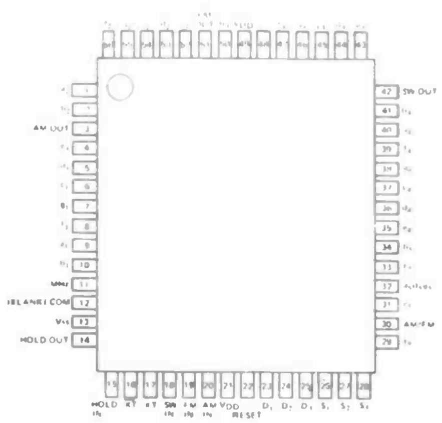
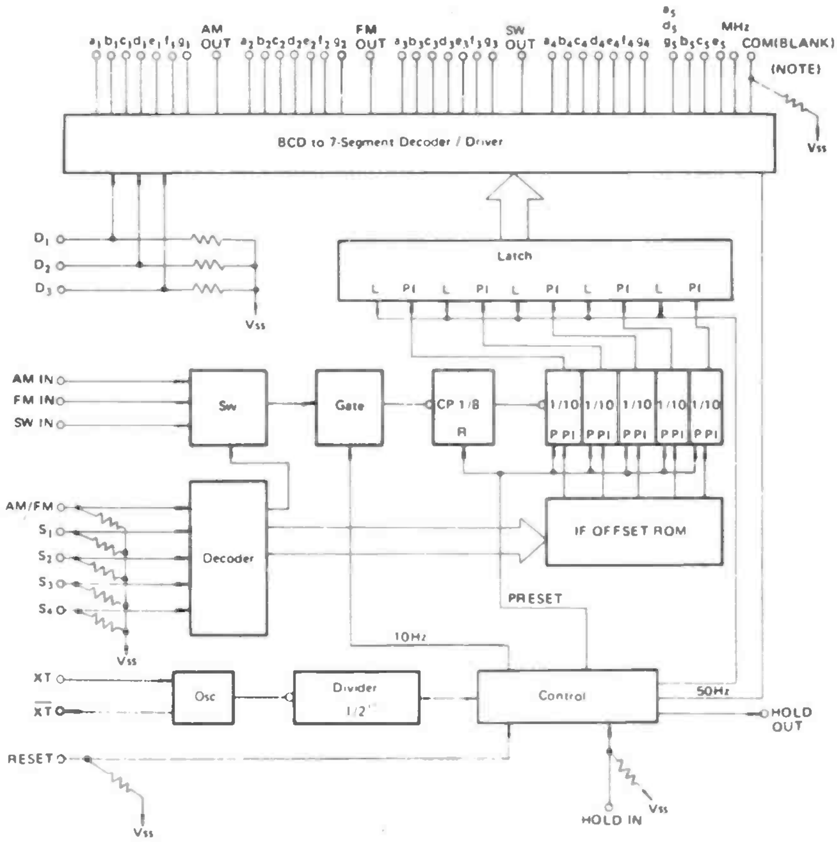


Figure 1 Pin out above and block diagram below of the OKI MSM5527 I.C. used in the FC177 module.



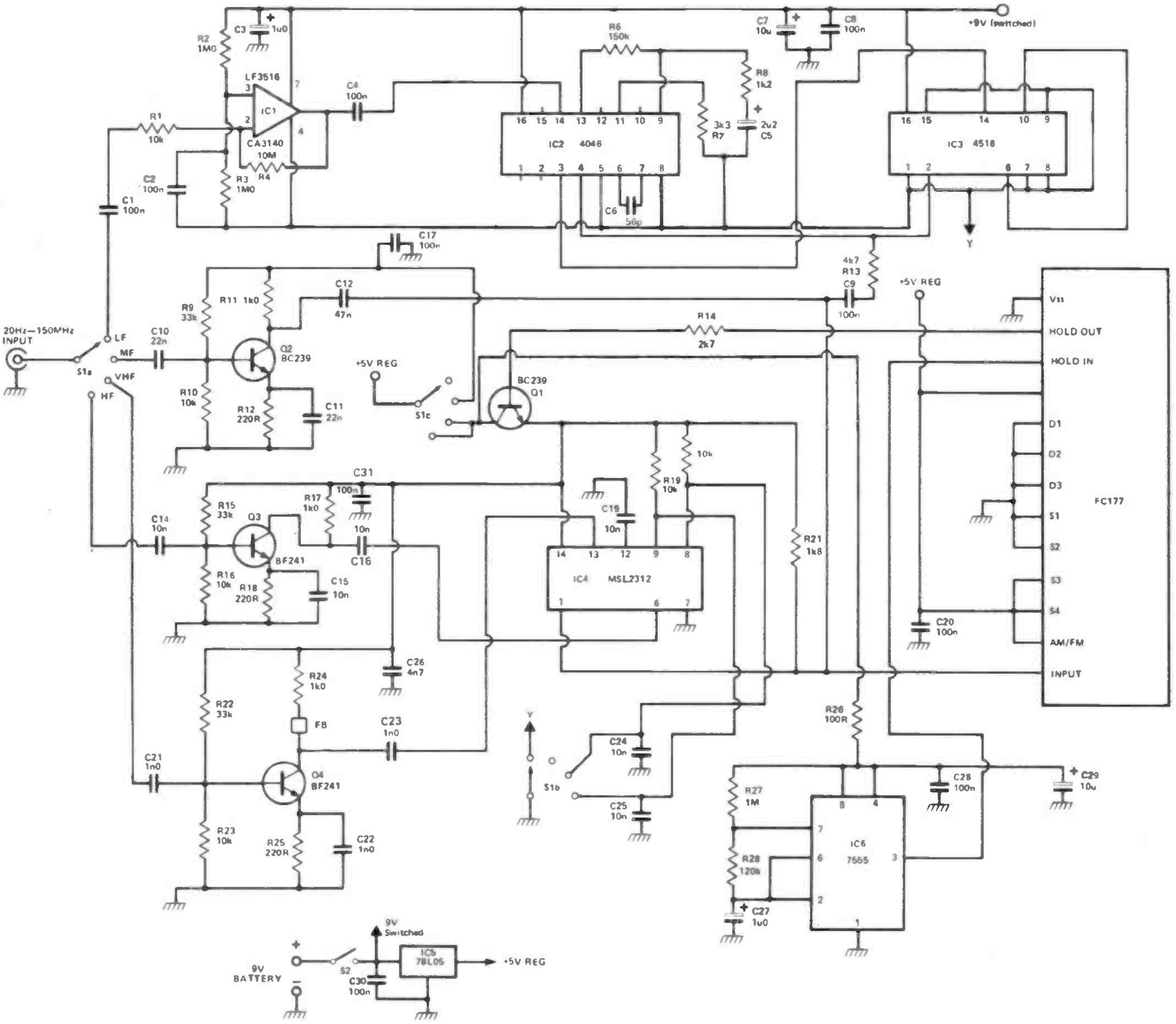


Figure 2 Complete circuit diagram of the frequency counter

CIRCUIT DESCRIPTION

The input frequency is switched by S1a to one of four buffer stages depending on the range selected. When the LF range is selected frequencies in the range 20Hz-10KHz are amplified by IC1 and capacitively coupled into pin 14 of IC2. IC2(4046) and IC3(4518) comprise a X100 multiplying phase locked loop. The internal VCO in the 4046 is used to cover 2KHz to 1MHz, the frequency being determined by the choice of capacitor between pins 6 and 7 and the resistor from pin 11 to ground. The VCO output is divided by 100 in IC3 (4518) and fed to the wideband phase detector in the 4046 (pin 3). Here the phase is compared to the incoming signal, its output goes through the loop filter (C5, R6,R8) and closes the loop by running the VCO. The direct output from the VCO is connected to the input of the FC177 counter module through C9 and R13. Thus for an audio input of 800Hz the VCO frequency will be 80KHz and displayed as --800 ie 800 Hz (with suitable positioning of the decimal point).

When the MF range is selected signals in the range 10 KHz - 4.0 MHz are amplified by Q2 and connected directly to the input of the FC177. Signal conditioning within IC4 is not used to reduce current consumption.

When the HF range is selected, frequencies between 100KHz and 40.0MHz are amplified by Q3 and connected to the divide by 10 input of a low power prescaler MSL2312RS (IC4).

The MSL2312RS is both a ÷10 and ÷100 prescaler with separate inputs, the division ratio is selected by logic applied to pins 8 and 9, in this case simply provided by S16 grounding the relevant one.

On the fourth range Q4 is used to amplify frequencies between 10 and 150 MHz. IC4 is now used to provide it's÷100 function using internal ECL. Output from IC4 is connected directly into the FC177 module. Although the MSL2312RS is a low power prescaler it's current consuption is typically greater than 30mA. To reduce this to an acceptable level the hold facility on the FC177 module is employed. When the hold input to the FC177 goes high the display is fixed within 300mS and then the FC177's hold output pin goes low. The hold output turns off the prescaler by the action of a switching transistor Q1. Timing signals for the hold input are derived from IC6 a 7555 timer, its output waveform is shown in *Fig.7* Thus a count and hold technique is used, which measures the incoming frequency once every second. As the prescaler is only on 40% of the time the average current consumption is reduced to below 15mA. IC5 is a 5 volt regulator for all the counter circuitry, maintaining a constant output voltage under varying battery conditions.

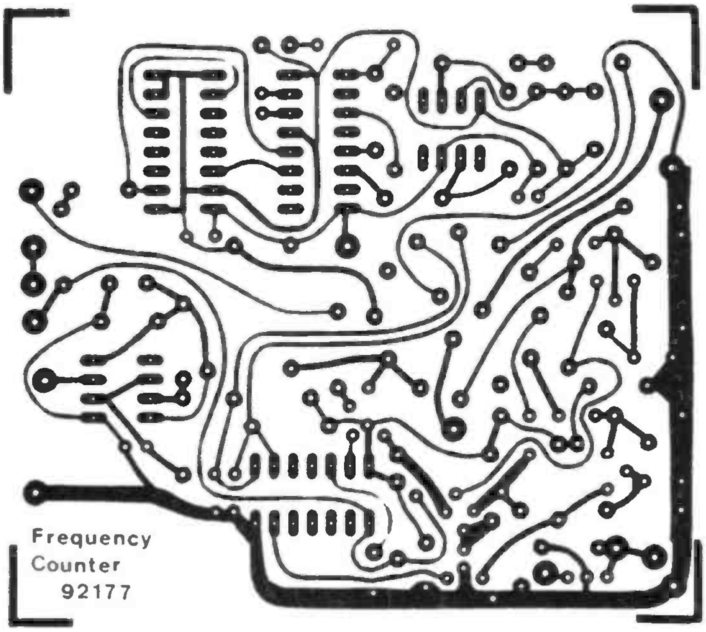


Figure 3 PCB foil pattern

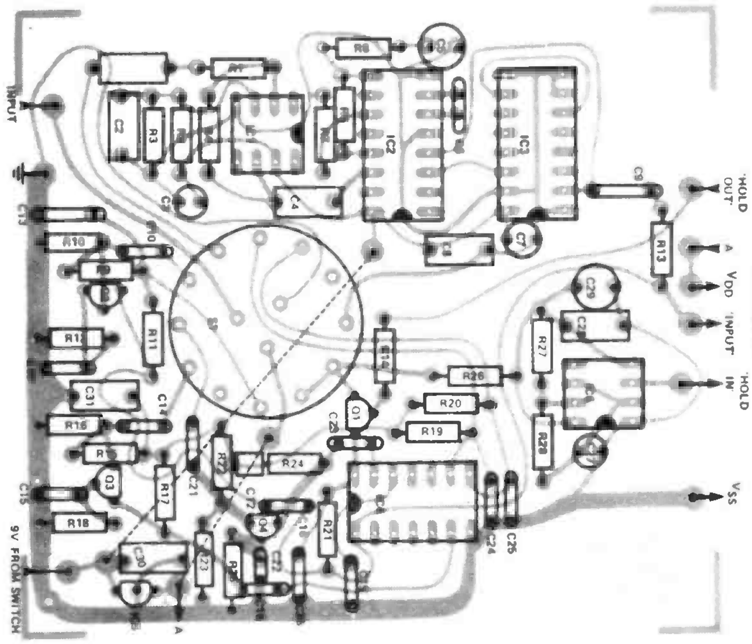


Figure 4 PCB overlay

COMPONENTS LIST

Resistors (all ¼W 5%)

R1,10,16,19,20,23	10K
R2,3,27	1M
R4	10M
R6	150K
R7	3K3
R8	1K2
R9,15,22	33K
R11,17,24	1K
R12,18,25	220R
R13	4K7
R14	2K7
R21	1K8
R26	100R
R28	120K

Capacitors

C1,2,4,8,9,13,28,30,31	100n mylar
C3,27	1u 16V tant
C5	2u2 electrolytic
C6	56p ceramic
C7,29	10u electrolytic
C10,11	22n ceramic
C21,22,23	1n ceramic
C20	100n monolithic
C26	4n7 ceramic
C12	47n
C14,15,16,19,24,25	10n ceramic

Semiconductors

Q1,2	BC239
Q3,4	BF241
IC1	CA3140
IC2	4046
IC3	4518
IC4	MSL2312
IC5	78L05
IC6	7555

Miscellaneous

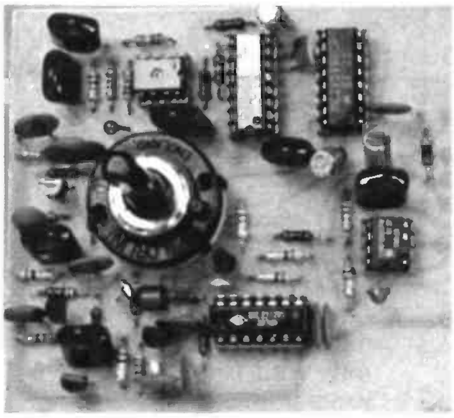
S1	3 pole 4 way switch
S2	push to make switch
FC177	frequency counter
PCB	
I.C. sockets	
Case	
FX1115	
BNC socket	
PP3 Battery connector	

Figure 5 Overall specification of the counter

RANGE	FREQUENCY	RESOLUTION
LF	20Hz - 10KHz	1Hz
MF	10KHz - 3.9999MHz	100Hz
HF	100KHz - 39.999MHz	1KHz
VHF	10MHz - > 150MHz	10KHz

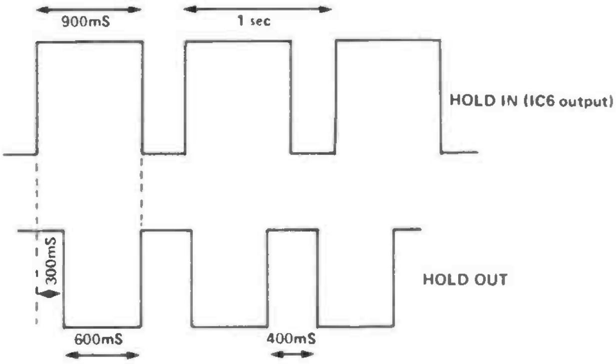
Figure 6 I.F. offset table for FC177 module

SELECT INPUT						
AM/FM	S1	S2	S3	S4	DISPLAY	IF OFFSET VALUE
H	L	L	L	L	AM	-455kHz
H	L	H	L	L		-260kHz
H	L	L	H	L		-450kHz
H	L	H	H	L		-261kHz
H	L	L	L	H		-468kHz
H	L	H	L	H		-470kHz
L	L	L	L	L	FM	+10.7MHz
L	H	L	L	L		+10.63MHz
L	L	H	L	L		-10.7MHz
L	H	H	L	L		+10.66MHz
L	L	L	H	L		+10.74MHz
L	H	L	H	L		+10.77MHz
L	L	H	H	L		-10.63MHz
L	H	H	H	L		-10.65MHz
L	L	L	L	H		-10.66MHz
L	H	L	L	H		-10.67MHz
L	L	H	L	H		-10.68MHz
L	H	H	L	H		-10.71MHz
L	L	L	H	H		-10.74MHz
L	H	L	H	H		-10.75MHz
L	L	H	H	H		-10.77MHz
L	H	H	H	H		-10.78MHz
H	H	L	L	L	SW	-455kHz
H	H	H	L	L		-468kHz
H	H	L	H	L		-2.0MHz
H	H	H	H	L		-10.7MHz
H	L	L	H	H	FC	NONE
H	L	H	H	H	Counter	NONE



Sensitivity Measurements on Prototype

LF	50 Hz	20 mV
	10 KHz	12 mV
MF	500 KHz	2 mV
	4 MHz	2 mV
HF	1 MHz	3 mV
	40 MHz	4 mV
VHF	70 MHz	20 mV
	150 MHz	75 mV



OPERATING SPECIFICATIONS

Absolute maximum ratings (referenced to VSS)

Item	Symbol	Condition	Rating	Unit
Power supply voltage	VDD	Ta = 25C	–0.3 to 7	V
Input voltage	Vi	Ta = 25 C	–0.3 tu VDD	V
Storage temperature	Tstg	—	–10 to 60	°C

Operating range

Item	Symbol	Condition	Rating	Unit
Power supply voltage	VDD	—	4.75 to 7	V
Operating temperature	Top	—	0 to 50	°C

DC characteristics (VDD = 5v±5%, Ta = 0 to 50 °C

Item	Symbol	Condition	MIN	TYP	MAX	Unit
High input voltage	Vih	—	3.6	—	—	V
Low input voltage	Vil	—	—	—	0.8	V
Holdout output high	Voh	IO = –40uA	4.2	—	—	V
Holdout output low	Vol	IO = 1.6mA	—	—	0.4	V
Holdout output current	IOH/IOL	Vo = 2.5v/Vo = 0.4v	-0.2/1.6	—	—	mA
Dynamic current consumption	Idd	f = 6.5536MHz, no load	—	—	4	mA

Max operating frequency (VDD = 5v±5%, Ta = 0 to 50°C

Item	Symbol		MIN	TYP	MAX	Unit
Count frequency (AM FM SW In)	f(in)	Vi 1v p–p Capacitor coupling	—	—	5	MHz

DESIGNATION AND DEFINITION OF INPUTS AND OUTPUTS

VDD Positive voltage to module (H)

VSS Negative voltage to module (L)

INPUT Input from the local oscillator of radio. No prescaler is required for LW or MW. An external 1 to 10 and 1 to 100 prescaler is required for SW and FM respectively. Capacitor coupling is required if the input is 3.6 volts peak to peak or less for VDD = 5 volts

AM FM S1 S2 S3 S4 (Internal resistor pulldown to VSS)
Inputs for selecting the operating mode and IF offset see Table 1

D1 D2 D3 (Internal resistor pulldown to VSS)
Inputs for selecting the display format see Table 2

HOLD IN (Internal resistor pulldown to VSS)
When at VSS or open the display follows the INPUT. When connected to VDD the display is fixed within 300ms and ignores the INPUT

HOLD OUT This output is used to reduce power consumption of a prescaler. HOLD OUT goes from VDD to VSS within 300 ms after HOLD IN has gone from VSS to VDD

RESET (Internal resistor pulldown to VSS)
When in AM FM or SW mode connection to VDD displays the contents of the IF offset ROM (read only memory)
When in the frequency counter or event counter mode connection to VDD resets the counter

LMP Two inputs are provided to power the 5 volt back light lamp

COUNT AWAY

There is no setting up or alignment required with this project, so assuming it has been constructed carefully it should work first time. If it does not work straight away voltages around the circuit diagram should enable the faulty section to be located.

To use the counter simply connect the signal source to be measured to the input, switch on S2 and turn S1 to the range required. The units displayed and the position of the decimal point are shown by markings on the front panel, the decimal point shown on the display should be ignored. Input sensitivity depends on the range selected but is typically 10-20mV. For counting very low level signals on external amplifier may be used.

Other functions are available on the FC177 module, including 26 IF offset frequencies and event counting. These are not used in this simple counter, but are their to be used if required (see *Fig.*).

When switched to the LF range the display will show the upper frequency limit of the VCO in the 4046(IC2) with no signal input. This is typically around 13KHz and therefore should not confuse any measurement up to 10KHz being taken on this range. Display on the MF range will read 01 with no input signal. On the HF and VHF ranges there will be a display with no signal input due to the operation of the prescaler (IC4). The frequency displayed is relatively constant and so as with the LF range once the frequency counter has been used a couple of times, should not cause confusion.

While using the counter it has been found that 100Hz resolution to 10MHz and 1KHz resolution to 70MHZ can be performed, by changing to the next range down and subtracting 1 or 2 times 4MHz/40MHz from the display frequency. A reading on the correct range should be taken first to avoid ambiguity in the measurement.

The decimal point on the FC177 display is not in the correct place for all ranges, front panel markings are used to show its position. If the decimal point is annoying it can be easily removed by lifting pin 3 of the MSM5527 (see Fig) on the back FC177 module. This can be done with a small screwdriver or pliers, a solder iron cannot be used as the connection is cold welded in place.

Your Reactions......	Circle No.
Excellent - will make one	12
Interesting - might make one	13
Seen Better	14
Comments	15

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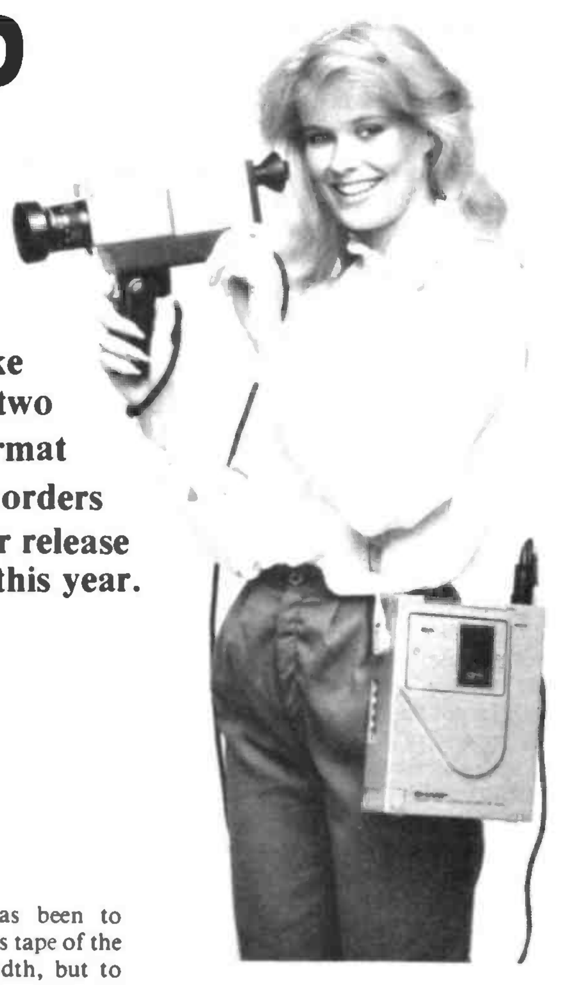


Peter Luke previews two 'mini' format VHS recorders due for release later this year.

ALL BUT THE MOST determined of salesmen would concede that the current generation of 'portable' video recorders are somewhat of a compromise. All such recorders seek to offer a camera to complete a 'home movie' system as well as a tuner timer unit in order that the facilties of a mains machine may be emulated.

The major criticism of such recorders is not in terms of performance, for this is exemplary in most cases, but in the sheer size and weight of the machines. (A possible exception is the Sony F1 but, while small, it is still rather too heavy to comfortably cart around over the shoulder for any length of time).

The bulk of these recorders is due, in the main, to the fact that they have been constrained to use standard size VHS or Beta cassettes, housings that were not designed for portable use.

Following the path trodden by the semi-professional U-matic format, in which cassettes for portable recorders are considerably smaller than those used for mains operated machines, the VHS manufacturers have developed a mini VHS cassette.

November will see the first recorder to utilise this new format, VHS-C, with the launch of Sharp's VC-220N. JVC will follow up with their HR-C3 a little later in the year.

Before looking at these two machines in more detail, a few words about the VHS-C format itself.

The approach adopted has been to produce a cassette that contains tape of the standard (half inch) VHS width, but to considerably reduce the size of spools, tape guide mechanism etc. The result is that the same tape pattern and signal processing of the standard format may be employed which in turn means, that with the aid of an adaptor, the 'mini' cassette can be played back on an unmodified VHS recorder.

The length of tape squeezed into the C cassettes restricts their continuous recording time to 30 minutes - not a draw back as a battery pack to provide power for a recording of longer than this would be of a prohibitive size.

SHARP'S SMALLEST

The small size of the Sharp VC-220N (177mm wide x 78mm high x 238mm deep) does not preclude a healthy complement of features.

Visual search at three times normal speed is available in both forward and reverse directions, audio dub and an indicator to signal the fact that tape is running out are just some of the standard facilities offered.

By using an optional AC adaptor/RF modulator the recorder's output can be viewed on a standard TV set but, as mentioned above, the C cassette can be played back on a standard VHS recorder by the use of a cassette adaptor.

The projected selling price of the Sharp model plus AC adaptor/modulator, battery pack and one cassette is £550.

COMPANION CAMERA

The XC-51H camera has been designed to complement the new recorder and will offer a no frills specification at around £330.

The camera lens is a fixed focus F1.6 type with a x2 zoom. The viewfinder is through-the-lens optical and features a couple of tally lights for VTR run etc.

The camera is said to be idiot proof and while its facilities are rather sparse it should provide an adequate performance for most 'point-and shoot' recording.

JVC JEWEL

The JVC recorder is of quite a generous specification offering: automatic back space editing for assembly editing, a power saving mode, an LCD remaining time display, two-way shuttle search and a full function remote control. Audio dub, recording standby mode lock switch, auto rewind and a high quality transport mechanism utilising four motors completes a very impressive array of facilities.

As with the Sharp AC adaptors, RF modulators and battery packs are part of the array of accessories to complement the recorder.

The HR-C3 measures 182(W) x 75.5(H) x 203(D)mm and weighs an incredible 2kg (The Sharp weighs in at 2.6kg).

The recorder may be used with the tuner/timer that is already part of JVC's range and a micro cassette offering a 50 minute capability means that the recorder is suitable for time shift recording of shorter TV programmes.

As yet we have no details of JVC's micro camera but the photograph seems to indicate that this will have a similar, generous specification with CRT viewfinder and a healthy zoom range.

WILL C SELL?

The quick canter through the specs of the new compact recorders shows the JVC to have a lead in 'selling points' - but the Sharp will be launched first. To a large extent, however, it is not which of these two recorders will sell best, but whether either of them will sell well at all.

The C format is a stop gap system that is the forerunner of recorder/camera combinations that will sound the death knell for the traditional movie camera. With the present range of portable recorders, while going portable means carrying a rather bulky machine around, it does not hit the pocket too hard. With a companion tuner/timer unit the price paid for a home system is not much more than for an equivalent mains operated machine. The camera adds another £300 or so - about the cost of a cine camera, projector, screen etc.

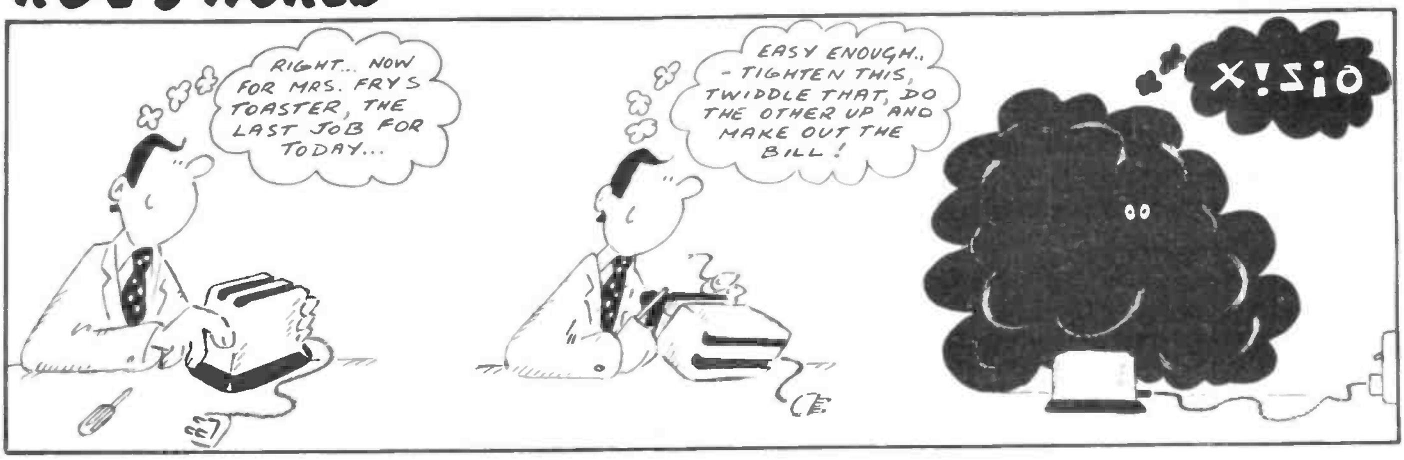
With the C format the outlay of £500 will be purely for the pleasure of roving recording - you'll still need a standard recorder for time shift recording and those home cinema evenings. While their will undoubtedly be some people to whom this is an acceptable price to pay, it will be beyond the reach of most.

Also doubtful, is the future of the C format when the combined recorder/camera machines make their debut in a year or two's time.

Your Reactions..........	Circle No.
Immediately Interesting	28
Possible application	29
Not interested in this topic	30
Bad feature/space waster	31

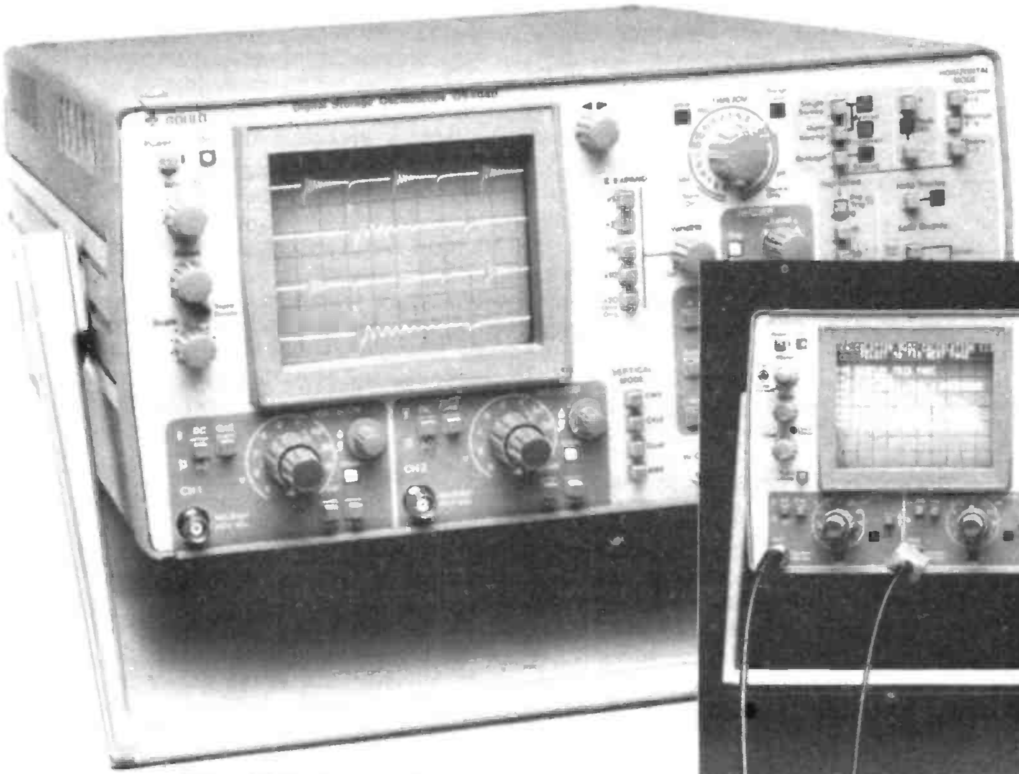
R&E's WORLD

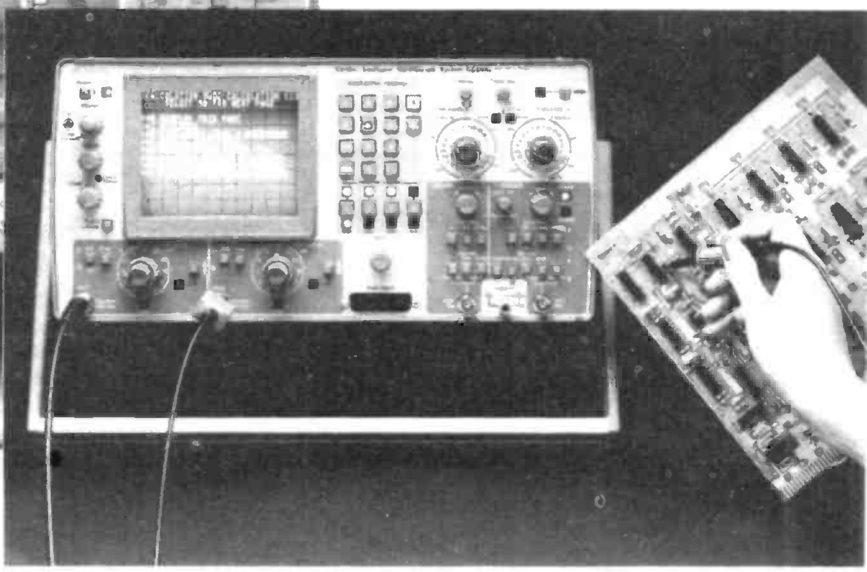
MIKE TURNER



DIGITAL- STORAGE OSCILLOSCOPES

CHRIS CROOK* DESCRIBES THE PRINCIPLES AND APPLICATIONS OF THESE INSTRUMENTS





*Gould Instruments

The oscilloscope is probably the most widely used general purpose test and measuring equipment today, but nevertheless, it does have a number of limitations.

For example, how does one automatically extract the displayed waveform in order to analyse the data in more detail, or display waveforms which occur at different time periods simultaneously for comparison purposes? Indeed, how does one expand a particularly interesting section of a stored single-shot waveform for a more detailed analysis?

These are just a few of the problems that occur on a regular basis and which cannot be solved with conventional realtime or tube storage oscilloscopes. The digital storage oscilloscope (DSO) can, however, solve all of these problems very easily and it has therefore extended the abilities of the widely used oscilloscope even further at a price which could well make the DSO the most cost effective test and measuring system available on the market today. **(See Fig. 1)** What then makes it so much better than other instruments within its class?

DIGITAL STORAGE

The DSO is based round standard oscilloscope design and therefore around a CRT which reproduces the applied input waveform by deflecting a beam of electrons onto a phosphor layer causing it to fluoresce at the point of contact **(See Fig. 2a)**. The position of this beam is controlled by applying an electrostatic deflection force in each of the two axes *via* the X and the Y deflection plates. This force is derived *via* high-voltage output amplifiers from the timebase ramp generator, (X-axis) and from the input signal conditioned to the correct scaling factor by the input amplifier (Y-axis). The conditioned signal is also fed into the trigger circuit which is designed to initiate the timebase ramp at a voltage level set from the front panel and which is extremely stable to ensure that a jitter-free picture is obtained on the screen for repetitive waveforms. A problem with this basic system is that for slow sweep speeds the low persistence of the phosphors result in a flickering display or often only a moving spot on the screen. The faster one shot event would pass across the screen too quickly for the operator to analyse.

In both these cases none of the historic data of the signal is retained long enough for analysis.

The length of time that the illuminated phosphor remains visible (persistence) is dependent upon the type of phosphor used. This fact can be utilised to improve the situation by using a long persistence phosphor such as 'Type P7' which enables a short after-glow to be created of the order of 0.2 to 0.5 seconds. However this small improvement in persistence is not adequate for many applications, and therefore purpose built storage 'scopes have to be considered, *viz*:

BISTABLE STORAGE CATHODE RAY TUBE

In this tube a high energy beam of electrons is used to create a charge pattern on a transparent metal screen deposit on the inner surface of the CRT.

Flood guns are then used to send a cloud of low energy electrons on to the screen and this is controlled so that the positive charge pattern previously created is the only part of the screen to visibly fluoresce. These low energy electrons are designed to have insufficient energy to illuminate the phosphor on other parts of the screen.

MESH STORAGE TUBE

This works on much the same principle as the bistable CRT but in this case the writing beam is used to store the signal information on a target which consists of a dielectric material deposited on a storage mesh. In this case the charged pattern on the storage target allows electrons to pass through the mesh in order to fluoresce the standard phosphor deposit on the inner surface of the CRT.

CHARGE TRANSFER STORAGE CRT

This was developed to increase the writing speeds of tube storage scopes and operates by storing the pattern on a mesh, as explained above, and then transferring it to a second mesh which is designed to give exceptionally good insulation for better retention of the writing pattern.

Real-time oscilloscopes	Tube storage oscilloscopes	Digital storage oscilloscopes
COMPARISON OF REFERENCE TRACE AND UPDATED TRACE		
No trace retention therefore non-repetitive signals and slow signals cannot be analysed	Limited trace retention for single time slot only, therefore previously stored trace cannot be displayed on screen at the same time as the updated trace for comparison purposes	Trace can be stored permanently. Display screen can be used to show previously stored traces and updated trace simultaneously for comparison purposes
LONG TERM STORAGE OF TRACES		
Storage by expensive film techniques only	Long-term storage by expensive film techniques only	Trace can be stored indefinitely and returned to display whenever required. Alternatively, low-cost permanent hard copies can be made *via* standard pen recorders
DISPLAY OF SINGLE SHOT EVENTS (ie TRANSIENTS)		
Amplifier and time-base controls have to be set accurately first time. Trace cannot be expanded after the signal event	Amplifier and time-base controls have to be set accurately first time. Trace cannot be expanded after the signal event	Small portions of the trace can be selected and expanded after storage for detailed analysis of signal content
DATA ANALYSIS BY COMPUTER		
Signal data cannot be automatically extracted for subsequent analysis in IEEE systems	Signal data cannot be automatically extracted for subsequent analysis in IEEE systems	Data can be fed into computers, back-up stores, analysers, *etc via* IEEE-488 data bus

Figure 1: Application of oscilloscopes to measuring non-repetitive and slow signals

The DSO owes its success to the fact that it does not merely reproduce its input signal as a charge matrix or by momentarily transferring energy to a phosphor on a screen, but it saves it in a permanent store so that it can be recalled on the screen at any time, as many times as necessary, or manipulated as required. The secret lays within the dotted area shown in *Fig. 2(b)*. The connection between the Y defection plate amplifier and the Y input amplifier, is broken such that the conditioned input signal can be fed into an analogue to digital convertor and thence into a digitial store which is clocked in at a frequency determined by the timebase selection. This stored information can be retained indefinitely and then recalled back on to the screen *via* a digital to analogue convertor and the existing deflection plate amplifiers at any time required.

One of the further advantages of this over tube storage is that standard traces can be stored in the DSO memory and then recalled on to the screen for comparison with a real-time trace which can be displayed on the screen at the same time. This real-time trace can then be replaced by a subsequent one for further comparison and, in each case, it can be shifted to overlay the stored trace so that in a testing environment a known good circuit board can be very easily and quickly compared with unknown boards with a minimum of operator error. Also, because the information is stored in digital format, it can be retrieved *via* the interface pots on to a data highway which can include the IEEE 488 bus and then fed into other peripherals or into a computer/calculator for manipulation.

This makes it an ideal system where many signals have to be averaged or where Fourier analysis is required, or where it is necessary to obtain, for example, the energy presented by the measured system by calculating the area under the curve.

With a tube storage oscilloscope, it will be necessary literally to transpose data presented on the screen manually and then to utilise a terminal to manually feed this data into the computer system. Therefore the automatic method possible with the DSO is not only quicker, but also eliminates reading errors and reduces the possibility of operator error.

THE PLOT THICKENS

It may, however, be the case that a file copy is required of a display trace, either for future reference or for presentation in a report. With a tube storage scope, one can either try to transpose the trace manually by sketching it, or take a photograph of it with a camera suitably designed for use with 'scopes. Again, the DSO scores considerably because it is possible to take the stored trace *via* the digital to analogue convertor and to present it for reproduction automatically to a standard pen recorder. The recorder controls can then be used to expand the trace to whatever size is required in either axis and the result is a low-cost, high-resolution permanent record. In some DSO's, such as the Gould 'OS4020', it is possible not only to alter the plot rate to suit a wide variety of hard copy output peripherals and to control the pen movement so that the chart is only marked during data output, but it is also possible to delay the data output after plot initiate so that the recorder can be allowed to reach its full speed before being presented with the data. This is particularly useful where a U.V. recorder is used in order to maximise the speed of the hard copy so that the store can be cleared quickly in order to receive the next signal.

The advantages of the DSO do not stop here. It is possible to also arm the data store so that when a signal comes along, the store is filled and, its contents are automatically transferred to the recorder. As soon as this output function is complete, the store is then re-armed in order that the process can be repeated. This can be done as many times as necessary and is invaluable in many applications. For example, consider a computer which is suffering from data corruption due to suspected transient voltages occurring in its main input power supply. It is possible for the DSO to be set up and triggered on a Friday afternoon and then to be left

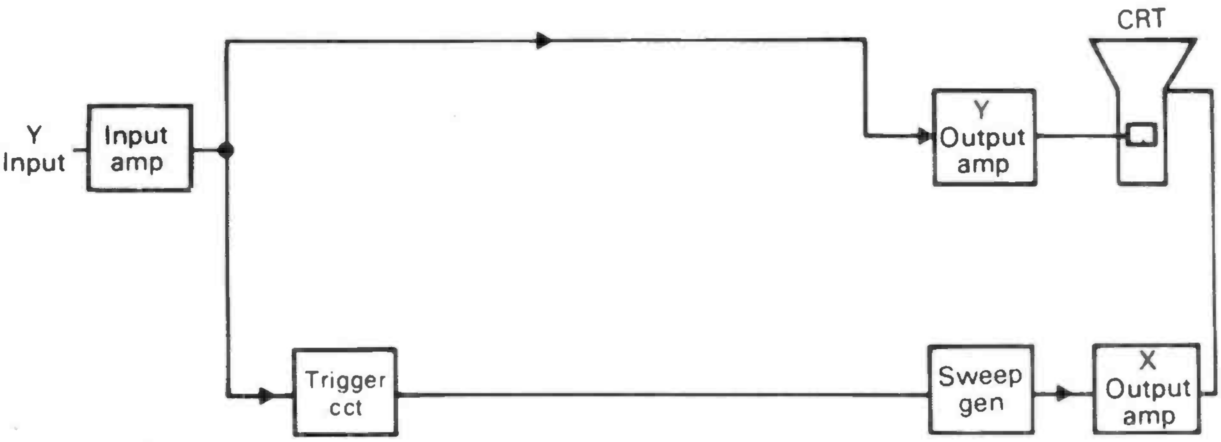


Figure 2a: Standard oscilloscope

unattended through to the Monday morning so that if any transients occur over the weekend, these are all captured and copies in full detail on to the recorder in sequential mode for analysis in order to either determine their source or to design an effective filter circuit. It is also possible to either capture a waveform from a system model or to receive a computer simulated waveform *via* the IEEE bus and to hold it in store and then to continuously plot it out in a cyclical mode and therefore utilise the variable plot speed output options to implement a complex waveform generator.

It is not only in the areas of post trigger storage that the DSO scores, but also prior to the trigger point. In many applications the requirement to trigger from a voltage level determined by the trigger sensitivity means that the first part of an input signal is lost.

A QUESTION OF TIMING

With a digital storage 'scope, it is possible to sample the waveform continuously and to use the trigger not to initiate the store, but to determine when the store is frozen. Therefore, by suitable use of the timing logic, it is possible to present the data with any pre-determined amount of history prior to the trigger so that all of the signal, including any events that preceeded the trigger, can be displayed. On scopes such as the Gould 'OS4100' as well as others in this same family, it is also possible to set up a trigger window. This means that you do not have to know whether your input transient is going to be positive or negative before you initialise the recorder (with the possibility of considerable data loss if you make the wrong choice). It is possible with the trigger window to set up a positive upper limit with a lower limit separated by a distance determined by the window width control. A pass band for the input signal is therefore created. (See *Fig. 3*) Under these circumstances, any signal which goes outside of this pass band in either a positive or a negative direction, is arranged to trigger the data capture, and by utilising the pre-trigger facilities, those parts of the trigger waveform which occur within the pass band can also to be reproduced in the store. Also, by adjusting the trigger level control, the mean value of the pass band can be set to enable a wide range of high or low set points to be established so that the DSO will only record alarm conditions.

Since the store length is constant, then the slower the timebase speed the slower the rate at which data is put into the store. Therefore, any glitches which are super-imposed on slower waveforms may be missed by conventional sampling techniques. The 'OS 4040' is able to run the analogue to digital convertor at its maximum rate irrespective of the timebase speeds selected, so that for slower sweep rates, the signal is sampled in between store entry points.

Consequently, by arranging that the most positive and/or the most negative signal seen by the ADC between store input points, is stored separately and compared with the signal intended to be put into the main store, it is possible to arrange that the most positive and/or the most negative signal is always put into that store position. In this way glitches are recorded on slow waveforms which would not otherwise show up and also a peak envelope can be plotted to indicate invalid data in the case where alias effects

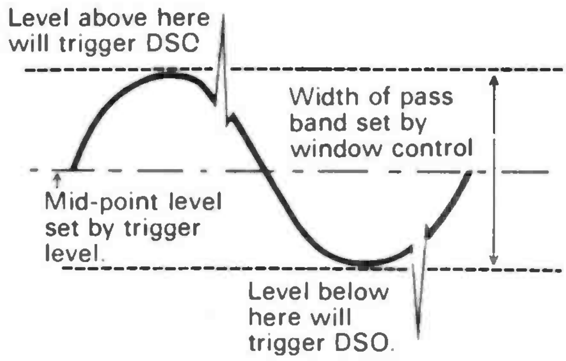


Figure 3: Trigger window control

prevail. Should the latter situation occur, both the 'OS4020 and the OS4040' can be switched into a realtime mode which bypasses the sampling circuits and enables the true data to be seen in the case of repetitive waveforms.

8-BIT RESOLVING POWER

An 8-bit resolving power in the vertical axis means that there are 3 samples per mm over an 8cm range. This is more that adequate for resolving a trace with the human eye. However, if the trace is then expanded in the vertical axis by say 5 times, then the displayed resolution becomes only one sample every 1.7mm. A 10-bit system improves the resolution by four times and therefore returns the trace to its original fidelity in the magnified mode without having to resort to interpolators which only predict what should happen between samples and do not necessarily record what is actually happening.

The Gould 'OS4200' scope uses a 10-bit analogue to digital convertor to complement its magnification abilities in the vertical axis. The advantage of this can be seen by reference to *Fig. 4*.

Figure 4(a) shows a small portion (1.2%) of a signal waveform which is sampled into a 4k store *via* an 8-bit convertor (which gives an 0.4%f resolution) and the portion shown is therefore resolved into three segments. The signal will be resolved to the nearest of these segments for each store position and this will result in the trace shown in *Fig. 4(b), Fig. 4(c)* shows the same signal resolved by a 10-bit (0.1%) convertor and it can be seen that there are 4 times as many segments in the display matrix. Again, if we applied the same process, the trace shown in *4(d)* results. The immediate advantage is obvious in that far more detail is shown in*4(d)*than *4(b)*and also the amplitude levels of the peaks and troughts are reproduced more accurately.

If we then look at *Figs. 4(e)* and *4(f)* which consist of an 8-bit convertor into a 1k store and a 10-bit convertor into a 1k store respectively, we see that in both cases a considerable amount of trace detail is lost. It is because the trace fidelity is retained using the high resolving combination of a 10-bit convertor and 4k store

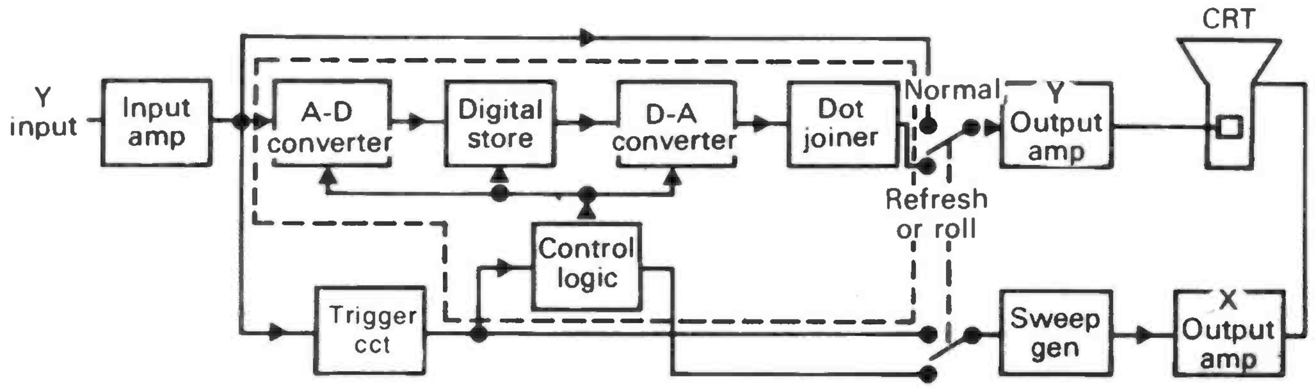
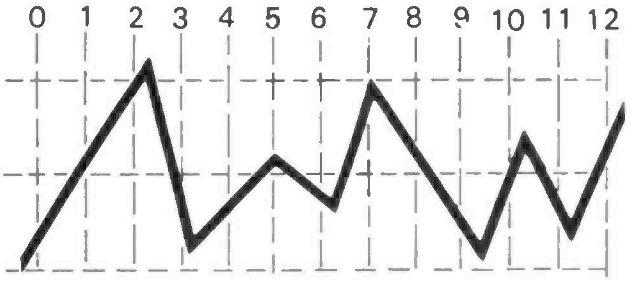
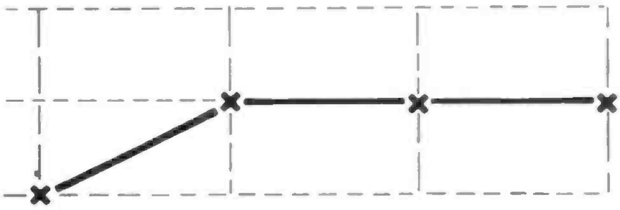


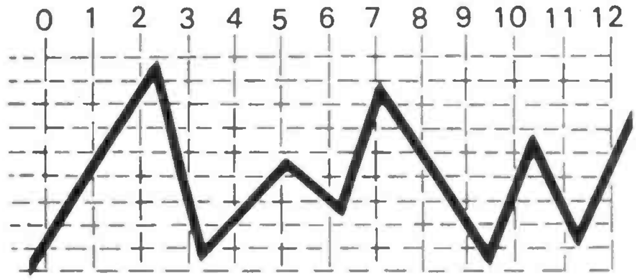
Figure 2b: Digital storage oscilloscope (DSO)



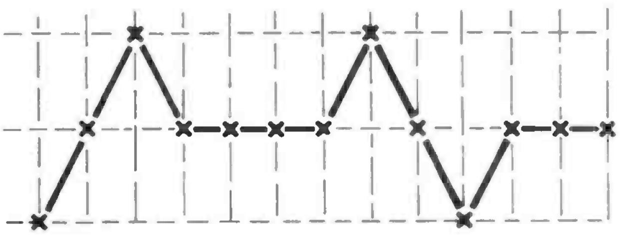
(a) Original signal



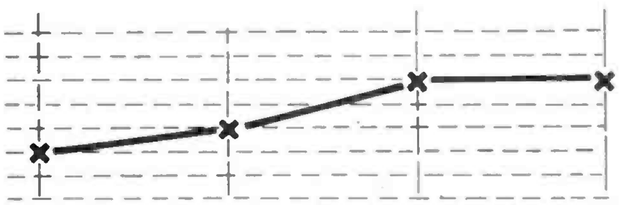
(b) Signal sampled at 8 bit x 1kw



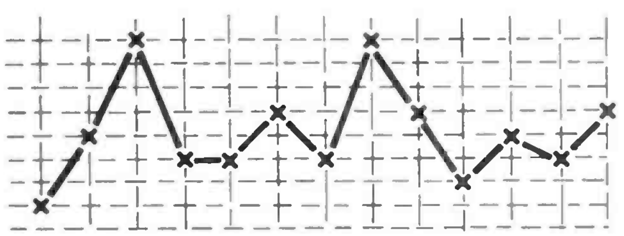
(c) Original signal



(d) Signal sampled at 8 bit x 4kw



(e) Signal sampled at 10 bit x 1kw



(f) Signal sampled at 10 bit x 4kw

Figure 4: Converter/store resolution

that very small portions of this trace can be expanded for much more detailed analysis.

In the case of the 'OS4200', it is possible to expand the 8 x 10cm display by 10 times in the vertical axis and 50 times in the horizontal axis, to give it an effective 80cm x 4m.

Sometimes it is necessary to capture single shot events which occur in a spurious fashion such that two may occur in a time frame which is too short to enable the contents of the store holding the first event to be copied before the second event occurs. A multi-sweep facility on the 'OS4040' enables four separate stores to be accessed fully automatically so that the first transient is stored in the first store and the system re- armed so that the next transient is automatically frozen in the second store and so forth, until all four stores are full.

Already DSO's are gaining wide acceptance for their extreme flexibility and this is being improved all the time with the use of microprocessors and faster ADCs.

Another method which has been considered for the storage of input waveforms uses a charge coupled device (CCD) to capture the input signal in analogue form, This utilises a string of very small capacitors which are arranged so that upon receipt of the first sample clock the analogue voltage present on the input at that time is stored on the first capacitor, then upon receipt of the second clock pulse, the information on the first capacitor is transferred to the second and the now empty first capacitor is filled with the analogue voltage present on the input at the particular time. In other words, the analogue signal is stored as a series of discrete charges which are progressively moved down the string until the string is full, hence the CCD devices are often referred to as 'bucket brigade stores'.

CCD PROBLEMS

With the earlier CCD lines, however, a number of problems prevented them from being used in DSOs, *viz.* noise, corner errors, linearity and dark current degradation with time. This meant that lines were restricted to relatively short lengths and therefore a reduced horizontal resolution which severely limited the ability to expand interesting portions of the waveform without interpolation - which at best estimates what the signal should be and not necessarily what it is. In any event, for any meaningful long term storage, the contents of the CCD have to be either refreshed or transferred to a digital store. The latter is probably the most convenient method to use and one could therefore ask why this is not done directly rather than *via* the CCD.

It can be argued that the CCD can be used effectively as a primary gearbox which slows down the required sampling speed of the following analogue to digital convertor and therefore reduces its cost. One problem with this is that the DSO would then have a 'blind spot' between allowable triggers, since the CCD line is cleared at a slower rate than it can accept new information. This could be a severe problem where automatic plotting of random transients is required, or where multi-sweep facilities require stores to be filled in quick succession.

The Gould OS5100 probably represents the ultimate of what can be achieved within the confines of standard oscilloscope packaging and control format. The built-in microprocessor enables a wide range of normal oscilloscope measurements - risetime, differential voltage etc.--to be carried out automatically, while a combination of keyboard control and on-screen alphanumeric menus makes the instrument very easy to use. The microporcessor also offers very wide possibilities in terms of expandability and flexibility to meet future requirements, and the instrument can be interfaced with computers, peripherals and hard-copy devices to form a complete measuring system.

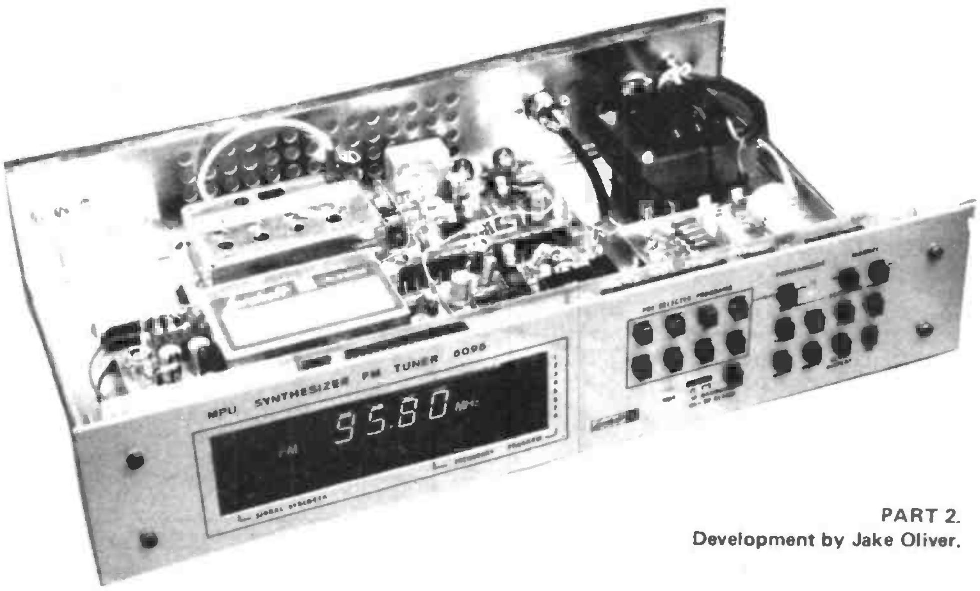
■R&EW

Your Reactions

	Circle No.		Circle No.
Immediately Interesting	61	Not Interested in this Topic	63
Possible Application	62	Bad Feature/Space Waster	64

A SYNTHESISED HI-FI FM TUNER

By Eric Larsen and William Poel



PART 2.
Development by Jake Oliver.

FOLLOWING ON from last months article, there is little more to say about the circuit. To start with, the power supply-- one transformer supplies the complete tuner. There are two windings on it:one is a 3V AC winding for the fluorecent display filament with simulated centre tap to ground via two 5R6 resistors (R165,166), the other a 20V AC, winding to supply the synthesister and tuner section. From this 15V, 8V and 5V supplies are derived using 3pin regulators. The 15V rail is provided to run the tuper section, the fluorecent display driver, the signal strenth bar graph driver and the scan-stop circuitry.

The 8V line is provided solely for the phase locked loop chip and the 5V line runs the MPU, the memory LED driver, the prescaler and buffer. Nowsome of you must be thinking that running the tuner section from the same course supply as the digital display driver, signal strength meter, and scan stop circuitry sounds like bad news for the signal-to-noise ratio. Fortunately this has been thought of and a zener diode and pass transistor has been incorporated in the circuit, this brings the supply voltage to the 7255 module down to 12V.

CONSTRUCTION

This tuner can be constructed by anyone who can read the colour code on the resistors and capacitors, insert them into the correct holes in the board and solder neatly and accurately, all the boards are silk screen printed with an overlay legend, so there is no reason or excuse for making mistakes. The polarity of electrolytic capacitors and diodes is also printed on the board.

Four PCBs are to be assembled by the constructor: the front display and switch board, the MPU synthesizer board, the PSU board and the pre-amp board.

Fortunately for the constructor the display and display driver have already been mounted on the front board and just tacked on with a few solder joints. The mounting of these components is a nightmare, the display having somewhat flimsy pins that get bent about and break off. The side effect of all this is diminished patience resulting in broken display and possibly a bent tuner-- sledge hammer coming in handy! Larsholt obviously wouldn't like the constructorto take such desparate measures, so they have done the difficult bit. Now, the constructor has just to finish soldering ALL the connections

The only things that should not be mounted on the display board, at this stage, are the LEDS.They should be mounted when the display board has been bolted to the chassis and the front panel placed on top. The current lead length for the LEDs is then apparent after pushing them from the rear of the display board. The lids can now be soldered. Assemble the MPU and synthesizer. This is a double sided board and the greatest care must be taken to put all the through board links in first. These must be soldered on both sides. Take care on the second side so they do not drop out of the bottom on application of the iron. Over the PLL and prescaler, there is a screening can. This should be mounted last after the board has been thoroughly checked for component values and orientation. An important point to note here is the screened coax lead from the prescaler preamp to the LO output of the tunerhead. This passes through a sleeved hole in the bottom of the board. If forgotton, the screening can will have to be removed to make the connection!

Both the pre-amp board (8823) and PSU board are straight forward. When the constructor is certain that all the boards are correctly assembled and soldered (no dry joints!) the tuner can then be wired together.

The MPU board is plugged into the display board at the front and supported on mutual pillars at the rear. The 7255 then plugs into the MPU board and is also supported on metal pillars. The PSU board is supported in a similar way with additional support from the heatsink for the 3 pin regulators. The best way to mount

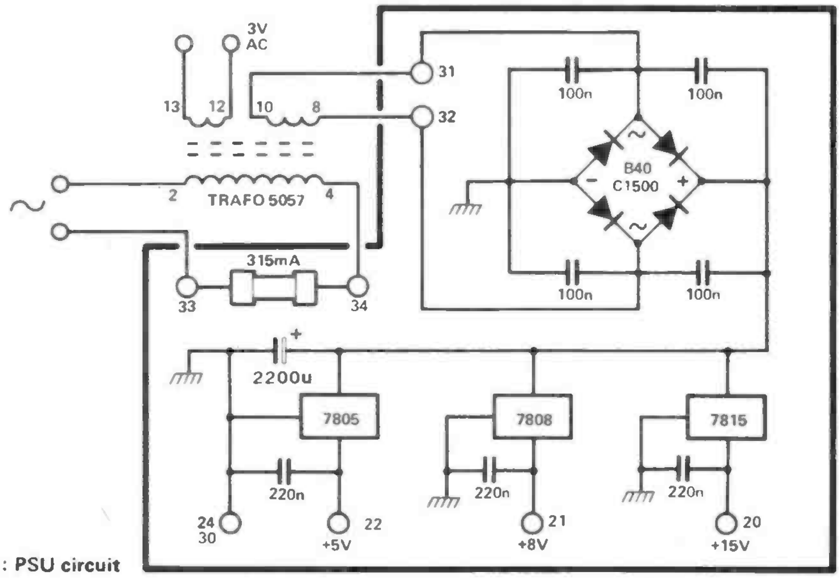


Figure 1: PSU circuit

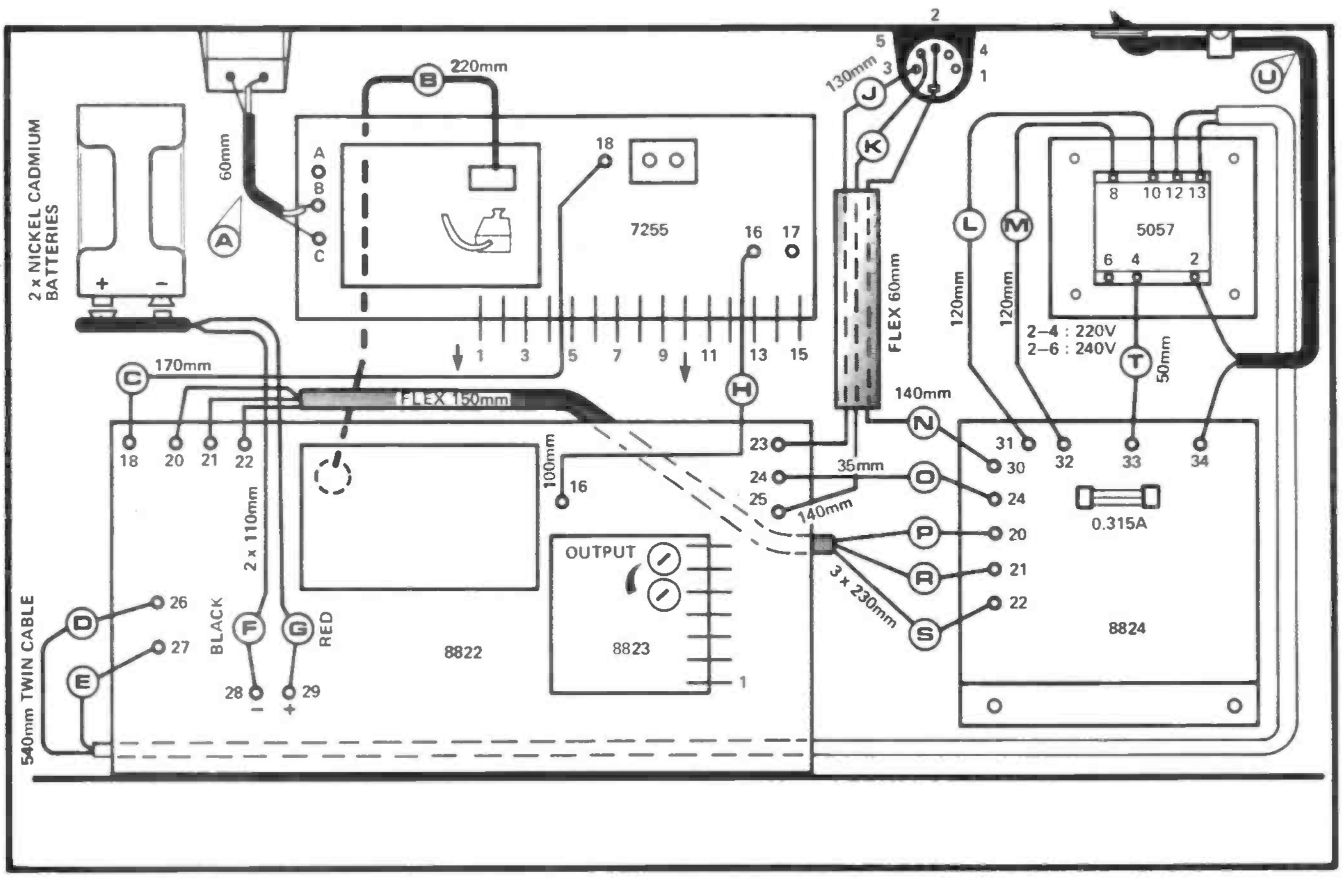


Figure 2: Wiring diagram of the synthesized tuner. The wire is supplied precut to length

these correctly is to screw the regulators to the heatsink first, insert the legs of the regulators into their respective holes in the PCB, then carefully bend them to the correct length.

The wire links required are displayed in the easy to follow diagram *Fig. 2* on completion of this the tuner is *almost* ready to switch on. Here at **R&EW** we built a sample kit from Larsholt and in our opinion the circuit does need a small amount of modification to make it function correctly.

TUNED TO PERFECTION

With any synthesizer of this kind one common problem is getting it to stop on station after scanning.

The scan stop circuitry is quite simple so the home constructor should have no problem; so long as he has a test meter. However, before this is attempted the crystal frequency should be set up using a frequency counter on the crystal (11.52 MHz) or a centre tune meter if a counter is not availiable. The centre tune meter should be connected directly between pins 5 & 8 on the 7255. This should make the mixer movement very sensitive. Tune to the bottom or top of the band, away from any station and without an antenna connected, the meter, should be centre tuned in these positions. If not, tweek the *right* hand side of the detector with a trimming tool-do not move the left hand core. Now tune to a station in the centre of the band with the antenna connected. Then trim the crystal so the meter is again centre tuned. the crystal should now be on frequency.

We recomend that component 163, a 4K7 resistor, is removed and replaced with a 47K preset with a 330n capacitor tacked on between pins 5 & 8 of the 7255. Component 163 controls the muting band width and at 4K7 this is too wide and the tuner stops too frequently before it reaches a station. The preset should be adjusted so it stops only *on* station. The mute level or threshold is adjusted (if necessary) with a 25K preset connected to pint 19 on the 7255.

On the spectrum analyser, we found distortionoccurredon very strong signals. This can be simply overcome with some extra AGC circuitry around the BF 240 preamp on the 7255. The modified circuit is shown in *Fig. 3* and the more couragous or fool hardy constructor can attempt the modification. All that is left to do is to adjust the signal strength meter pot (component 112) to give a meaningful reading and then screw the cover on and away you go.

On the IF bandwidth switching, there is also hi-blend, meaning the noise found on the weak stations is filtered to ground. The operation of this circuit can be inproved by taking the following action.

Pin 16 on the 7255 is the hiblend output. When grounded, hiblend is effected. On the circuit diagram pin 16 is connected to the base of transisistor 159 and switching resistor 157. Pin 16 should be connected to the collector of transistor 159 so when the base is taken high the collector will be taken to ground, thereby effecting hiblend. To correct this fault, connect the wire from pin 16 to the 22k resistor (156) at the end nearest transistor 159 and you should then the able to get satisfactory results.

R & EW

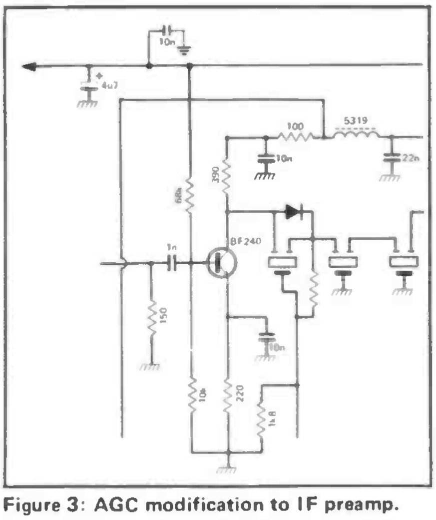


Figure 3: AGC modification to IF preamp.

Your Reactions.........	Circle No.
Excellent - will make one	133
Interesting - might make one	134
Seen Better	136
Comments	137

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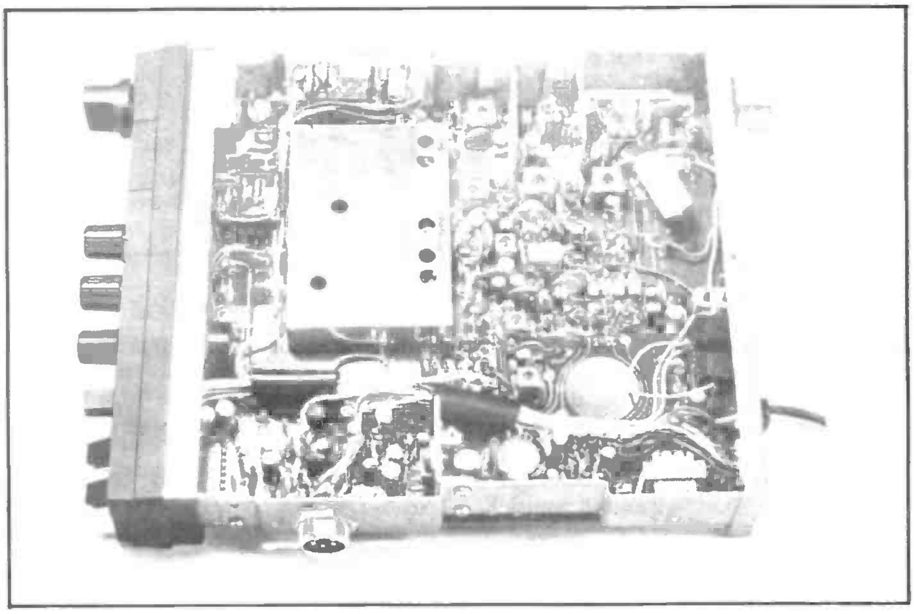
CB NOISE SQUELCH.

The popularity of the CB noise squelch published in September's R&EW has prompted Adrian Barnes to take a closer look at installing the circuit in some of the more popular commercial rigs.

A brief description of the installation procedure to be followed with three rigs was featured in our September article. However we have had a number of enquiries from readers asking for a more detailed explanation of incorporating the Noise Squelch circuit into various rigs and we are happy to oblige with complete details for three sets this month.

It should be noted that, as mentioned in the original constructional article, any modifications to a CB set will invalidate the manufacturer's guarantee, for which no responsibility can be accepted by **R&EW** We must also stress that fitting instructions other than those published in **R&EW** cannot be supplied. (Also that the PA function may be affected on some rigs).



SHOGUN

Referring directly to the PCB, remove R330 (near squelch pot), C37 (56n), C38 (lu 50V), and R38 (4k7) all near the IC TA713OP.

At this point check that C36 is 10n since C37 and C36 may be interchanged.

Next break the PCB track leading to C71 just above the squelch pot (VR2) near the through board link which should be removed. Finally replace C71 (100n, 50V) with a wire link (near speaker hole).

Now, to put it back together. The squelch module can be bolted or stuck with padded double-sided sticky tape, the recess in the chassis opposite the microphone socket is a good place. Take care that the underside of the PCB does not short on the chassis when mounted. It may be preferable to wait until the final value of R13 has been chosen before mounting the board.

Power for the module (pad 4, *Fig. 5* September **R&EW**) can be taken direct from the on/off switch on VR1, the central tab is the switched side. A convenient place to connect earth (pad 5) is via a hole in the PCB just under the volume control VR1,

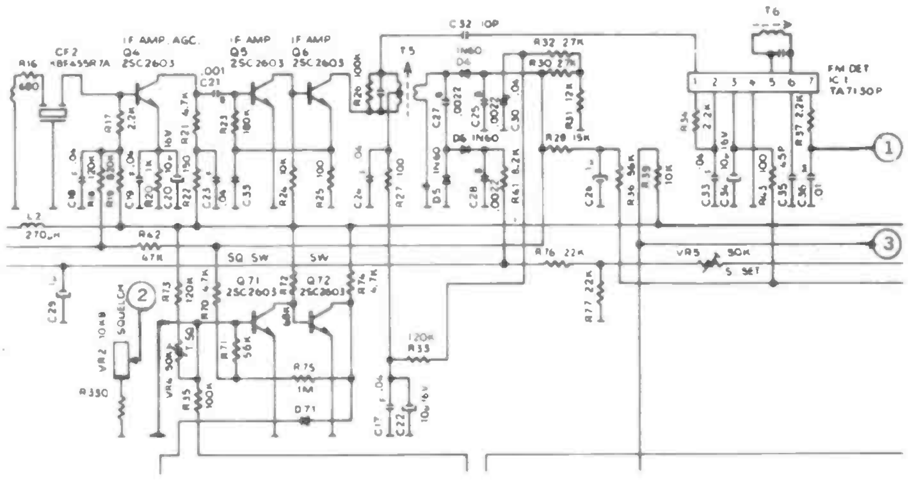


Figure 1: Input, output and squelch connections on the Shogun.

to the earth plane on the underside.

Pad 2 on the module is connected through the PCB where the pin was removed from, to the wiper on the squelch pot.

The input to the module (pad 1) is taken from the junction of R37 and C36, through the hole in the circle where R38 has been removed.

Similarly, the output (pad 3) is connected through the hole where C38 has been removed to the junction of D8 and R39. This is the hole through which the negative lead of C38 went, marked by a white dot.

A value for R13 on the module must now be chosen. As recommended 1k8 is a good starting point. However, this can be dropped to 680R in electrically quiet environments such as a home- based set up, or increased to around 4k7 if required, but this should not be necessary in most applications.

Finally, the range for the squelch control must also be chosen, being set by either changing the squelch pot, or by simply, replacing R330 with the required value. This will depend upon the value of R13 since this determines the sensitivity. For low values of R13 such as 680R a wire link is sufficient, and above R13 = 1k5, R330 should be about 2k2.

The unit should work first time, provided it has been constructed and connected correctly.

All that now remains is to turn on the power, sit back and listen to civilized copies.

MAXCOM 4E

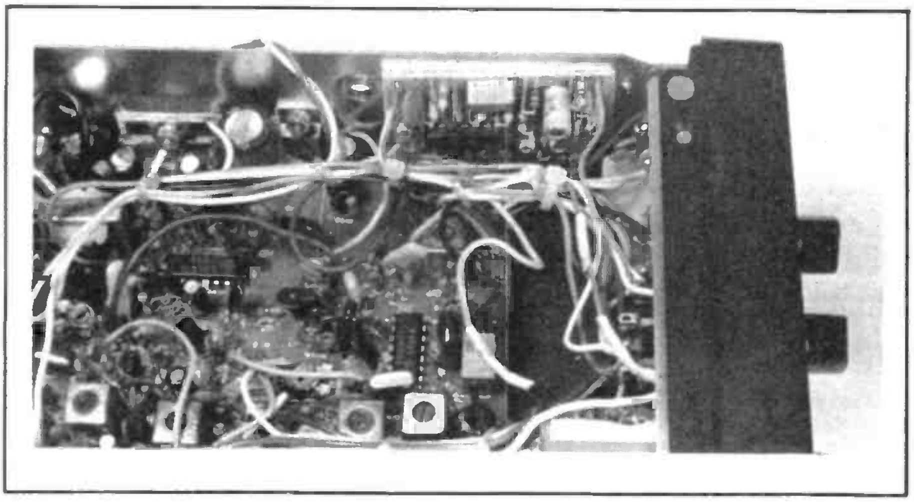
The Maxcom 4E is the next to receive the treatment, being a fairly popular rig, mainly due to its low price and reliability. The PA function should not be affected by the installation.

It is best to make the easiest connections first but do not mount the module until a final value for R13 has been chosen. Power (pad 4) is taken from the on/off switch on the back of the volume control, the pin nearest the squelch pot is the switched side.

Earth (pad 5) can be taken from the meter, taking care to take the tag nearest the volume control.

Turning the on-board mute off is the next task. Remove the two bottom wires from the squelch pot, the wiper and the wire going via (27) to L105. Connect these two together and insulate the joint (heatshrink sleeving is ideal). At this point it is necessary to note that some numbers on the board are not coincident with the numbers on the schematic diagram. However, tracing the printed circuit tracks proves the components in the areas with which we are concerned to be correct.

Swop the remaining wire on the squelch pot to the bottom of the pot so that squelch is increased as the control is rotated clockwise. This is because the original squelch is active when the wiper is low, whereas the module mutes when the wiper is high.



For input and output connections remove the wire connecting the centre pole of the CB/PA switch on the rear of the squelch pot and the end of the track of the volume control pot.

Connect the input of the module (pad 1) to the tag on the CB/PA switch from whence the link came. The output of the module (pad 3) should then be connected to the free tag on the volume pot.

As with the shogun, trial and error will

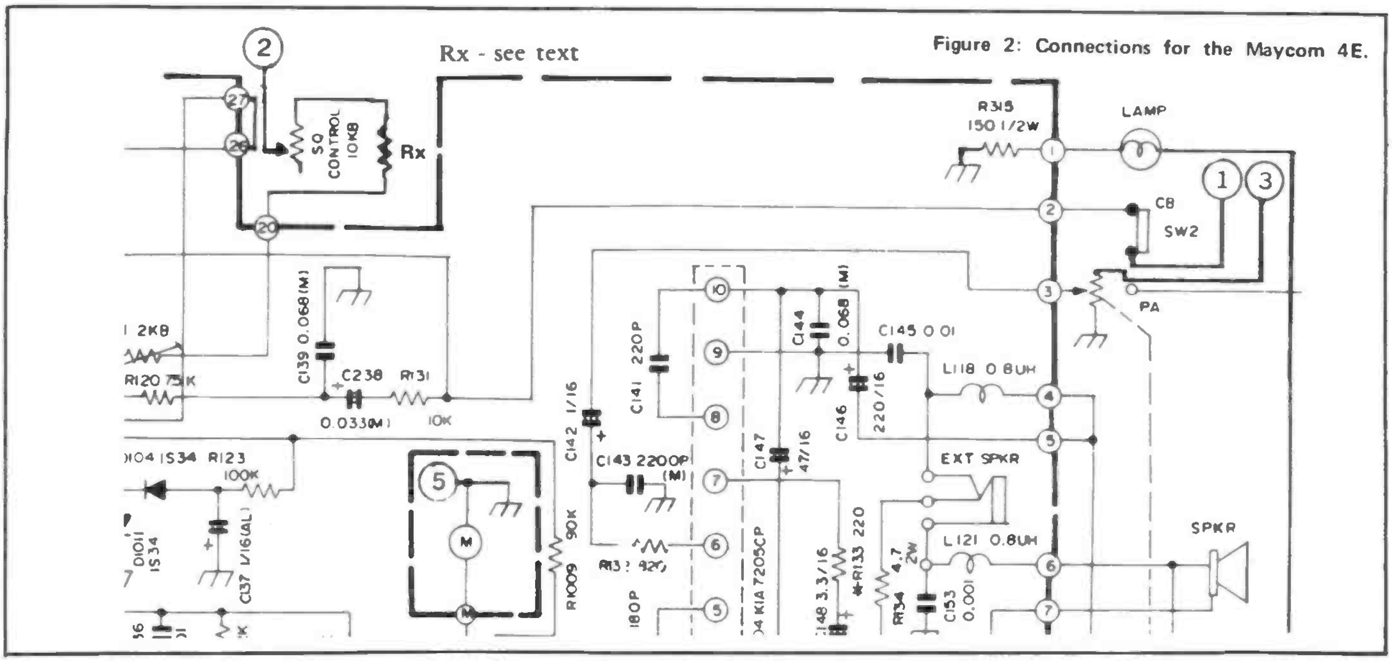


Figure 2: Connections for the Maycom 4E.

find the value of R13 best suited to the environment and the user's preferences. 1k5 works a treat, but this can be varied between about 470R and 3k9.

This adjustment of the sensitivity of course adjusts the squelch pot offset, which has to be brought back into line with a series resistor. The value of this resistor will again depend upon user preference but around 20k will be necessary for R13 < 680R, increasing to around 25k at R13 = 1k8 and 27k at R13 > 2k2. This resistor connects the wiper of the squelch pot and (pad 2) on the module.

A finer control of the offset can be obtained by setting RV101 (RV120 on schematic). This preset gives about 2k range and can be increased if desired, about 4k7 should suffice. Set the squelch control at the position you would like it to cut out most background noise, pick a channel which is hissing and turn RV101 until mute just cuts in. If this position cannot be reached, dead silence indicates the series resistor with the squelch pot is too large, or white noise indicates the value is too low. However, ensure that the squelch offset is set such that really noisy signals can be cut out, but more important, quiet copies are not muted out.

The board can be mounted as before with double sided padded sticky tape to the chassis. There is plenty of room, the side of the chassis nearest the 's' meter proves satisfactory.

Overall this is a very straight forward installation and should present few problems provided the board is correctly constructed.

Note: The Maxcon 4E, Cobra 21XFM and Commtron CB40F all share a common chassis and installation in these is similar to the 4F.

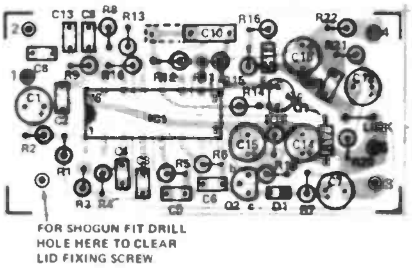


Figure 5: Revised overlay for the squelch board.

AMSTRAD 900/901

Unfortunately, since the Amstrad already has a fairly good squelch on board, the improvement in performance is not as noticeable as for say the Shogun.

The original article mentioned removing several components, and changing one capacitor. This is not necessary since the module can be connected into the squelch and volume pot wiring fairly easily.

If you have not yet built the module, or before it is mounted, it will be necessary to change C2, normally a decoupling capacitor from 220p to around 10n. The capacitor then will still perform the decoupling function, but also acts as a low-pass filter with R2, to remove 455KHz signals from the second I.F. If this is not done, the module will see the signal as noise and stay permanently muted.

A good earth point is not an easy thing to find, but there is a convenient post next to D23 near the speaker output sockets. The positive lead can be taken from the switch on the volume control pot, the switched side is that nearest the PCB.

The yellow wire from the detector section off of R77 and C96 should be removed from the PCB end of the volume pot.

The input of the module (pad 1) can be connected to the wire and the output (pad 3) to the tag from whence the yellow wire came.

One wire on the squelch pot goes to ground, via a 100K preset RV5, which is very useful since it removes the need for a series resistor in-line. The other two wires on the squelch pot should be removed, joined and insulated, thus turning the on-board mute off.

The squelch control on the module (pad 2) can now be connected to the wiper of the squelch pot.

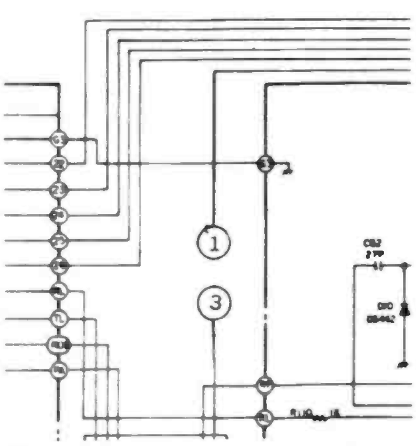


Figure 3: Input and output connections for the Amstrad

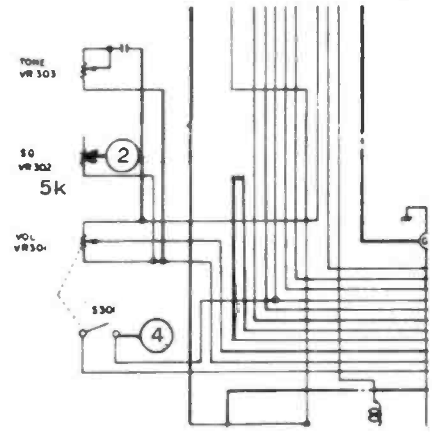
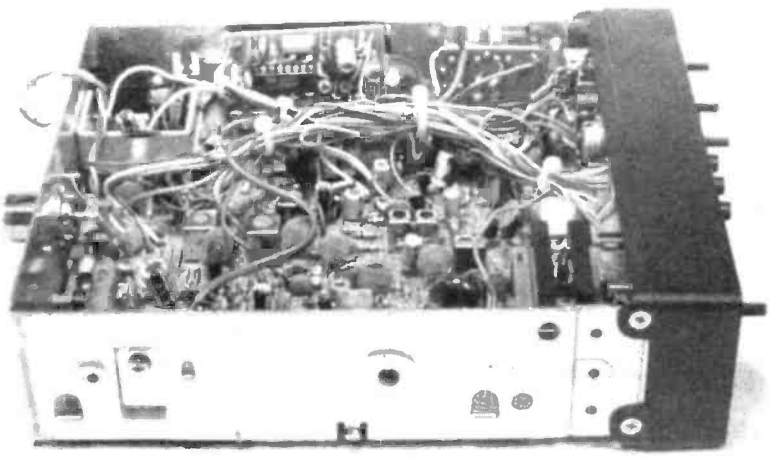


Figure 4: Squelch connections for the Amstrad



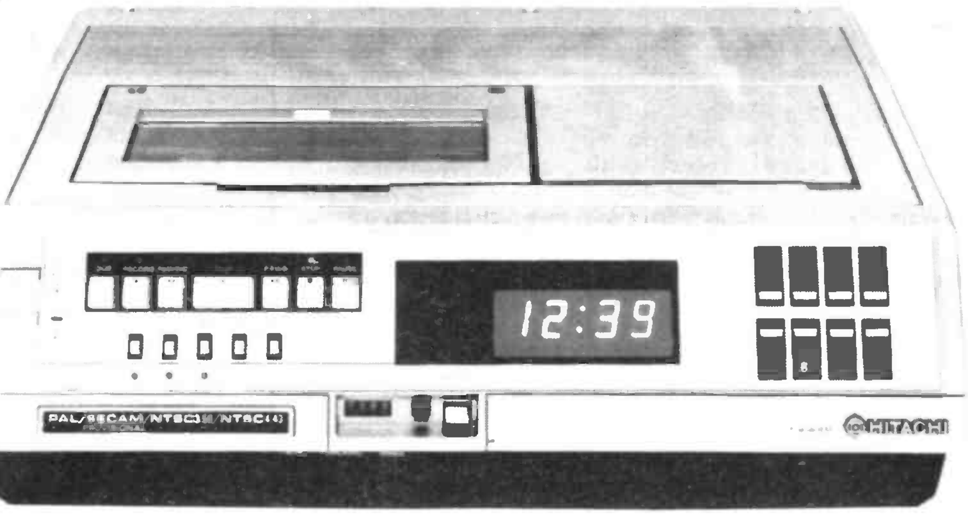
Powering up, a value for R13 can be chosen, which may be any where between 470R and about 6k8. RV5 will now need to be set to give the desired range of control on the squelch pot.

It may be noticed at this stage that the control is very touchy. This is because the pot is 50k. The only way around this is to change the pot, 5-10klin is about right and VM10R's fit in nicely. The knob does have to be enlarged to accept the non- splined shaft and then glued on but this is little trouble.

The module can now be mounted, the same side of the chassis as the microphone socket is a likely place. Apart from the pot change, this is the simplest of the installations to date and should present few problems.

Your Reactions..........	Circle No.
Immediately Interesting	44
Possible application	45
Not interested in this topic	46
Bad feature/space waster	47

VIDEO NEWS



Peter Luke has news of Hitachi's new multi-standard system and an explaination of the noise bars that appear during fast search modes.

As one of the data briefs in our September issue highlighted, TV standards throughout the world are, as it were, anything but standardised. The PAL system is the front runner in Europe, with the exception of Le France who felt obliged to devise the SECAM system as a monument to their individuality. The USA and Japan fall into the NTSC camp while the rest of the world adopt one of these three standards on a fairly ad hoc basis with, as often as not, minor variations in the vision/sound spacing, modulation system, video bandwidth etc.

This diversity of standards necessarily means that a TV set designed for the American market will, even if the differences in mains voltages are compensated for, be of little use in this country. This fact hardly affects the quality of life or the freeness of trade as manufacturers have long been accustomed to providing sets for the differing systems and very rarely does the 'man in the street' want to lug his TV set across the Atlantic on his hols.

The advent of the video recorder, and the easily transportable nature of video cassettes, has however meant a demand for video recorders capable of playing back tapes recorded to any one of the systems.

At first sight it may seem that, although transmission systems may vary, if a video monitor were used in conjunction with a recorder, the results obtained, no matter whether the tape was NTSC, PAL or SECAM, would at least be viewable. Sadly this is not the case.

The problem lies mainly with a video recorder's servos and associated drive circuitry, responsible for controlling both linear tape speed and the helical heads rotational speed. Thus while a 625 line set will display a 525 line picture without much trouble-contrary to the rumours spread by the retailers of micro computers in the early days of micro computing - a tape recorded at 525 line rate will NOT play back on a 625 line machine. The range of adjustment of a TV's line time base is quite large but there is no equivalent adjustment on a VCR as much of its timing circuitry is based on division of the received sync pulses, a 625 recorder playing back a 525, 60Hz frame rate tape, will divide by two, expect 25, get 30 and panic.

Table one sets out the full story and it can be seen that any hope of PAL/NTSC compatibility is out of the question, but that there is a certain amount of PAL/SECAM interchangeability.

The only way for businesses, educational establishments or individuals to exchange tapes with any degree of freedom is thus to make use of a multi-standard recorder in conjunction with either a monitor or multi-standard TV set.

Such machines have been available for some time, the prime source being conversions to standard machines undertaken by one of the specialist video firms such as R&EW (no relation) of London.

Hitachi are one of the major manufacturers who produce such a multi-standard machine as a standard item in their range and the new VT 8040 EM is capable of playing back and recording PAL, SECAM and both 3.58 and 4.43 MHz NTSC material.

The recently released machine features the mix of trick video facilities found on up-market machines, still frame, visual search, fast & slow play back etc., and a ten day timer. Solenoid operated transport of course and a look that is reminiscent of the 8000 series, being a matt grey rather than the black of the 9000 range.

The price of £732 is very reasonable when considering the flexibility of the recorder and should make it an excellent choice for anybody envisaging a need to play back any imported tapes, a need that will probably arise more and more over the next few years.

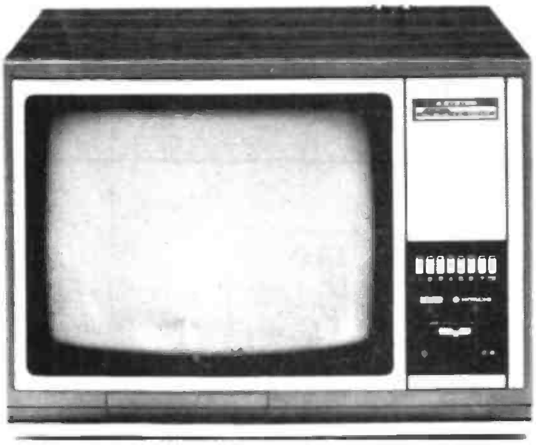
As a companion to the 8040, Hitachi have launched the CMT 2060, a 20" TV that is able to cope with the same range of transmission standards of the recorder. This weighs in at £477, again not too much of a price penalty when considering the multi-standard facility but many people might consider that the extra would be better spent on a video monitor to give an extra edge on definition.

ACCOUNTING MADNESS

At **R&EW** we are in the process of setting up our own video production facility and, with an eye on the Editorial budget, have been shopping around for the necessary cameras and recorders. Last month we managed to pick up one of the end of range C5 machines at under £300 and recently acquired two Videostar cameras and a portable v-matic in a very reasonably priced package deal.

The company that sold us this latest batch of equipment deals, in the main in ex-rental set sales to the trade, the cameras and U-matic being outside their normal sales activities. The owner of the business talked quite frankly about ex-rental sales in general and had an interesting tale to relate about a large rental company's policy with regard to releasing ex-rental video recorders to the trade.

As with TV sets, the price paid by a dealer for ex-rental machines depends on the 'book value' of the recorder. To allow a trader a decent margin on a video recorder, the price needs to be about £100.



Hitachi's CMT 2060 multi-standard monitor.

VCR	Cassette	TV set operating on: PAL	NTSC	Secam
PAL	PAL	Colour	Mono	Mono
	NTSC	-----	-----	-----
	Secam	Mono	Mono	Colour
NTSC	PAL	——		——
	NTSC	Mono	Colour	Mono
	Secam	——	——	——
Secam	PAL	Colour	Mono	Mono
	NTSC	——	——	——
	Secam	Mono	Mono	Colour

Table 1: Playback compatibility between the various TV standards.

This would allow a new set of heads to be fitted, the machine tweaked up a bit and still give a realistic retail price by the time the dealer has taken his margin.

Now the 'book value' as determined by the accountants is greater than that magic £100 barrier and thus the trade are not interested in the machines. In Bedford there is therefore a pile of machines depreciating away until their value will have fallen enough for the company to release them.

Firms must base their dealings on sound accounting principles but keeping a pile of machines in a warehouse, machines that could realise valuable cash and reduce borrowings, does seem to be a particularly daft state of affairs.

NOISEY QUEST

We've had a lot of enquiries about just why the picture search functions of video recorders give rise to the disturbing noise bars on the played back picture. Thanks to the awfully nice people at Sanyo we can explain all.

All domestic video recorders adopt the helical scan system in which a drum assembly with two diametrically opposed video heads record a series of narrow diagonal 'tracks' on the tape. Each track records one complete frame of a TV picture (312.5 lines) and *Fig. 1* illustrates a series of such tracks recorded onto a tape. The June issue of **R&EW** explains the basics of helical recording in greater detail.

When playing back a recording at normal speed, each of the video heads will retrace the path it followed during recording and a noise free picture will be reproduced.

During a fast search, the **LINEAR** tape speed is increased and the geometry of the system means that now, instead of any one head scanning a single track laid down during the recording process, it now scans a number of tracks.

Nominally labelling the heads 'A' and 'B', *Fig. 2* shows that during a fast forward search head 'A' will reproduce sections of tracks A1, A2 and A3 (while the head traverses tracks B1 and B2 no signal is received from these as the slant Azimuth system used in domestic machines dictates that adjacent tracks are recorded with differing Azimuth angles and thus only the head with the corresponding angle will reproduce any signal).

Similarly, for the next field, head B picks up signals from tracks B3,B4 and B5 ignoring the tracks A4 and A5.

The head output diagram shows that, in this example, two noise bars are present and that the noise bars for both the A and B heads follow a similar pattern.

During a fast reverse search, the 'head to track' angle is slightly different and three noise bars will appear.

In practice the noise bars will tend to shift position on the screen as, during a search mode, tape speed is not as accurately controlled as during playback.

Hope that has cleared the noise bar phenomena up.

R & EW

Your Reactions..........	Circle No.
Immediately Interesting	104
Possible application	105
Not interested in this topic	106
Bad feature/space waster	107

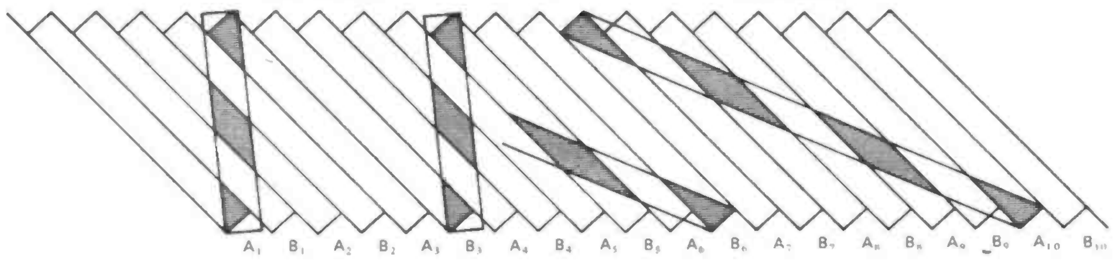


Figure 1: As a tape's linear speed is altered so the helical head's angle of incidence changes.

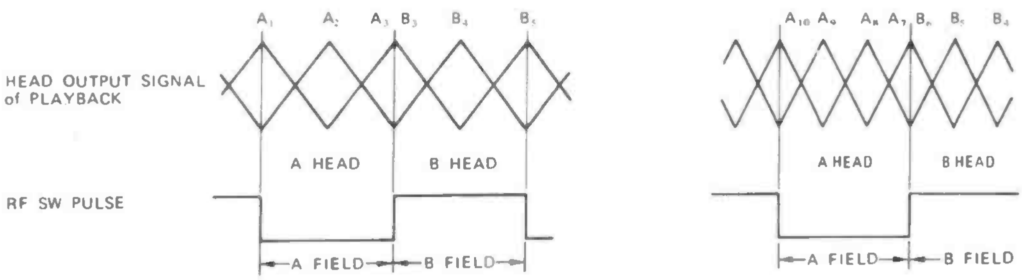


Figure 2: The changing angle of incidence of the helical heads means that during a fast search any one head will replay signals from a number of tracks.

PCW '82: Quad density, floppy punters

WE WERE THERE. This year, the mecca of the Personal Computer World shifted to that erstwhile multistorey car park in London's Barbican complex. (If you didn't already know, the exhibition halls in the Barbican are converted car parks.)

The claustrophobic effect of the low ceiling is generally overcome fairly rapidly once you get absorbed into the warren of exhibits, but when nigh on 10,000 have the same idea, then it can all get to be rather clammy. Stepping over the bodies of those resting from the rigours of the Grand Tour only heightens awareness of the fact that the facilities of the Barbican exhibition centre are stretched by as few as 1000 visitors at any one time.

Such high density packing would not be out of place in the latest technology Winchester disk drives.

However, the show performed its objective with admirable success: Thursday and Friday (September 9th and 10th) saw a healthy flow of the 'faithful', whilst Saturday and Sunday witnessed a flood of the enthusiastic and eager newcomers that seem to multiply by a factor of 100% each year.

SO WHAT?

As we bore witness to what can only be described as a 'phenomenon', various analyses were being attempted as to the meaning of all this frenetic activity. Whilst TV games were undeniably the main attraction for many, there was also a very healthy interest in the more constructive aspects of the hobby, although there was lamentably little in the way of 'hands-on' experience for the hardware hungry. The *R&EW* stand displayed the only *real* microcomputer application in the whole place (The Z8 TBDS, of course).

This ignorance of hardware is indeed the saving grace of many dealers whose margins on basic machines (as the BBC and VIC are affectionately termed) are so pathetic. Less then 25% in many instances.

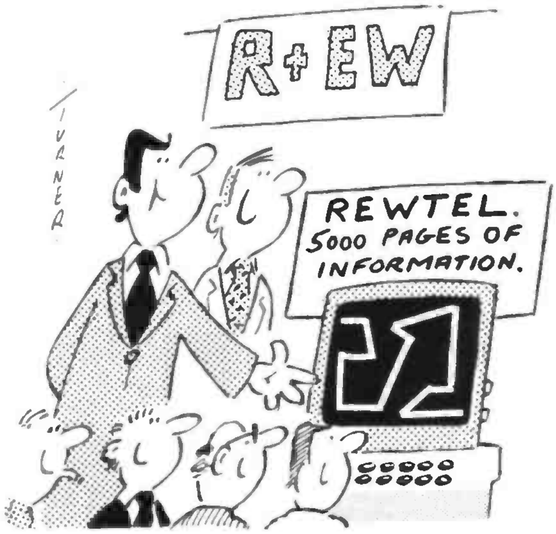
They only manage to make a living by charging what to us (who know about 'D' connectors, soldering irons and other such things) look like extortionate sums for the peripheral bits and pieces. Can anyone top £25 for a 3 foot 'D' to 'D' cable?

Another interesting sideline is the fact that well over 90% of the visitors dipped into their pockets for the £2.50 entrance fee without a murmur. Just think what sort of a rumpus an entry fee like that would cause at an electronics/radio hobbyist exhibition.

Conclusion number one was that most of the visitors to the show were thus not the same animals as might generally be found strolling around the RadCom exhibition, or the new AP show sponsored by IPC. (We're there too, don't forget).

Judging from the number of 'obvious' questions that were being asked about very basic electronics, the show had managed to bridge the gap that seems to exist between technology as understood by readers of **R&EW**.... and 'normal' people, as the non-afficiandos tend to define the situation.

The 5th Personal Computer World Show



"WHAT A STROKE OF GENIUS... A PAGE TITLED 'FINDING YOUR WAY OUT OF THE BARBICAN COMPLEX.'"

LIFE THE UNIVERSE AND EVERYTHING

The most positive lesson that *we* learned from the whole exercise was that the 'personal computer' has managed to overcome the techno-phobia of the person-in-the-street that still acts as a serious barrier to entry into the particular neck of the market represented by this publication.

TV games are the 'missing' link, and no matter how superior we may feel about messrs. PAC-MAN & friends, these manifestations have managed to do for computing exactly the opposite of what Tony Hancock and James Burke have done for other aspects of 'Information Technology'.

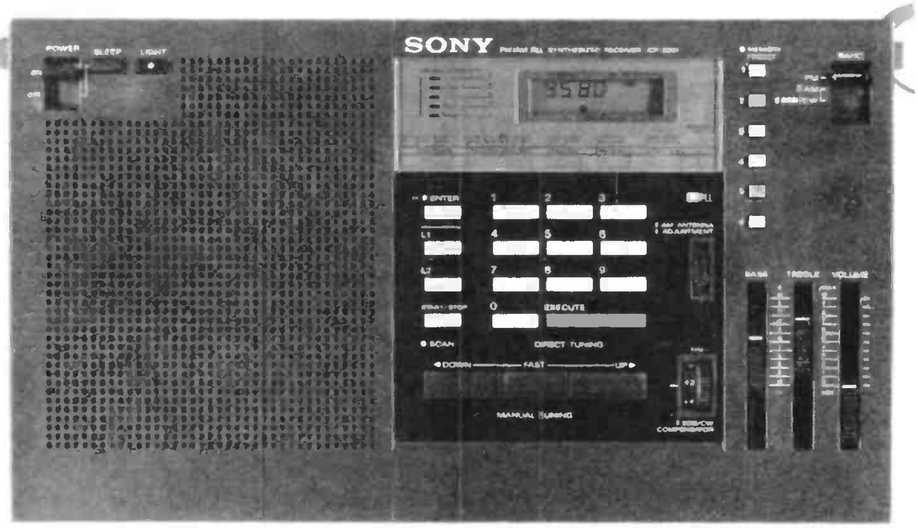
Once saturated with games, the personal computer user (PCU) seems to aquire a taste for 'doing things' with the I/O: enter **R&EW**. REWTEL performed immaculately throughout the show, although we had occasional trouble dialling into our *secret* number, since someone had been daft enough to disclose the numbers we were using during the show. It was heartening to see such instant interest from the show visitors.

Another generally encouraging feature of the show was the emergence of RS232 facilities on virtually all the new hardware. The Lynx offers it as standard, and the Dragon (the Mettoy PC) promises it 'very soon'. Uncle Clive should just about have it ready, all of which means there's no excuse for you lot not to be using REWTEL once the modem situation is sorted out.

Finally, a cautionary note: the great chasm between the 'soft' and 'hard' ends of the PC business shows few signs of closing. There was scant evidence of any component source attending the show, and most talk of development referred to software. Unless a little more emphasis can be placed on a rounder appreciation of the subject, the PCU will be in the same position as some modern Radio Amateurs - namely having to ask the dealer to fit the mains plug.

■ R & EW

Sony's ICF-2001



William Poel takes off on an Odyssey around the inner space of Sony's masterpiece in portable radios, and discovers one or two black holes amongst the galaxies of features.

FOLLOWERS OF THIS magazine may have detected something less than complete enthusiasm on our part for some of the facets of the redoubtable Sony Corporation. This may in part have been due to the absence of the invitations to their press bunfights, although we must now report that Gary Evans has indeed sampled the Sony hospitality department, and lives to tell the tale. (Or so we believe.)

The hassles we have had over the ICF2001 have never really been resolved, but we have been asked so frequently to provide the ***R&EW*** view of the receiver, that we have succumbed and decided to 'give it a whirl'. After all, although the particular model we play with has been around for nearly 3 years now, the ICF2001 has not really been approached in terms of design concept and price by anything else in the meantime.

We'll start by saying that *we* all preferred the Panasonic RF3100 which was reviewed in the July 82 issue. However, the inability of Panasonic to get any sort of marketing act together to put these receivers into the hands of the communications equipment dealers, in the way that the ICF2001 is apparent at most amateur radio dealers, has meant that despite getting the R&EW accolade of good receiving - most of those who might actually want to see and fiddle with one have not been able to do so.

Not so the ICF2001, and there are few followers of the communications persuasion that have not fondled the controls of the Sony device on some occasion or other. But apart from the availability aspect, the 2001 is in many ways a horse of a slightly different colour, offering full MPU control of everything, including direct frequency entry, scanning and preset stations.

Get your shares in Berec first

Major operational gripe is the fact that the ICF2001 is a *very* thirsty little receiver. Battery life (with 3 'D' cells) is stated as 9 hours on AM bands operation, 10 hours on FM. The actual consumption can be found lurking on the main circuit diagram in small red letters alongside the DC input jack:
'FM 190mA'
'AM/SSB 225mA'
Using 4Ah Nicads, this means about 15 hours to the effective 'end point' bearing in mind the basic voltage deficiency. Indeed, with 3.6 volts, as opposed to the requisite 4.5v, there is never quite the same *apparent* sensitivity, although this appears to be more a function of psychology (the LED signal strength indicator is more reluctant to light up) than inability to resolve weak signals. After 10 hours listening to FM, the D cell still measured 1.2v (as opposed to 1.32 immediately after charging), and the receiver showed no signs of distress.

Obviously the volume setting will have a bearing, but you get the picture.... Incidentally, the sound quality is quite superb, so you might get tempted to turn the volume up louder than you might otherwise do.

The mains adapter is extra, though obligatory for anyone whose battery purchases are not tax-deductible. A 12v adapter is also available, but the real snorter is the similarity between the AM/FM switch and the On/off switch. OK - so one's on the left, and one's on the right of the panel - but it is perilously easy to switch from FM to AM and not actually notice that you haven't turned it off, if the last AM station tuned was a weak and watery signal in some part of the HF spectrum that has since quietened down.

Bigger than average ears

The wonderous FM sensitivty encourages use with the telescopic antenna right down (to avoid poking eyes out and generally cluttering up the place), which further improves your chances of not noticing that AM is selected, since the telescopic antenna is all-important to the reception of AM, as although an internal ferrite antenna is available for 360 to 2143kHz, the telescopic antenna and the RF trimmer also contribute enormously to reception on these bands.

Measurement of sensitivities is not very straightforward due to the available methods of input matching, but for those of you charitable enough not to be too pedantic, we have had a go, and present the results elsewhere. Whichever way you look at it, the ICF2001 is a hot receiver.

However, the real fascination of the ICF2001 lies in the circuitry, which must be an example of giving a design engineer a free hand to do his own thing, since it quite simply knocks some 45 years of radio design on the head in one go. It must have taken a lot of nerve.

Hold tight

A brief glance at the block diagram of *Fig. 1*, and the detailed diagram of *Fig. 2* will show that we are not dealing with anything less than the leading edge of the art. The receiver uses two PLL frequency synthesisers (which, incidentally, NEC advise us have been obsolete for some time past, although we have no doubt Sony have good stocks laid in). The uPD2819C resembles the Motorola MC145155 in many ways, and use of the low power CMOS Motorola part may indeed lead to considerable power savings.

Much of the power wastage must occur in the DC/DC converter and subsequent regulation. The curiously antiquated appearance of the audio output stage (Q10,11,12) is probably explained by the need to make the most of 4.5v supply, so we won't snipe at the lack of IC sophistication here.

The provision of sleep timer also requires that a pass transistor (Q27) be placed in the way of the volts from the battery, which has an impressively low Vce sat. of apparently 100mV. Which means that at best, 200mA dropping through 100mV is going to waste 200mW. That's the price of progress.

FM first

L1 feeds a tuned signal to the gate of the JFET Q1, with a further tuned circuit in its drain. For us lesser mortals, such practice usually results in an oscillator stage, but not so for the gifted Japanese. The mixer stage is a slightly less inspired bipolar device, albeit using emitter oscillator injection (via buffer Q47), which is the best way to do it, if you must. Q47 gets its drive from Q21, which in turn gets its signal from the buffer of the first VCO, Q29.

The oscillator is injected on the low side of the RF signal, and the resulting IF of 10.7MHz is selected and amplified via IFT F1 and the ceramic filters, CF1 and CF2. The IF amplifier IC (IC1, a CX162) is a fairly uninspiring device, which, we suspect, again finds board room by virtue of its low working voltage. Nonetheless, it does its job admirably, and feeds the ratio detector discriminator stage that rounds off the FM department. Not so tricky, so far.

The local oscillator has thus far only used the first PLL stage, and using 100MHz as an example RF frequency - the LO is injected at (100-10.7)MHz = 89.7MHz.
The reference frequency of the loop is 5kHz although the step size is 100kHz, thanks to the /20 prescaling effect of IC3. So the n counter is instructed to divide by 89,700/(20x5) = 897.
Note that the receiver tunes 76-108MHz in its FM mode.

150kHz to 30MHz

The simplicity of the FM section is contrasted by the complexity of the AM processing department. RF signals enter the set via one of 6 bandpass filters selected by diode switching via Q13-Q17, driven from the CMOS MPU controller. At this point in the Sony circuit descriptive, the author goes off the rails and states that:
'The one megohm resistors Rs 54,56,59,61 and 63 shape the frequency response of the bandpass filters, along with C178...'
It's back to the 'Walkman' production line for you, sunbeam. In fact, these resistors back bias the coil selection diodes until the appropriate transistor switch turns one on. C178 decouples the line to RF.

The input circuitry of the 2001 is essentially a series of parallel tuned tank circuits tuned by D13 - a TOKO KV1211 - via a DC voltage derived from the 6 bit D/A based on a memorable application of a 4015. The complexities of track tuning are such that an approach all the way from 150kHz to 30MHz has meant that the 2001 also provides a thumbwheel antenna trimmer control for peaking the input stage.

The cascode RF stage formed by the JFET Q52, and the bipolar Q50 are worthy of plagiarization, judging the set's performance in this department. Overall gain is preset by switching the source resistance of the FET around, using a slider switch on the edge of the set. Q18 and Q23 drive the AGC into Q50, deriving the prime AGC signal from the IF amplifier and detector stage, IC1. The collector of Q18 also drives the signal strength bar graph, IC2, a Sanyo LB1405. Note that the scanning autostop signal uses the output of the second LED driver stage to detect a 'presence'.

You may be wondering where the rest of the RF selectivity lies. So does the ICF2001; when used in the presence of strong signals, not only in the same frequency range as the set is tuned to, but it also apparently responds to image and IF spurii, as there is only the trap formed by L5 and C52 to keep out such

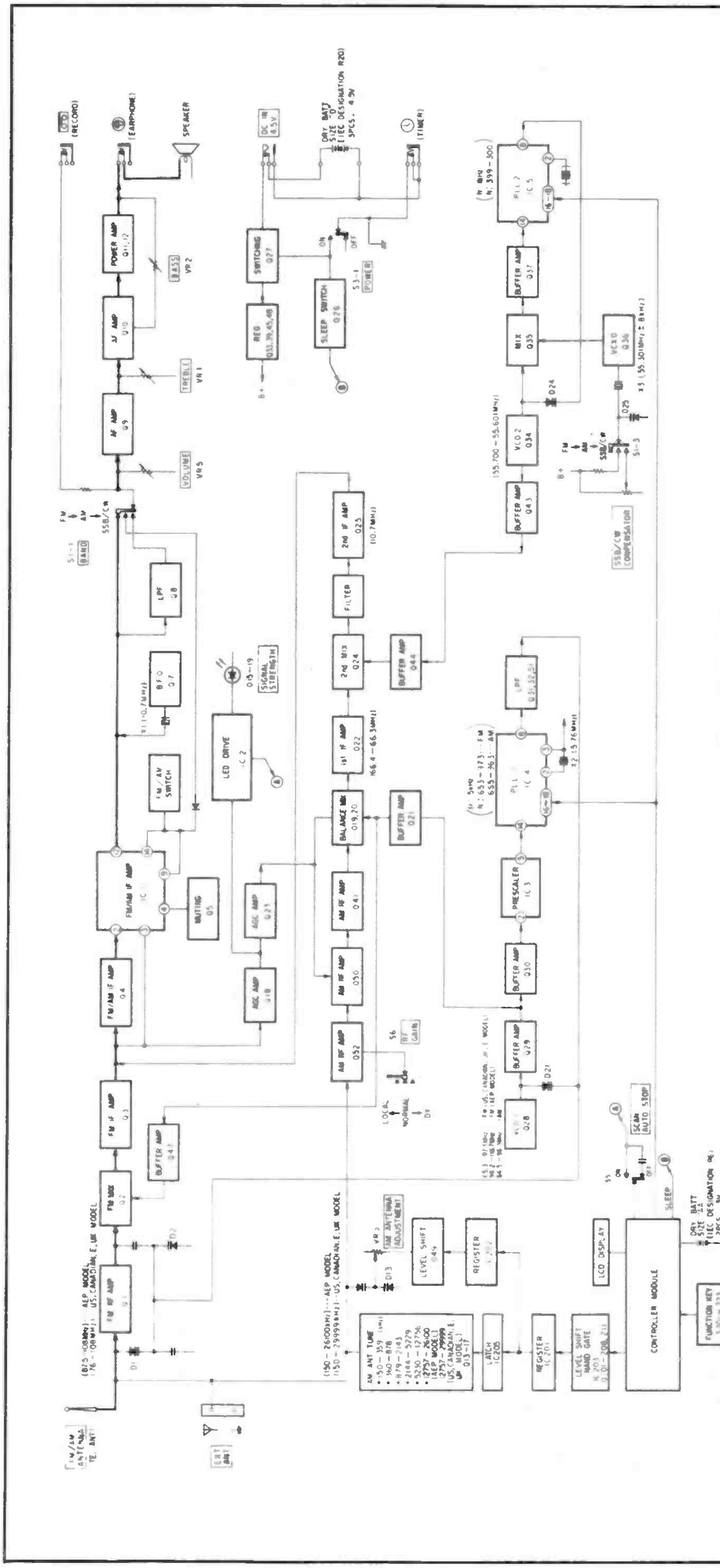
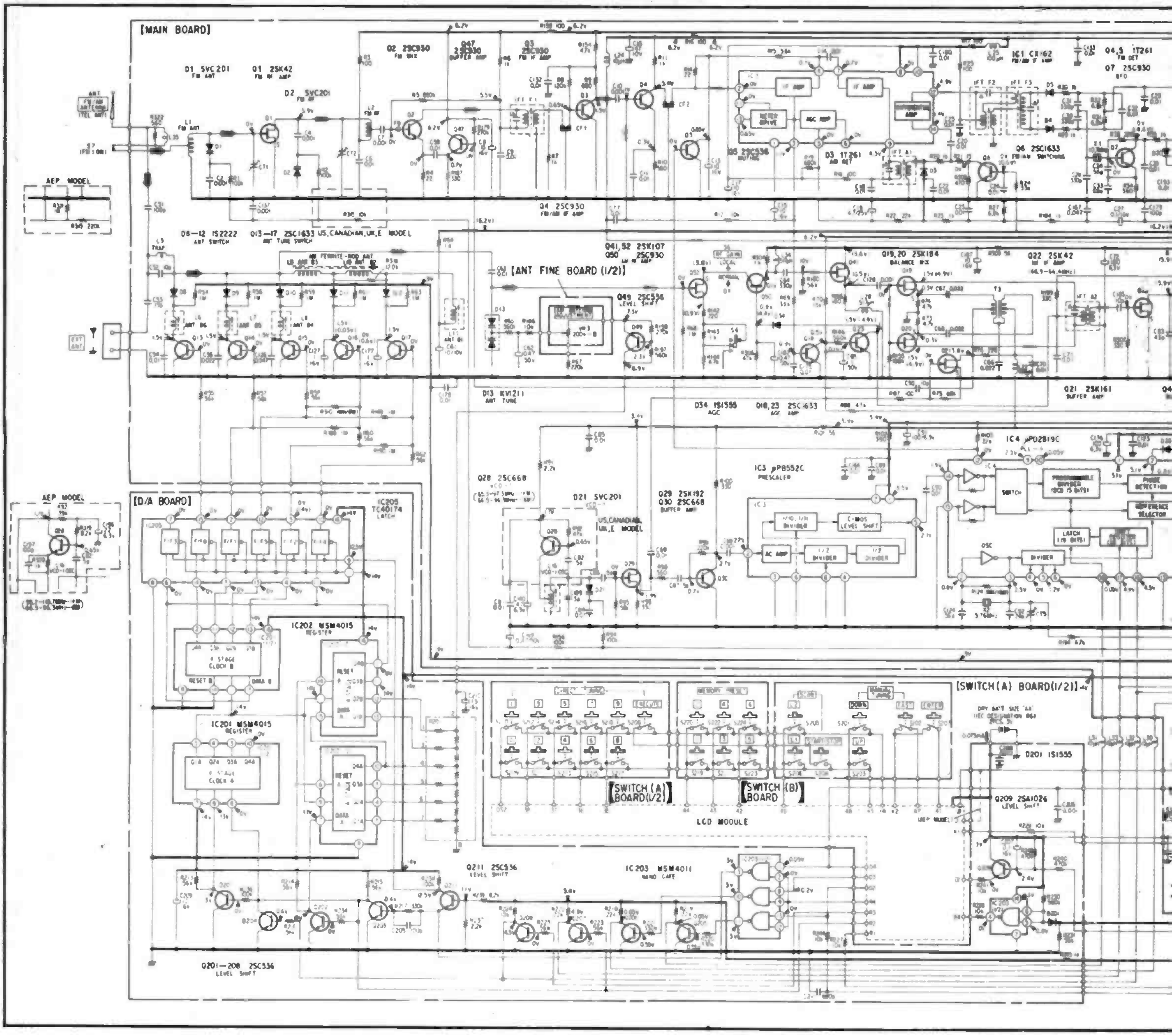


Figure 1: Block Diagram.

Sony's ICF-2001



interlopers. Comparing the front arrangement of this set with something like an R1000 (or RF3100) reveals a major disgruntlement, namely the receiver is prone to intermod and various brands of imagery and crosstalk when the external antenna option is employed. When using the internal telescopic antenna (especially, if like us, you accidentally manage to lop off the top three sections when poking it out of a window) there are few problems.

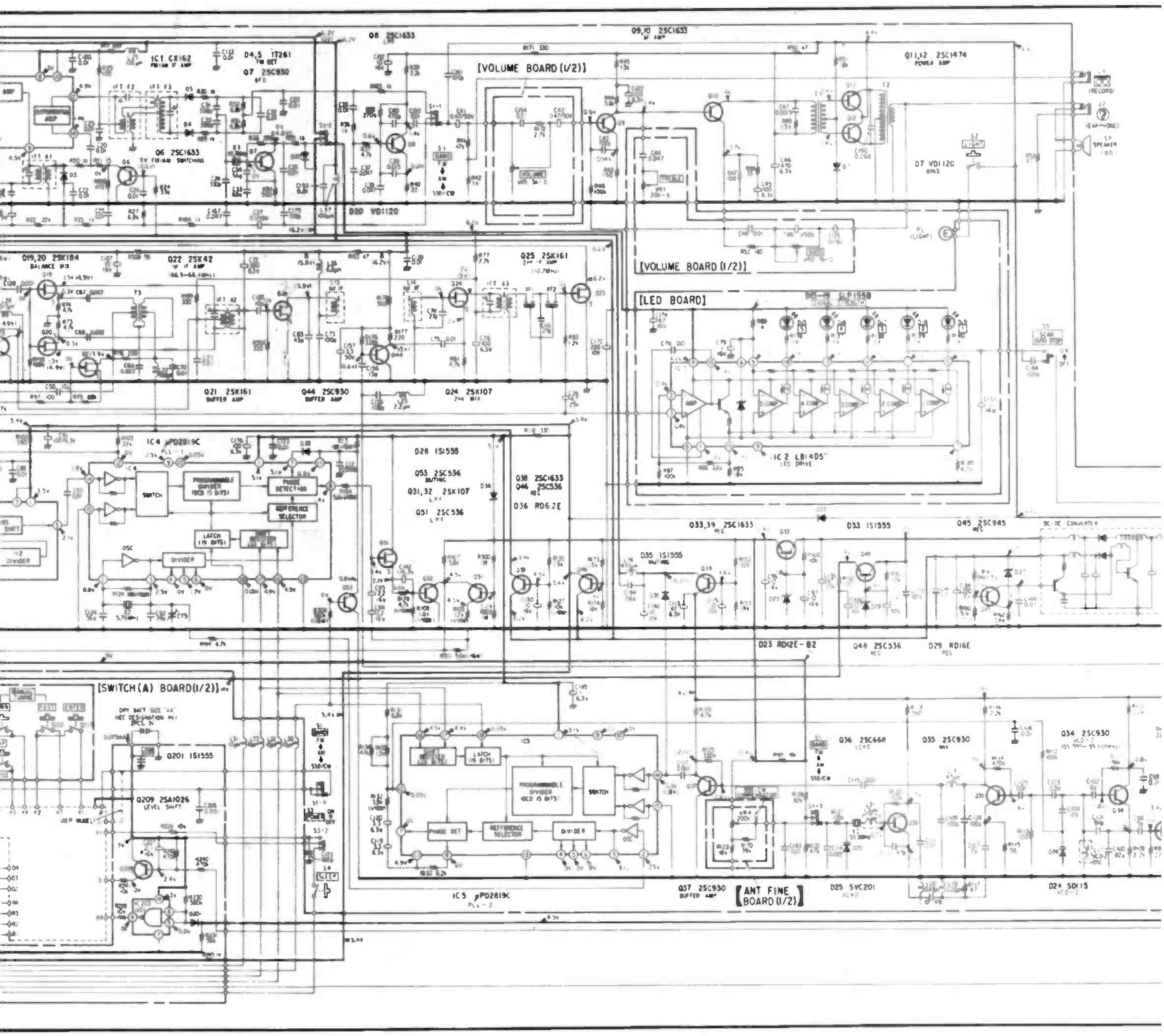
It may be unfair to criticise this aspect of the ICF2001 - after all, it is primarily intended for portable operation, and here it undeniably excels. Further untuned RF gain from Q41 completes the problems for the first mixer stage, which is a balanced FET configuration based on Q19 and Q20 with injection of the LO via the buffer and Q21.

The first IF of 66.3MHz to 66.4MHz is not a fixed frequency (you noticed, eh?) and so does not lend itself to the application of narrowband crystal filters *a la* R1000 and FRG7700. So, channel filtering has to wait until the second conversion to 10.7MHz in Q24, the 2nd mixer. In view of the gain and bandwidth preceding Q24, it is probable that this is the weakest link in the chain as far as close in overload and IM is concerned, but we haven't had the nerve to dismantle the ICF2001 far enough to probe into the spectrum analyser - yet.

The AM and SSB selectivity is thus simply a 4 pole 10.7MHz crystal filter. Apart from considerations of available frequencies in the PLLs, a dive to 455kHz for the second IF (as per R1000) would result in the image channel (910kHz) being embarassingly obvious, thanks to the broad bandwidth of the first IF system. It seems entirely feasible that two DC switched 8 pole filters (7.5kHz and 2.4kHz for AM and SSB) could be hung in the place of XF1 and XF2 - watch this space.

The second LO tunes the interpolation range of the first IF by generating 55.700-55.601MHz. This loop mercifully avoids another thirsty prescaler, and mixes down using a VCXO nominally on 55.301MHz to bring the frequency in range of the second loop's 'n' counter. The VXCO can be swung over +/- 8kHz with VR4 in the SSB/CW mode, providing the facility for the fine tuning control for SSB/CW reception. In view of the wide IF bandwidth, SSB and CW reception is generally a shade on the academic side, but the tuned ear can still provide effective filtering, even to the extent of being able to sort out a crowded night on 40m.

If you plug the numbers into a calculator, you will find that the range of the second n counter is 300-399: representing the 100kHz



B) could be hung in the place F2 - watch this space.

LO tunes the interpolation first IF by generating MHz. This loop mercifully thirsty prescaler, and mixes a VCXO nominally on bring the frequency in range oop's 'n' counter. The VXCO ver +/- 8kHz with VR4 in the , providing the facility for the trol for SSB/CW reception. In e IF bandwidth, SSB and CW erally a shade on the academic tuned ear can still provide ng, even to the extent of being t a crowded night on 40m. he numbers into a calculator, hat the range of the second n 399: representing the 100kHz of interpolation. Although the PLL device doesn't stand an earthly of doing anything with the sum product (55.7+55.301)MHz, it is nevertheless put through a low pass filter (L18, C108, C109). Instructions from the MPU set up the correct combinations for both loops: MHz and 100kHz in loop one, 0-100kHz in loop two.

For example, a 5.55MHz RF signal is tuned by setting the first loop to:

66.4MHz + 5.55MHz = 71.95MHz
a division of 720 to the nearest 100kHz step.
So the second VCO runs at
66.350MHz - 10.7MHz = 55.65MHz
and subtracting the VCXO
55.65MHz - 55.301MHz = 349kHz
so the second loop division ratio is 349.

Waste not

The SSB demodulator is based on the FM ratio detector, by injecting the crystal controlled BFO into the point that usually goes to ground in FM applications. Q8 acts to provide de- emphasis of the resulting audio before amplification. And yes, tuning to an NBFM signal on the CB band, and tuning for zero beat actually works quite effectively, if you can get over the fact that most CB synthesisers bounce into lock, and there is at least 200Hz offset between stations nominally on the same channel. Once again, getting inside to disable the BFO for NBFM may prove enlightening. The basic IF bandwidth is certainly good enough.

This general type of SSB demodulator is rather better than perhaps many people realize, and it certainly throws doubt on the the need to dive for the nearest IC when thinking **WR&E** c and 10.7M detector c persuade sponsorship on multimode dete

The MCU an

The microproc must remain a b this review. It p including the ra D/A network dri stage, plus the

The muting fu Q4, as per the otherwise near controlled by p pin is the inver

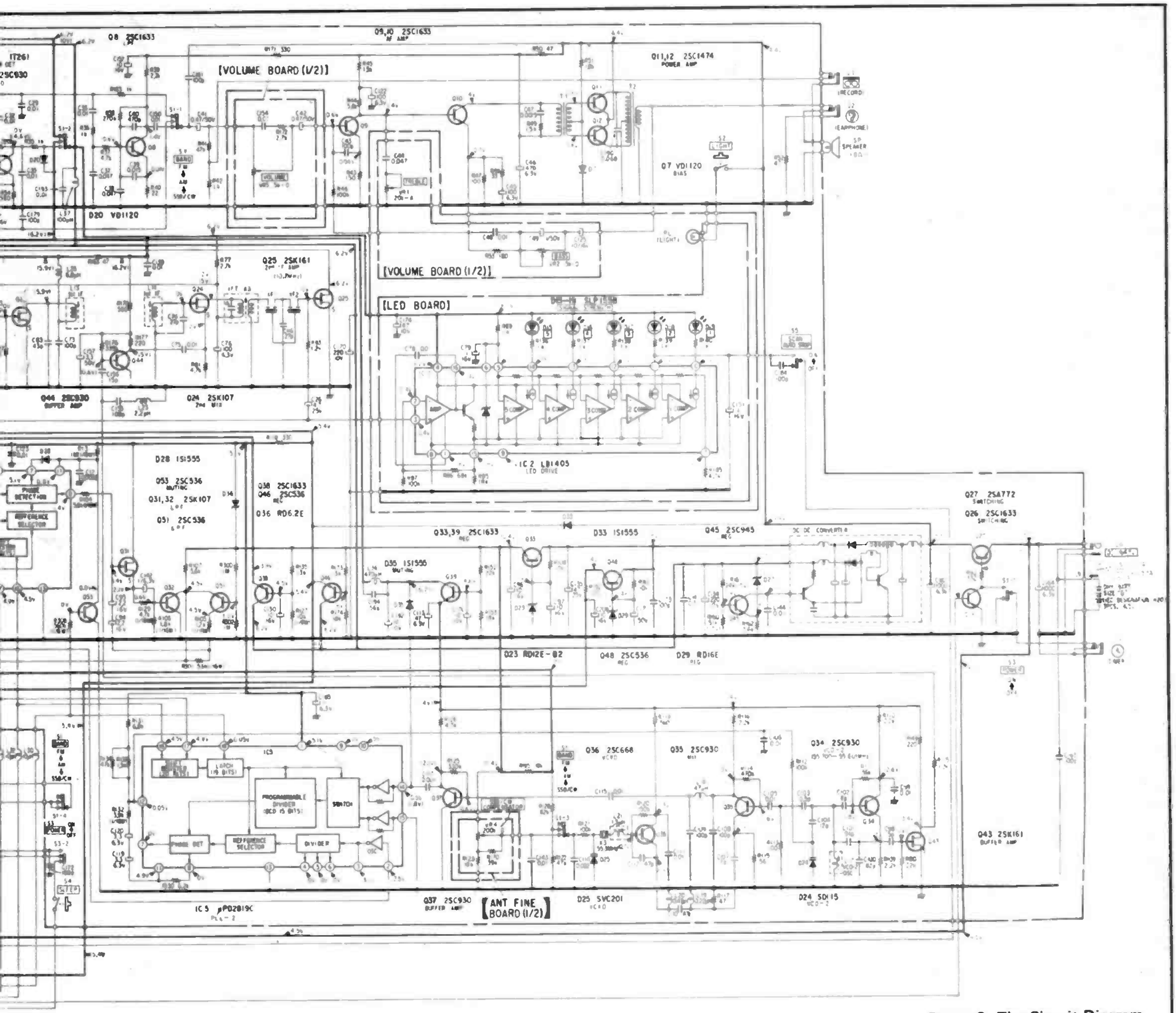


Figure 2: The Circuit Diagram.

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so the second loop division ratio is 349.

Waste not

The SSB demodulator is based on the FM ratio detector, by injecting the crystal controlled BFO into the point that usually goes to ground in FM applications. Q8 acts to provide de- emphasis of the resulting audio before amplification. And yes, tuning to an NBFM signal on the CB band, and tuning for zero beat actually works quite effectively, if you can get over the fact that most CB synthesisers bounce into lock, and there is at least 200Hz offset between stations nominally on the same channel. Once again, getting inside to disable the BFO for NBFM may prove enlightening. The basic IF bandwidth is certainly good enough.

This general type of SSB demodulator is rather better than perhaps many people realize, and it certainly throws doubt on the the need to dive for the nearest IC when thinking about demodulating SSB. The **WR&E** catalogue includes a suitable 455kHz and 10.7MHz (which also tunes 9MHz) ratio detector coil system, and perhaps we might persuade an interested reader to take up the sponsorship offer and devise a low power multimode detector system.

The MCU and Muting

The microprocessor and its programming must remain a black box for the purposes of this review. It performs a variety of functions, including the rather neat control of the R/2R D/A network driving the AM bandpass tuning stage, plus the LCD and the sleep timer.

The muting function is provided by Q5 (not Q4, as per the Sony circuit guide, which is otherwise nearly excellent), whose base is controlled by pin 12 of the first PLL. This pin is the inverse of pin 11 of the same IC, ▶

which ensures that the RF stage is muted whilst the loop is unlocked - and whilst Q53 is being kept quiet as the second loop is being latched.

Overall impressions

The ICF2001 is a lot of portable radio for the money. It's a shame that some aspects have been compromised - dual IF bandwidth would have been a major advance. Plus it seems possible that a fixed first IF might have been developed along R1000 lines without any penalties in additional circuit complexities.

Nevertheless, the overall purity of the synthesiser across the HF spectrum is flawless, and the facility for preset station selection is very neat. Indeed, circuits have appeared for applying a scanner logic system to sequentially search the memories. Used in conjunction with a VHF or UHF converter, such a facility might usefully be used to look for beacon signals as a pointer to band conditions - and developing the NBFM adaptation will make the set a very versatile tunable IF. The basic search system that comes as standard (between a programmed upper and lower frequency) is also very handy – for many applications, although it is rather slow and ponderous in operation.

We've been waiting for Sony to produce a new version that sorts out some of the niggles for a while now. However, they don't appear to have done so (yet) and there are now probably enough of the 2001s in the field to warrant details of some of the mods we have mentioned. We'll see what we can do, but meantime, if you own one, there is an excellent service manual available from Sony UK, and we suggest that you get one for information. If you want to get the back off and delve inside, it's vital.

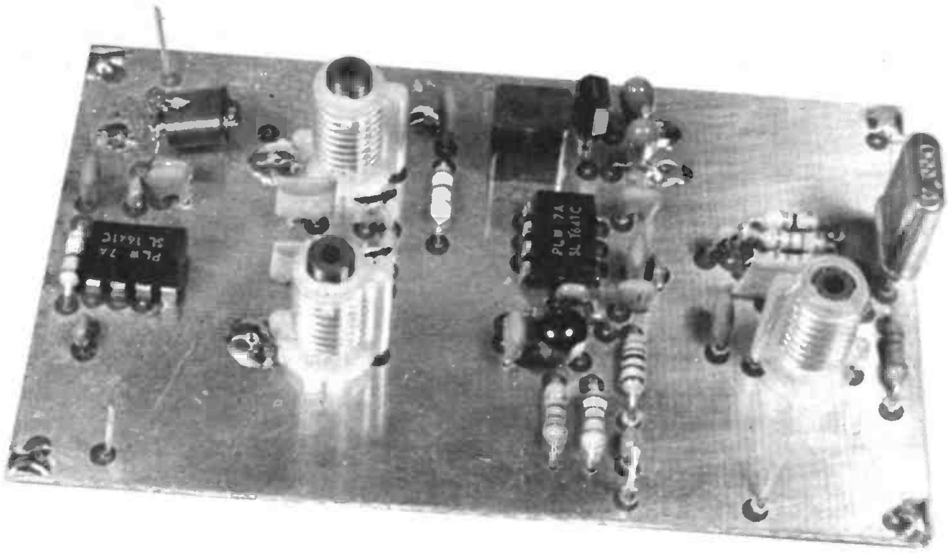
The RF3100 is still probably the best choice if what you basically want is a portable communications receiver. However, if you can use some of the natty functions of the ICF2001, you will probably find it relatively easy to turn a blind eye to its shortcomings. Just beware if you live near a Band 1 TV transmitter, since such things have been known to blast right through....
(66.3MHz - 21.4MHz) = 44.9MHz. Oops.

■ R & EW

SPECIFICATIONS

Circuit System:	FM: Superheterodyne AM: Dual conversion superheterodyne
Frequency Range:	US, Canadian, UK, E model: FM 76 to 108 MHz AM 150 to 29,999 kHz (2,000 to 10 m) AEP model: FM 87.5 to 108 MHz AM 150 to 26,100 kHz (2,000 to 11 m)
Antennas:	Telescopic antenna (AM/FM) Built-in ferrite bar antenna (AM 360 to 2,143 kHz) External antenna terminals (AM/FM)
Speaker:	Approx. 10 cm (4 inches) diameter
Power Output:	1,200 mW (at 10 % harmonic distortion), 1,600 mW (max.)
Input:	Timer Input jack (minijack)
Outputs:	Recording output jack (minijack) output level 0.8 mV (−60 dB) output impedance 1 kΩ Earphone jack (minijack) for 8 Ω earphone

Your Reactions......	Circle No.
Excellent - will make one	108
Interesting - might make one	109
Seen Better	110
Comments	111



R&EW TRANSCEIVER PROJECT AN OVERVIEW

Simon Ruffle G4EAG, looks at the progress of the system to date and previews the final stages of the project.

THE R&EW TRANSCEIVER should need no introduction to regular readers. Two articles have appeared, the first in the July **R&EW** described a 10.7 MHz single-sideboard generator, and last month's **R&EW** described the mixer and buffer modules which form the heart of the project. The project was not conceived as a set of constructional articles but should be viewed as distinct, separate articles that all describe a piece of RF circuitry in its own right, linked together by the common theme of their role in an HF transceiver.

The project is aimed at the experimenting amateur, and it is in this area that its great benefits lie. As has been explained, the advantage of the R1000 and FRG7700 receivers is their ready- built, ready aligned, synthesised local oscillator, and any owner of one of these receivers has already paid for the most critical part of a transmitter exciter. For an additional twenty pounds or so (the cost of the mixer/buffer kit) he has, in essence, a transceiver.

The **R&EW** transceiver boards have always been viewed as a base around which to build various experimental transceivers, tailored to requirements. A favourite arrangement being their use with a 80/40 metre ten watt transistor PA, with the mixer board driven by a 10.7 MHz source to give CW operation. This has allowed Europe to be worked comfortably. For the HF bands a 100 watt valve linear amplifier will allow areas from the USA to Japan to be worked on SSB. At present, work is underway on fast CW break-in systems for the system. The overall philosophy of the project; certainly not a kit version of a black box but a basis for experimentation. The relative advantages of the **R&EW** transceiver against commercial gear as follows.

Advantages:

System can be tailored precisely to your requirements however esoteric they may be.

Commercial systems are very sophisticated. The **R&EW** transceiver will be cheaper because you can miss out things you don't need.

You enjoy experimenting

You can make up a system around existing pieces of equipment; PA's etc.

Disadvantages:

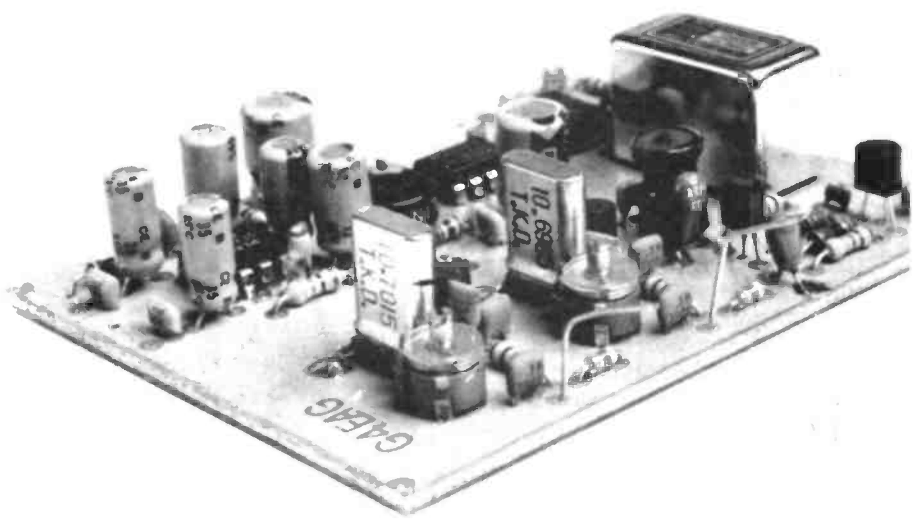
If you try and match all features, the commerical gear will probably be cheaper

R1000/FRG7700 were not designed to be part of a transceiver, eg no RIT.

The**R&EW** project does not come in a black box, and is unlikely to be at 'contest grade' robustness.

So the essence of the project is experimentation, and we would welcome comments from Readers, particularly from R1000/FRG7700 owners as to any modifications to their receivers that they have found to be worthwhile. For example we have heard rumours of tricks to cut the tuning rate on the R1000, but we haven't succeeded in doing it ourselves. Any other tips? We look forward to hearing from you.

The mixer/buffer modules form the heart of the project and can from the heart of your radio experimentation. Don't sit there waiting for every article to come out. So plug in your soldering iron and start experimenting.



What's Wrong with the Spectrum?

The Spectrum has a few shortcomings, but its low cost makes it an attractive choice in many applications.

The Spectrum is, as widely advertised, an inexpensive, full colour home computer, featuring large user memory, high resolution graphics, and sound. To provide such an apparent bargain, Clive Sinclair has necessarily cut corners. This in turn has led to certain limitations in the machine - limitations which prospective buyers should be aware of.

Much publicity has been given to the fact that the Spectrum is intended to compete with the BBC micro, so it is natural to compare the two systems. For the most part the comparison is not favourable to the Spectrum, but in the end the criterion must relate to the application.

To be just, the Spectrum has many good points. I will endeavour to weigh the good against the bad and give would-be customers the chance to draw their own conclusions. My personal conclusion is that the machine is indeed a bargain, ideal for most hobbyists, but that its limitations may rule it out for many applications.

The serious limitations are mainly in connection with the colour graphics. However, the sound facility must also attract some comment, the interfacing capabilities are primitive in the extreme, and no description of the Spectrum is complete without a snipe at the keyboard. These lesser points will be dealt with first.

Sound

Many reviewers have complained bitterly about the Spectrum's sound facilities. These complaints are generally levelled at the lack of volume and the lack of flexibility. Personally, I am more concerned with the latter limitation. For volume I can connect up my Hi-Fi and the results are more than adequate!

Sound on the Spectrum is controlled by the BEEP command, which takes two numerical parameters. The first controls the duration of the sound and the second the frequency. The duration is specified in seconds, while the frequency control is arranged so that the numbers 0 to 12 correspond to the notes of the scale starting at middle-C. Larger numbers give higher notes and negative numbers give lower notes. Fractional numbers give intermediate frequencies. Unlike the BBC Micro, there is only one voice and no control over volume.

For applications in which the duration of each note can be predetermined, the facility is just adequate. This category includes programs that simply play tunes, or programs that merely produce a few notes to attract the user's attention. However, as soon as the application needs to link the duration of the notes to some external event, such as the depression of a key, the BEEP command no longer suffices. One of the sample programs accompanying the BBC Micro turns the machine into a musical keyboard. The BASIC commands of the Spectrum could not support such a program. The minimum needed is a command to turn the sound on and one to turn it off again. The application could then be allowed to do anything in the interim.

The manner in which the Spectrum generates sound precludes the provision of such on and off commands. The Spectrum documentation mentions that bit 4 at output address 254 controls the speaker. The program invoked by the BEEP command simply waves this data line up and down at the appropriate frequency for the right amount of time. Both the frequency and duration are controlled by loop counters. The whole machine is thus dedicated to the production of the sound.

A determined programmer need not be deterred by this fact. The documentation also describes how the keyboard can be accessed as an I/O device. The keyboard is divided into eight half-rows, each containing five keys. Each half row is accessed at a given I/O address. The bits read are high unless the corresponding key is depressed. Combining these two pieces of information, it is possible to write a routine that waves the data line about at the required frequency, whilst checking that a given key, or perhaps any key, is still down. I hasten to add that it is no good writing this routine in BASIC. Even looping flat-out, a BASIC program will not be able to produce more than a stifled grumble.

The following simple assembler program will produce a fixed tone until the space key is seen. If you wish to try the program out, note that it uses only relative jumps and may therefore be positioned anywhere in suitable memory. The chapter on using machine code in the Spectrum manual is recommended. The frequency of the note may be changed, within limits, by poking the address containing the pause loop count (the second half of the LD B,0).

```
                ; Initialise
                ;
F3                          DI
3E 17                       LD       A,17H        ; stop anyone interfering
                                                  ; sound bit + white border
                ;
                ; Now make a noise
                ;
D3 FE           LOOP:       OUT      (254),A      ; wave the sound bit
EE 10                       XOR      10H          ; flip sound bit
                ;
                ; Wait a while
                ;
06 00                       LD       B,0          ; loop count = 256
10 FE           PAUSE:      DJNZ
                            PAUSE    ; tight loop
                ;
                ; See if 'SPACE' has been pressed
                ;
01 FE 7F                    LD       BC,32766     ; BC := input address
ED 48                       IN       C,(C)        ; read keys 'SPACE' to 'B'
CB 41                       BIT      0,C          ; was the space pressed?
20 EF                       JR       NZ,LOOP      ; nope
                ;
                ; Exit
                ;
                            FB                    EI
C9                          RET
```

For many applications sound will not be an important consideration and the Spectrum facility may even come as a bonus. If you want to turn your computer into a music processor then the Spectrum will not suffice without the addition of musical hardware similar to the SN76489 chip built into the BBC Micro, which provides four voices and control of both volume and frequency envelopes.

Interfacing

It is generally a good idea for computers to have some means of communicating with the outside world. All home computers have at least a keyboard for input and some form of visual output. The input is usually a full 'qwerty' keyboard, although there are systems with only hexadecimal keypads. The most common output is a UHF modulated signal which connects to the aerial socket of the domestic television set.

These basic devices provide for communication between man and machine. Computers should additionally be able to control and communicate with some form of permanent storage device, such as a tape or disc drive. There is also a frequent requirement for communication between machine and machine. The secondary machines may simply be printers or plotters, or the central heating installation, or they may be other computers or networks of intercommunicating computers. Many personal systems are based on a standard bus, such as the S100 bus, enabling device interfaces built on compatible boards to be simply plugged into the system.

The back edge and underside of the BBC Micro reveals a wealth of connectors. These include UHF video, separate RGB (red-green- blue) video, cassette I/O, disc I/O, serial comms port, parallel printer port, user port, analog port, and several more.

All that the rear of the Spectrum holds is a UHF video output, cassette I/O and a slot revealing the edge connections of the main board.

This contrast probably accounts for most of the difference between the price of the Spectrum and that of the BBC Micro. There is really a complete difference in design philosophy. In the case of the BBC Micro, the idea has been to build a system which accomodates almost every expansion that may be required. The Spectrum, on the other hand, has been designed as a minimal system, taking the view that whatever else may be required can be added on afterwards.

To this end, the Spectrum edge connections contain all the Z80 control, address and data buses, together with the composite video signal, useful things like ROM chip-select, and all the voltages generated on the board (0, 5, -5, 9, 12, -12). In principle, this means that any desired interface may be built for the Spectrum, although the edge connections are liable to get overworked unless some sort of motherboard is used. The ZX Printer is already able to connect to the Spectrum, and Sinclair has also promised disc drives and a serial I/O port.

The Keyboard

The keyboard is another area in which Sinclair undoubtably saves on the cost of his machines. The keyboards of the ZX80 and the ZX81 were probably their least popular features. That of the Spectrum is an improvement on these, but is likely to remain the least popular feature of the system.

With the old keyboard, the user had to rely on visual feedback, seeing the character appear on the screen. The new keyboard in part remedies this problem, but introduces a new one. The keys do not actually register unless they are pressed fairly centrally. The user relying on tactile feedback may therefore 'feel' that the key has been pressed, even though the Spectrum is not aware of this fact.

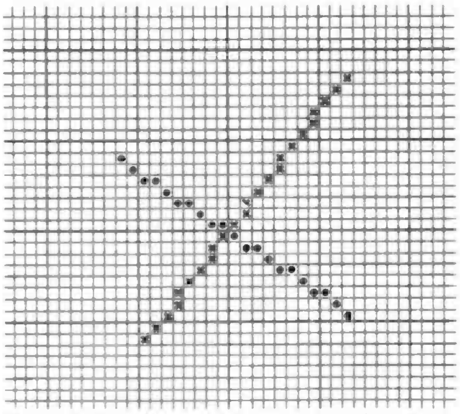


Figure 1: Two lines which cross at the junction of four character cells avoid any problems associated with the Spectrum's colour graphics.

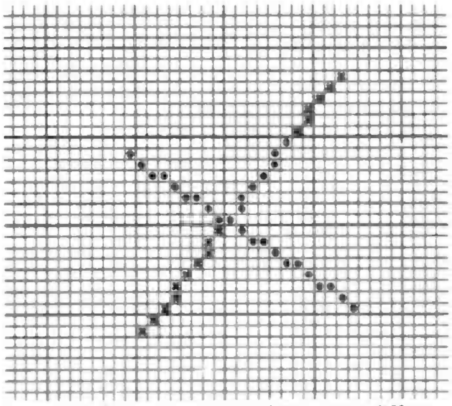


Figure 2: An arrangement of lines that differs only marginally from that of Figure 1, yet causes a whole segment of the line drawn first to change colour as the second line is drawn due to the fact that they have a single pixel in common.

The Spectrum has in common with the ZX80 and ZX81 the use of keyboard 'tokens'. For every BASIC keyword there is a corresponding key. This means that most keys have five functions, the function implied at any time is determined by the current input mode and the use of the two shift keys.

The positions of the more common functions are rapidly learnt, but when one of the more obscure functions is needed, a lot of time can be wasted hunting the keyboard before finally looking it up in the manual. Some functions take considerably fewer keystrokes to access than would be needed to spell out the function. Others actually take more. As one who knows his way reasonably quickly around a keyboard, I would much rather spell all the keywords out, or at least have the option.

Tokenising is basically a good idea, as it leads to a more compact internal representation of the code. The BBC Micro uses tokens to some extent, but the keywords have to be typed in full and in upper case. With more than 1K bytes of ROM to spare, Sinclair could surely have done the same.

Colour

Characteristically, Sinclair has chosen a rather unconventional way of providing colour graphics. There may have been other technical reasons for doing so, but the most obvious is that the scheme makes very economical use of user RAM.

The screen depicted by the Spectrum is bit-mapped, in common with most machines with graphic capabilities. The image on the screen is composed of dots, usually referred to as pixels. The screen is 256 pixels wide and 192 pixels high. Representing each pixel as a single bit requires 6K bytes of memory. Such a representation only provides for two colours, corresponding to on and off. To allow more colours at each pixel requires more bits per pixel. Two bits per pixel will give four colours, three will give eight, and so on. The obvious drawback is that the more colours required, the more memory needed to represent the screen. To provide a full eight colours per dot, the Spectrum would need to allocate 18K bytes for the screen. This is a very important consideration in selecting a home computer. The advertised RAM size is not enough in itself to provide a comparison between two systems, as a large proportion of the RAM may not be available to the user.

The BBC micro allows up to four bits to be associated with each pixel, or up to sixteen colours. Only eight of these are actual colours, the remaining eight being flashing pairs of colours. To avoid having a large amount of memory permanently allocated to the screen, the BBC Micro provides a number of graphics modes. If the full graphics facilities are not requested, then the screen uses less memory and thus more is available to the user.

The amount of screen memory allocated in the Spectrum is kept small by not giving the user full independ -ent control of the

SEE INSIDE BACK COVE
FOR
COLOUR PICS!

colour of every pixel! Instead, the user can set the background and foreground colours of each character cell on the screen. A character cell is a group of eight by eight pixels. The screen holds 24 rows of 32 characters each. The colour attributes for each character cell occupy one byte, so that only 768 bytes are required to hold all the colour information for the screen. The total memory requirement for the screen is thus a mere 6.75K bytes.

Much has been written describing what can be done with the Spectrum colour graphics. The first picture shows the good effect to which the colour can be put in drawing a chessboard. It may be more useful to know what cannot be done. In brief, any one character cell may contain at most two colours. The Spectrum programming manual contains an example which illustrates the effect of this limitation rather well. On page 122 is a program which simply draws random lines in random colours. As the manual points out, as the screen fills up with 'inked' pixels, instead of drawing thin, high-resolution lines across the screen, broad lines are eventually drawn, at the coarser resolution of the colours. The problem does not manifest itself in the chessboard because each square is composed of four character cells and no character cell has to contain more than two colours. The board is described in blue and cyan 'paper' and the pieces in red and white 'ink'.

The most obvious way in which this limitation will manifest itself is at the intersection of two lines of different colour. Figure 1 shows two lines crossing at the junction of four character cells, in such a way as to avoid the problem. Figure 2 is only marginally different, but because the two lines have a single pixel in common, a whole segment of the line which was drawn first changes colour as the second line is drawn.

It is not, in general, possible to contrive well behaved line crossings in graphics programs. The problem becomes more severe as the density of 'inked' pixels increases. The problem reaches unacceptable proportions if differently coloured areas of 'ink' are required. An example of such a requirement is the drawing of pie graphs. The second photograph shows a pie graph with one 90 degree slice. The centre of the pie had to be carefully chosen to fall in the bottom left pixel of a character cell. The picture appears correct because each character cell contains at most two colours. The two points at the edge of the circle where three colours meet are both at the borders of two character cells.

The second photograph shows how our luck runs out once the boundary of a slice does not lie on an orthogonal line. The resolution of the pixels is completely obscured by the lesser resolution of the colour. If alternate slices only were 'inked', then the boundaries between slices would be shown correctly. There would still be two problem areas, however. Towards the centre of the circle it may be necessary to change colour more than once in a given character cell, and at the edge of the circle the points where three colours meet will not in general fall between character cells.

The remaining photographs show further slices being added. It may be noticed that the addition of each slice changes the colour of the central pixel. This is because every segment in practice contains the centre of the circle. The phenomenon could be avoided by careful programming, so that the centre of the circle is nominally between pixels. The improvement on the production of pie graphs would be minimal. Of course, if the colour resolution was the same as the pixel resolution, then it would not matter in the end what colour the central pixel became.

Conclusions

The Spectrum has been designed for a particular market. It has had to appear to offer everything that its main rivals offered, whilst costing far less than any of its rivals.

To meet these aims, many of the features have been provided in a corner-cutting way. The sound is generated by software, external interfacing has been kept to an absolute minimum, the keyboard is a toy. To stretch the user RAM as far as possible, the colour graphics are provided in a restricted manner.

Having said that, it may come as a surprise that I actually recommend this machine as a worth-while home computer. As I have pointed out, there are many things that the machine cannot do. On the other hand, there are many things that it does quite well. The point is that it does have colour, graphics and sound and a lot of free user memory. For the programming enthusiast the basic facilities are there and the full power of a Z80 with sizeable memory is on tap. For the electronics enthusiasts it provides a ready-usable Z80 in a form ideal for adding on bits and pieces of home-grown hardware.

For the experimenter, the documentation explains various aspects of the system software, giving details of the store map and the internal representation of constants, variables, and program statements themselves. Advice is given on where to locate assembler programs and how to store them on cassette, even how to save an assembler program so that it will execute automatically upon loading. The I/O addresses of the keyboard, cassette interface and speaker are given, and the functions of the edge connections are listed. The user is essentially encouraged to use and abuse the system in any way he sees fit.

I have said little of the software, which I do not count amongst the machines shortcomings. It is generally user friendly, with the possible exception of the keyboard tokens. The user manuals are as good an introduction to BASIC as may be obtained anywhere. The style is easily read, well laced with examples and occasional touches of humour. On the use of the inequality relationship between strings: 'Which of these two is the lesser? 'EVIL', 'evil''.

Weigh up the shortcomings of the machine against the price of less compromising systems, in the context of why you want a machine, and decide for yourself which is the lesser of the two evils.

■ R & EW

Your Reactions..........	Circle No.
Immediately Interesting	20
Possible application	21
Not interested in this topic	22
Bad feature/space waster	23

A solution to the problem of information gathering.

Indisputably, the telephone is the worlds most commonly used communications medium. It can be used to convey vast quantities of computer stored information across borders and oceans directly to your office or home.

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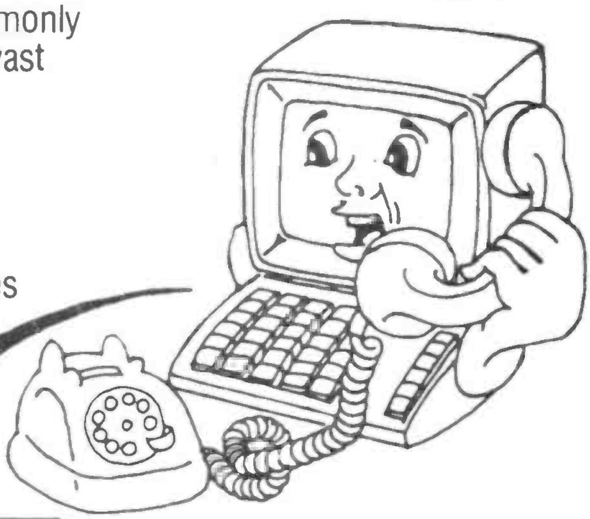

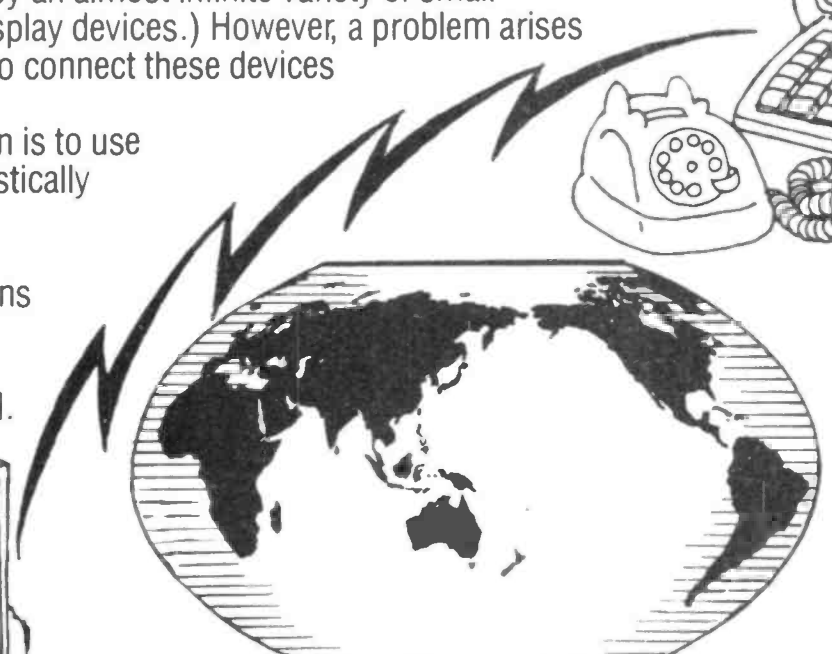

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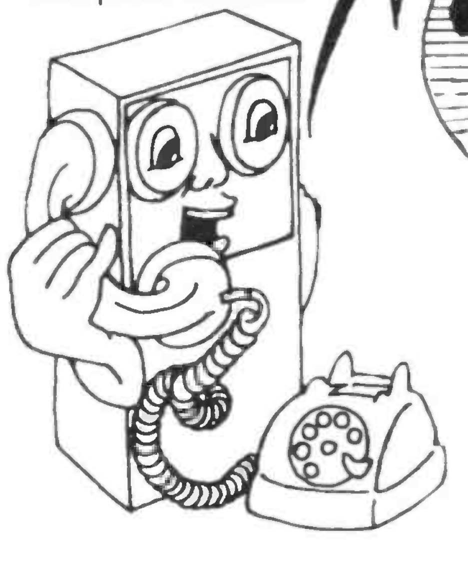

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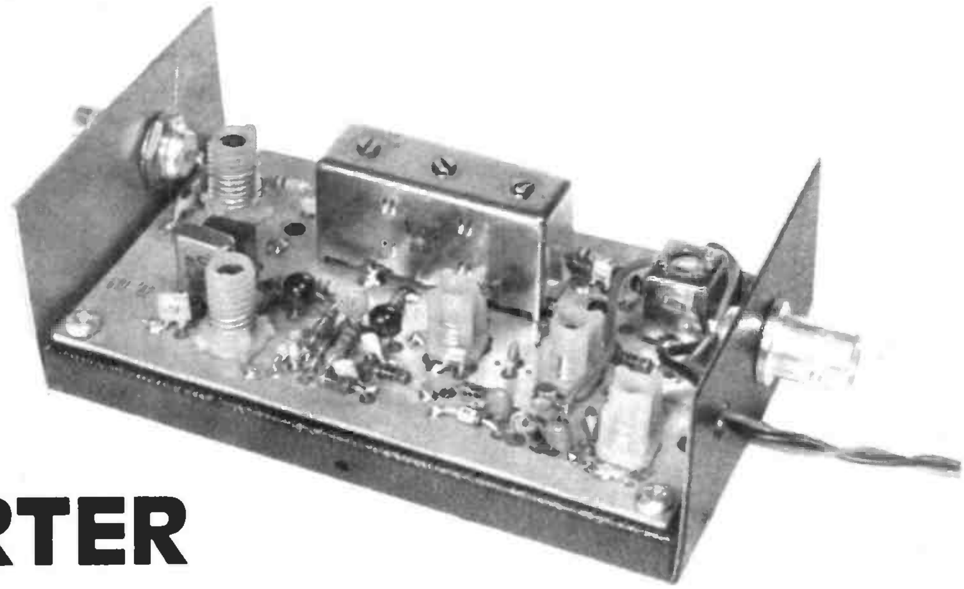


2M CONVERTER

Graham Leighton describes the MK2 converter based on our October '81 design. Simplified alignment and a new oscillator at 116MHz are features of this new design.

The MK2 **R&EW** 2m converter uses the best features from the original design published in October 1981. The alignment has been simplified and the number of possible spurii reduced by using a new oscillator at 116MHz.

2 metres is the band where most new class B licencees first operate. This converter is simple and cheap enough to use to investigate this band but the performance is such that the enthusiast will also be satisfied.

The alignment requires only a multimeter to set up the local oscillator. The helical filter, being prealigned, leaves only the input and output coils to be setup. This can be done using an off air signal.

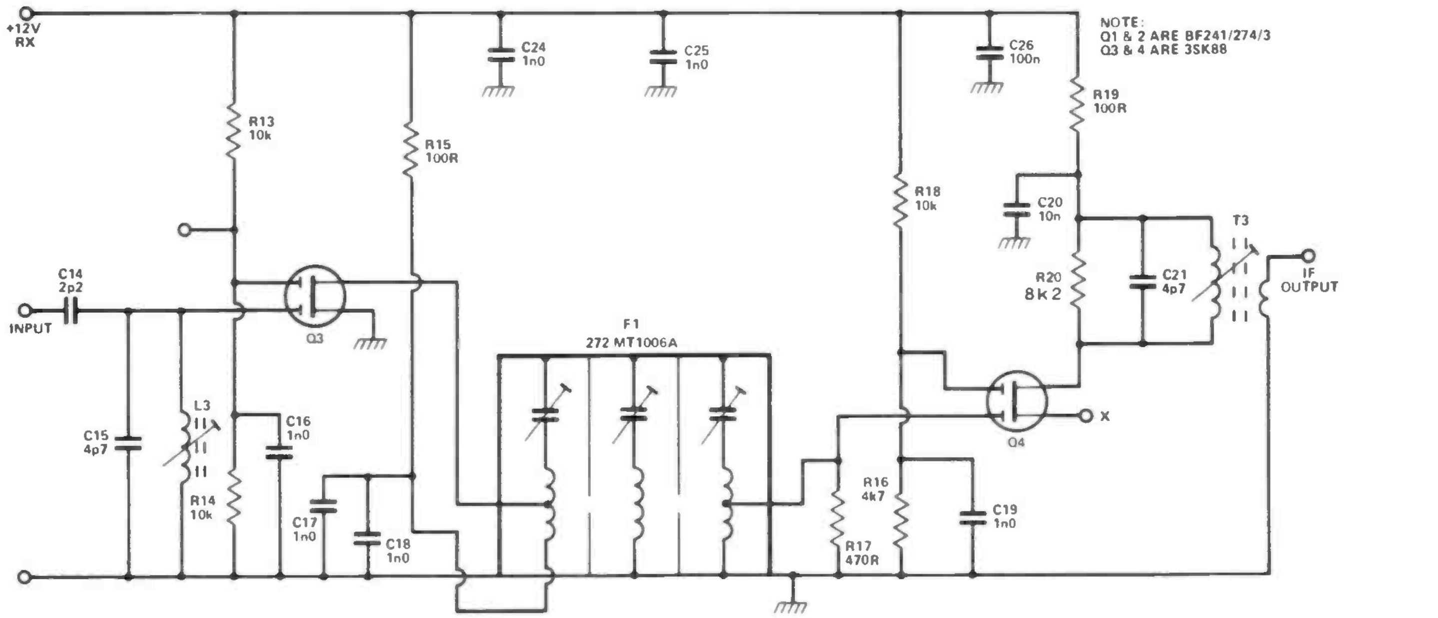
The oscillator chain has been replaced by a reliable 116MHz overtone circuit which is followed by a double tuned buffer stage. The resulting output has a very clean spectrum which helps reduce spurii. The coils used originally included some minaiture types which have been replaced by more robust types. It should be noted, however that the correct trimming tools must be used to avoid damage to the cores.

The popularity of the 2m converter which we published in October 1981 proved that there is a large demand for such a high performance design. The MK2 **R&EW** converter improves on the original design and will, eventually, form part of a transverter for the 2m band.

RF AND MIXER STAGES

The input is noise matched to gate 2 of Q3 gate 1 being biased to half the supply voltage. Varying the voltage on gate 1 from 0 to VCC/2 gives about 40dB of gain control. The RF amplifier output matches approximately the 470R impedance of the helical filter, F1. A 470R resistor R17 on the gate of Q4 provides the matching between the filter and the mixer, Q4. A local oscillator level of about +4dBm is applied to the drain of Q4.

The 3SK88 which is used in the RF and mixer stages is still a good device to use on 2m. Better noise figures are available, but the improvement is so marginal when there is feeder loss in the system that it is not worthwhile. A masthead amplifier is really the only way to get the best system noise figure. In order to prevent



Circuit diagram of RF and mixer stages.

COMPONENTS LIST

Resistors (all ¼W 5%)

R1	3k3
R2	12k
R3,20	8k2
R4	680R
R5,10,11,12,15,19	100R
R6	27R
R7	1k
R8	6k8
R9	1k5
R13,14,18	10k
R17,21	470R
R16	4k7

Capacitors

C1,3	18p
C2,6	47p
C4	5p6
C5,7,8,9,13,16, 17,18,19,24,25	1n
C10,12	15p
C11	1p
C14	2p2
C15,21	4p7
C20	10n

All the above are minature ceramic, 0.1" spacing.

C23, 26,22	100n

mono ceramic

Semiconductors

Q1,2	BF241/273/274
Q3,4	3SK88
D1	6V8 Zener

Inductors

L1	S18 green 5½t
L2	1uH choke
T1	200058 4¼ /1¼t
T2	200027 4¼ /2¼t
T3	154FN 6439

Miscellaneous

X1	116.000MHz HC18/
F1	272 MT 1006A

Case,BNC sockets (2 off),

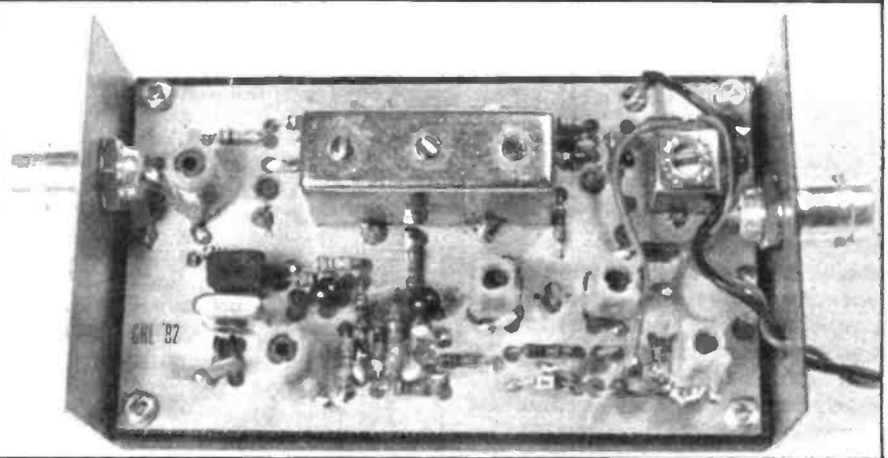
Additional Components required for 116MHz output option.

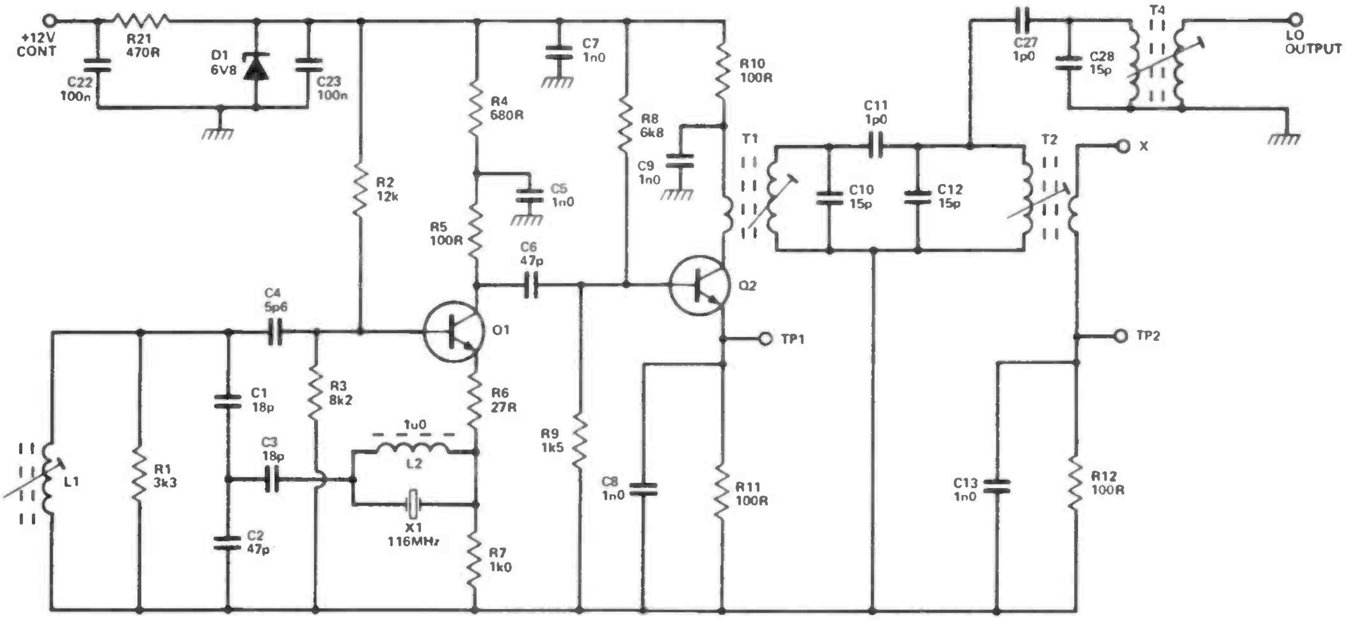
T4	200058
C27	1p
C28	15p
BNC Socket	

overload problems the RF stage gain may need to be reduced slightly.

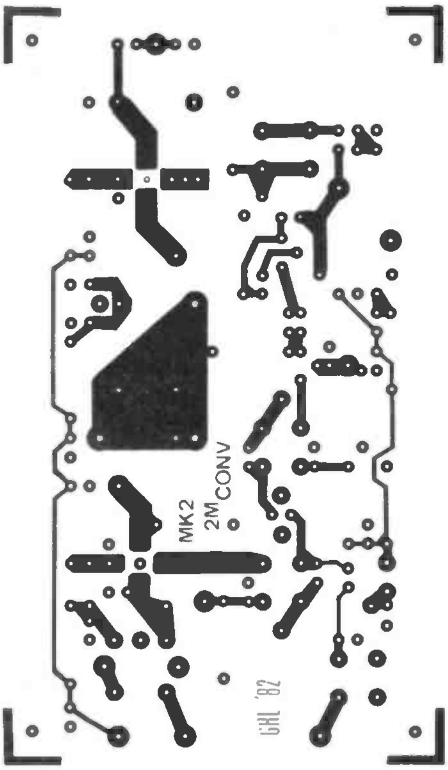
LOCAL OSCILLATOR AND BUFFER

The supply to the oscillator and buffer stages may be switched separately from the RF stages and may be run continuously when used to drive a transmit converter. The oscillator, Q1, uses 116MHz series resonant crystal. The tuned circuit formed by L1,C1,C2 sets the approximate frequency of operation of oscillator the output of which is fed to Q2 which is a buffer amplifier stage. Q2's collector is tuned by T1, which together with T2 forms an output filter at 116MHz. Some RF is fed to the LO ouput via C25/T4. T2 matches the local oscillator to the drain of Q4.

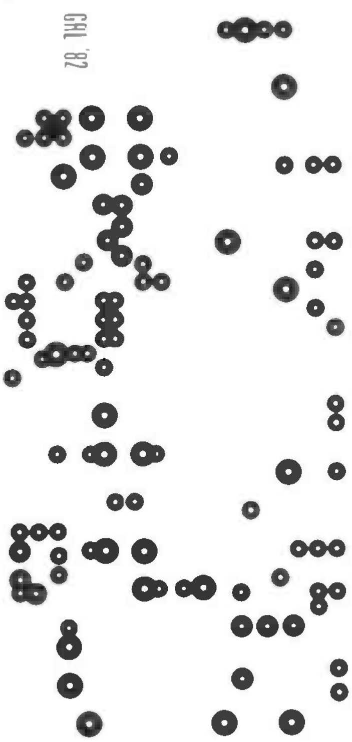




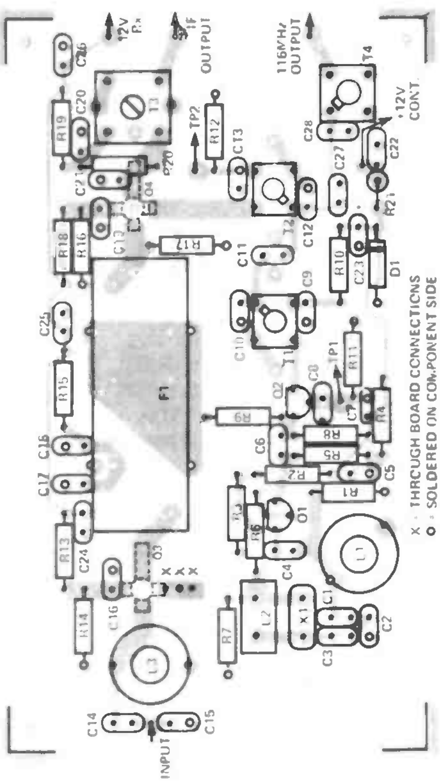
Circuit diagram of the oscillator and buffer.



PCB foil pattern(track)



PCB foil pattern(top).



Component overlay.

CONSTRUCTION

A double sided pcb is used to provide good electrical stability and simplicity of construction. Most components that need an earth connection are soldered directly to the earth plane. The uncommited pads are only included on the layout to indicate component positions.

Fit the through pcb links that make the drain connection to Q3. Insert and solder all the components with the exception of F1,T3,Q3 and Q4. Fit T3 and solder the can to the earth plane as well as on the track side of the board. F1 must also have its can soldered to the top of the pcb to form the through board connections to the track side.

Finally solder Q3 and Q4 in place on the track side of the board observing the usual handling precautions for static sensitive devices.

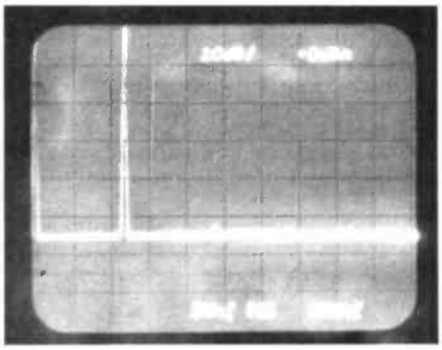
TESTING

Check the PCB for incorrectly inserted components, dry joints and solder splashes. Connect a 10 to 12V supply (preferably current limited at about 50mA) to the local oscillator. Measure the voltage on test point 1 (TP1). Adjust the core of L1. When the oscillator starts the current drawn by Q2 will increase slightly. Move the test meter to TP2 and adjust T1 and T2 for maximum reading. The approximate core positions are about 1mm below the top of the former on L1 and about 3mm below a T1 and T2.

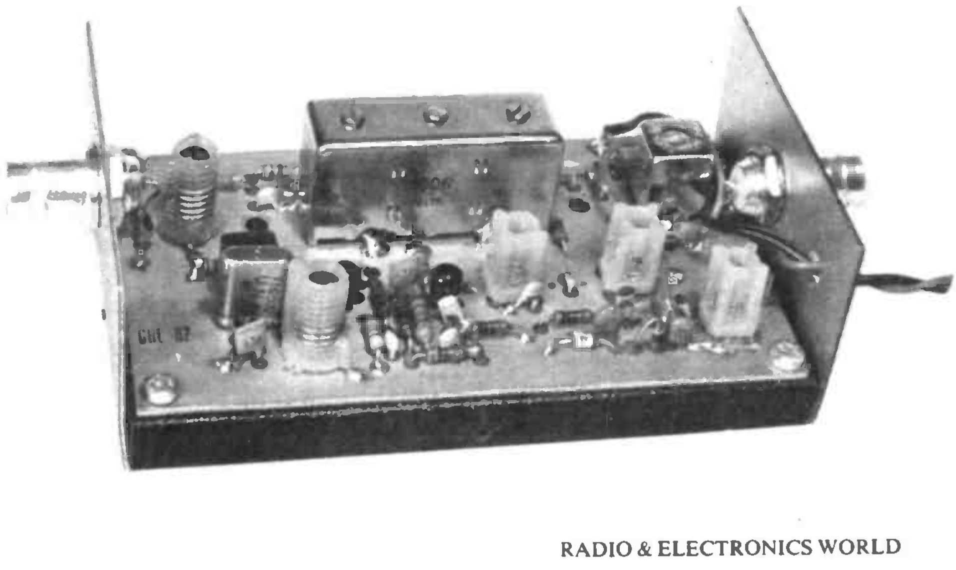
Connect an aerial to the input, a 10m receiver to the output and the RF/mixer supply. Signals on 2m should now be heard. Find a signal near the middle of the band and adjust T3 and L1 for the best signal to noise ratio.

The filter, F1, is supplied pre-aligned some minor adjustment may improve the performance, but unless some test equipment is avialable it is best left alone.

If the local oscillator output is to be used, T4 should be adjusted for maximum output.



116MHz Output Spectrum



R&EW Data Brief

DG300-303
DG304-307
DG381-390

Monolithic CMOS Analog Switches

designed for . . .

- **Portable, Battery Operated Circuits**
- **Low Leakage Switching i.e. Sample and Hold Circuits**
- **Communication Systems**
- **Low Level Switching Circuits**
- **Fast Switching Circuits such as Multiplexers**
- **Standard Linear Dual Supply Voltages or Single Supply Systems**

BENEFITS

- Environmentally Rugged
  Latchproof CMOS
- Low Standby Power
  0.06 μW Typical
- Minimizes Signal Error
  0.1 nA Typical Leakage
- Low Operating Power
  7.5 mW Typical
- Reduced Voltage Drop Across Switch in ON Condition
  $r_{ds(on)} < 50\ \Omega$
- Minimizes Switching Time
  Typ t_{on} & $t_{off} < 180$ ns
- Minimizes System Power Requirements
  Single Supply Operation Capabilities
- Easily Interfaced
  TTL, DTL / CMOS Input Compatible
  Pin to Pin Replacement for DG180 Series Switches
- Reduces External Component Requirements
  Logic Input Overvoltage Protection

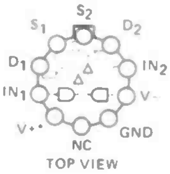
The range of analogue switches featured have utilise CMOS technology for low and almost constant on resistance over the full analogue signal range.

The on resistance is typically less than 50 R and current will conduct in either direction with no offset voltage. They have low power disipation (a few milliwatts for the DG 300-303 DG 381-390 and a few hundred micro watts for the DG 304-307) this makes them ideal for battery-powered or remote switching applications. The switching speeds are among the fastest availiable for such low power dissipation. In the OFF condition the switches will block voltages of up to 30V peak to peak. The ON/OFF action of all the switches is controlled by logic input drivers. The switch input of the DG 300-303 and the DG 381-390 are all TTL compatible, the OFF state being less the 0.8V and the ON state being greater than 4V. The DG 304-307 are switched at CMOS levels, the OFF state being less than 3.5V and the ON state with an input greater than 11V (with 15V positive supply). The logic inputs are protected against overvoltage of up to 18V about and 36V below the positive supply. The combination of low cost, low power, low resistance and high switching speed optimizes system design.

PIN CONFIGURATIONS

DUAL SPST DG381

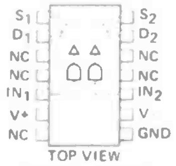
Metal Can Package



TOP VIEW

ORDER NUMBERS
DG381AA OR DG381BA
SEE PACKAGE 2

Dual-In-Line Package



TOP VIEW

ORDER NUMBERS
DG381AP OR DG381BP
SEE PACKAGE 11
DG381CJ
SEE PACKAGE 7

LOGIC	SW 1 SW 2
0	ON
1	OFF

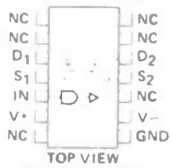
*(SUBSTRATE AND CASE)

SPDT DG387

LOGIC	SW 1	SW 2
0	OFF	ON
1	ON	OFF

*(SUBSTRATE AND CASE)

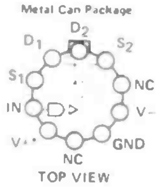
Dual-In-Line Package



TOP VIEW

ORDER NUMBERS
DG387AP OR DG387BP
SEE PACKAGE 11
DG387CJ
SEE PACKAGE 7

Metal Can Package



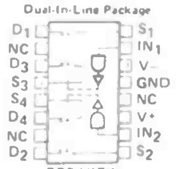
TOP VIEW

ORDER NUMBERS
DG387AA OR DG387BA
SEE PACKAGE 2

DUAL DPST DG384

ORDER NUMBERS
DG384AP OR DG384BP
SEE PACKAGE 12
DG384CJ
SEE PACKAGE 8

Dual-In-Line Package



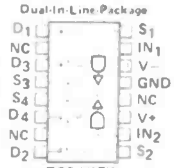
TOP VIEW

LOGIC	SW 1-4
0	OFF
1	ON

DUAL SPDT DG390

LOGIC	SW 1 SW 2	SW 3 SW 4
0	OFF	ON
1	ON	OFF

Dual-In-Line Package

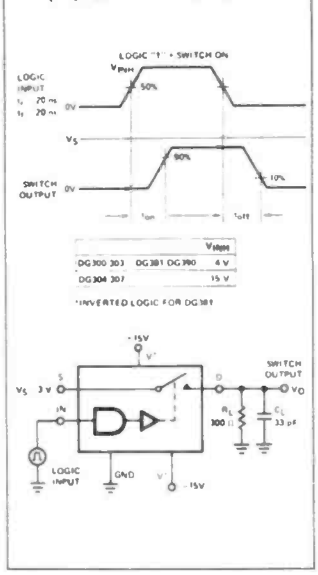


TOP VIEW

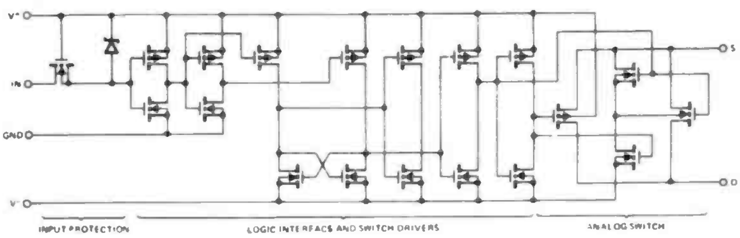
ORDER NUMBERS
DG390AP OR DG390BP
SEE PACKAGE 12
DG390CJ
SEE PACKAGE 8

SWITCH STATES ARE FOR LOGIC "1" INPUTS (POSITIVE LOGIC)

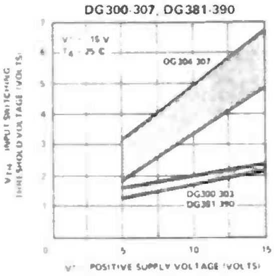
SWITCHING TIME TEST CIRCUIT (DG300-307 DG381-390)



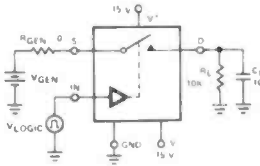
PARTIAL SCHEMATIC OF TYPICAL SWITCH (DG300-307, DG381-390)



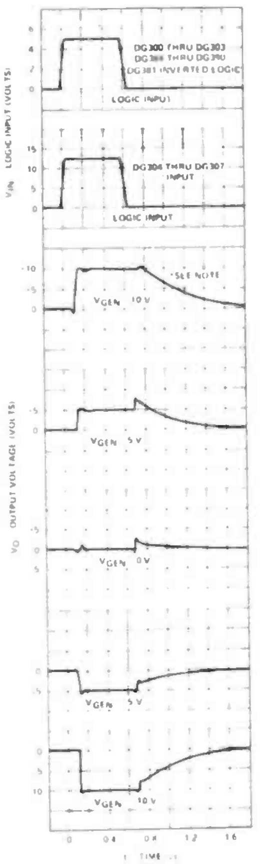
Input Switching Threshold vs Positive Supply Voltage DG300-307, DG381-390



Typical delay, rise, fall, settling times, and switching transients in this circuit.



If R_{GEN}, R_L or C_L is increased, there will be proportional increases in rise and/or fall RC times. Applying V_{GEN} to D rather than S results in much greater spikes.



Note: The turn off time is primarily limited here by the RC time constant (100 ns) of the load.

ELECTRICAL CHARACTERISTICS

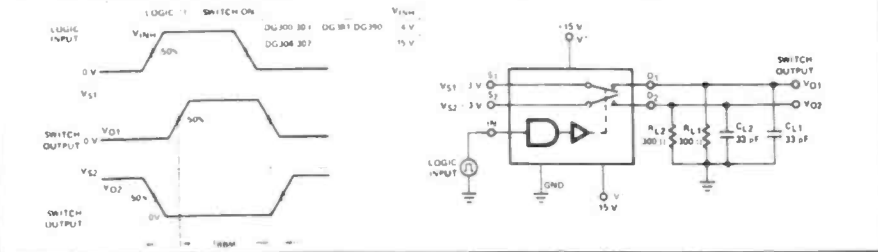
All DC parameters are 100% tested at 25°C. Lots are sample tested for AC parameters and high and low temperature limits to assure conformance with specifications.

			Characteristics		Typ[1] 25°C	Max Limits A/B Suffix -55°C/-20°C	A/B Suffix 25°C	A/B Suffix 125°C/85°C	C Suffix 0°C	C Suffix 25°C	C Suffix 70°C	Unit	Test Conditions V+ = +15 V, V- = -15 V, Gnd = 0 V	
1	SWITCH	V_{ANALOG}	Minimum Analog Signal Handling Capability		±15		±15	±15		±15	±15	V	Switch On, I_S = 10 mA	
2		$r_{DS(on)}$	Drain Source On Resistance		30	50	50	75	50	50	75	Ω	V_D = +10 V, I_S = -10 mA	Note 2
3					30	50	50	75	50	50	75		V_D = -10 V, I_S = +10 mA	
4		$I_{S(off)}$	Source OFF Leakage Current		0.1		1	100		5	100	nA	V_S = +14 V, V_D = -14 V	Note 2
5					-0.1		-1	-100		-5	-100		V_S = -14V, V_D = +14 V	
6		$I_{D(off)}$	Drain OFF Leakage Current		0.1		1	100		5	100		V_D = +14 V, V_S = -14 V	
7					-0.1		-1	-100		-5	-100		V_D = -14 V, V_S = +14 V	
8		$I_{D(on)}$	Channel ON Leakage Current		0.1		1	100		5	100		V_D = V_S = +14 V	Note 2
9					-0.1		-2	-200		-5	-200		V_D = V_S = -14 V	
10	INPUTS	I_{INH}	Input Current Input Voltage High	DG300-303 Only	-0.001	-1	-1	-1		-1		μA	V_{IN} = 5.0 V	
11				DG300-307 Only	0.001	1	1	1		1			V_{IN} = 15 V	
12		I_{INL}	Input Current Input Voltage Low		-0.001	-1	-1	-1		-1			V_{IN} = 0	
13	DYNAMIC	t_{on}	Turn ON Time	DG300-303 Only	150		300					ns	See Switching Time Test Circuit	
14		t_{off}	Turn OFF Time		130		250							
15		t_{on}	Turn ON Time	DG304-307 Only	110		250							
16		t_{off}	Turn OFF Time		70		150							
17		t_{on} - t_{off}	Break Before Make Interval	DG301, 303 DG305, 307 Only	50								See Break Before Make Time Test Circuit	
18		$C_{S(off)}$	Source OFF Capacitance		14							pF	V_S = 0, Note 2	f = 1 MHz
19		$C_{D(off)}$	Drain OFF Capacitance		14								V_D = 0, Note 2	
20		$C_{D(on)}$ + $C_{S(on)}$	Channel ON Capacitance		40								V_D = V_S = 0, Note 2	
21		C_{IN}	Input Capacitance		6								V_{IN} = 0	
22					3.5								V_{IN} = 15 V	
23			OFF Isolation[3]		58							dB	V_{IN} = 0, R_L = 1K Ω, C_L = 15 pF, V_S = 1 V_{RMS}, f = 500 kHz	
24	SUPPLY	$I+$	Positive Supply Current	DG300-303 Only	0.23	1	0.5	0.5		1		mA	V_{IN} = 4 V (One Input) (All Other Inputs = 0)	
25		$I-$	Negative Supply Current		-0.001	-10	-10	-100		-100		μA		
26		$I+$	Positive Supply Current		0.001	10	10	100		100			V_{IN} = 0.8 V (All Inputs)	
27		$I-$	Negative Supply Current		-0.001	-10	-10	-100		-100				
28		$I+$	Positive Supply Current	DG304-307 Only	0.001	10	10	100		100			V_{IN} = +15 V (All Inputs)	
29		$I-$	Negative Supply Current		-0.001	-10	-10	-100		-100				
30		$I+$	Positive Supply Current		0.001	10	10	100		100			V_{IN} = 0 (All Inputs)	
31		$I-$	Negative Supply Current		-0.001	-10	-10	-100		-100				

NOTES
1. Typical values are for DESIGN AID ONLY, not guaranteed and not subject to production testing.
2. V_{IN} = input voltage to perform proper function. DG300-303 V_{IN} = For logic "1" = 4 V, for logic "0" = 0.8 V; DG304-307 V_{IN} = For logic "1" = 11 V, for logic "0" = 3.5 V
3. "OFF" isolation = 20 log V_S/V_D, V_S = Input to OFF switch, V_D = Output. Since the DG300-301 and DG304-305 have a N/C pin between S and D, the OFF isolation generally improves by 7 dB @ 500 KHz over value shown here.

DG300 ICMA A	DG302 ICMB A
DG301 ICMA B	DG303 ICMB B
DG304 ICMA C	DG306 ICMB C
DG305 ICMA D	DG307 ICMB D

BREAK-BEFORE-MAKE TIME TEST CIRCUIT SPDT (DG301, DG303, DG305, DG307, DG384, DG390)



M40FM CB RIG MODIFICATIONS

Our review of the DNT rig in March suggested some improvements - we've implemented them to give a significant improvement in performance. Modifications are also described which convert the DNT to a 10M Amateur Band FM Tranceiver.

HAVING SAID IN OUR original review of the DNT M40FM rig that it suffers from some serious shortcomings, we thought it a good idea to publish a few notes on some improvements. It is possible that these modifications will also be of benefit to some other rigs, but we haven't checked this.

The most significant improvement is achieved by replacing CF1 with a two pole crystal filter. We used a 10M15A (10.7MHz 15KHz BW) but better results should be attainable with a 8KHz BW 10.695MHz filter - if you can get one. A narrow filter at this point in the circuit removes some of the signals which cause severe blocking and intermod problems in the MC3357's mixer. There is a slight mismatch to the 10M15A, but in practice it is not a problem.

The first mixer, Q2, is the cause of further intermodulation products. Changing the 2SC9626 to a 3SK45 as shown made a further improvement. A side effect of these modifications are the more sensible readings obtained from the S-meter.

The 3SK45 is 'nested' on the back of the PCB—this proves easier than fitting in the usual way.

The 10M 15A filter in place. Take care not to short the resistor leads to the can.

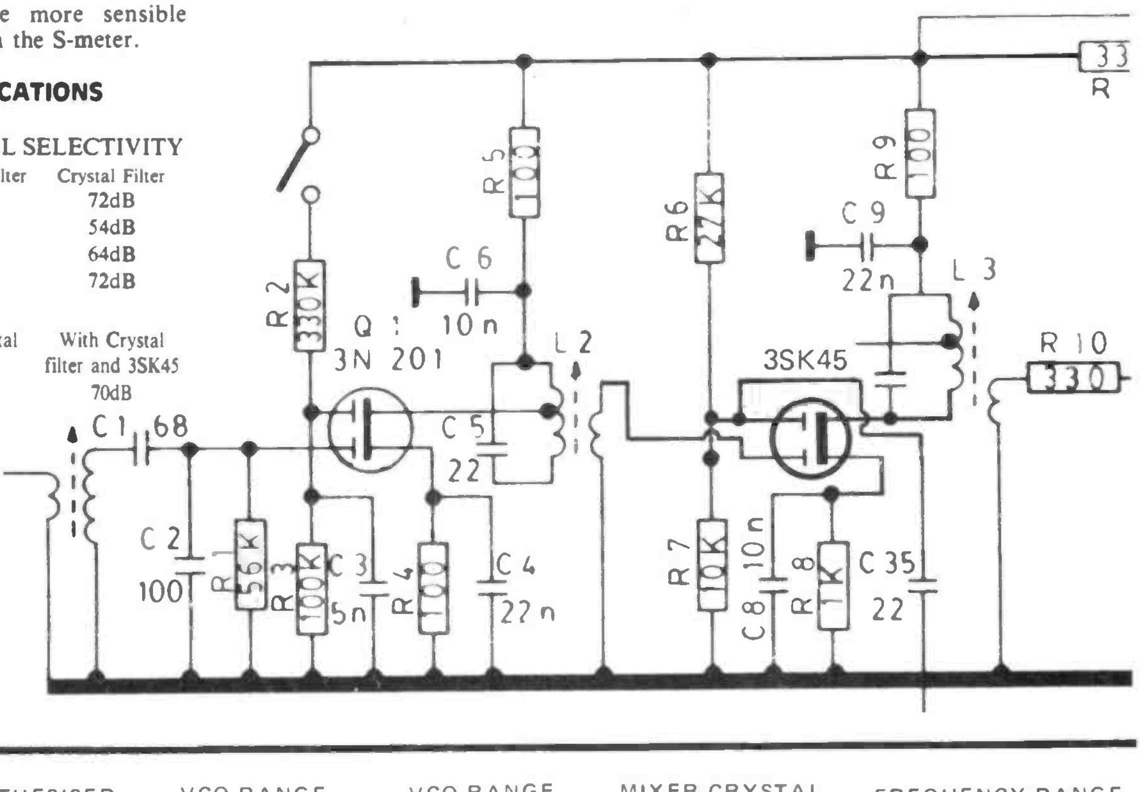
RESULTS OF MODIFICATIONS

ADJACENT CHANNEL SELECTIVITY

	Ceramic Filter	Crystal Filter
2CH High	-	72dB
1CH High	47dB	54dB
1CH Low	48dB	64dB
2CH Low	-	72dB

IMD

As Supplied	With Crystal filter	With Crystal filter and 3SK45
36dB	60dB	70dB



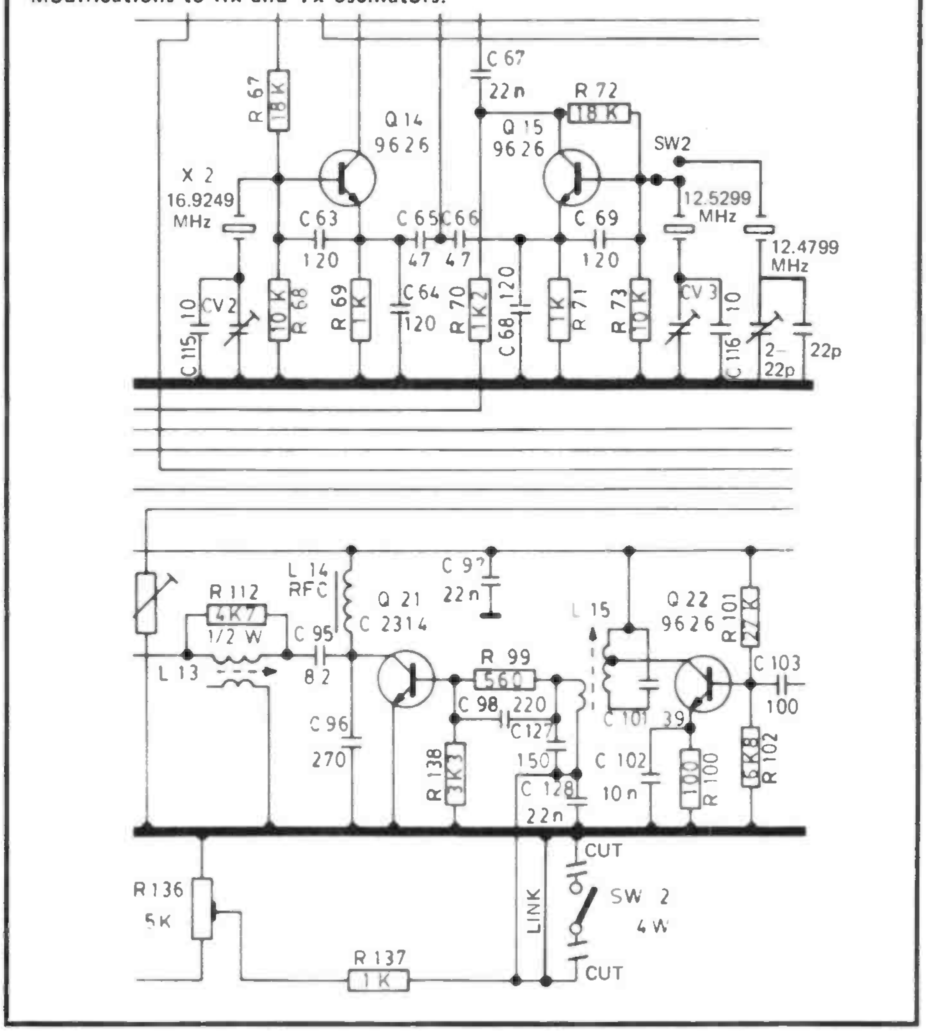
Modified mixer circuit.

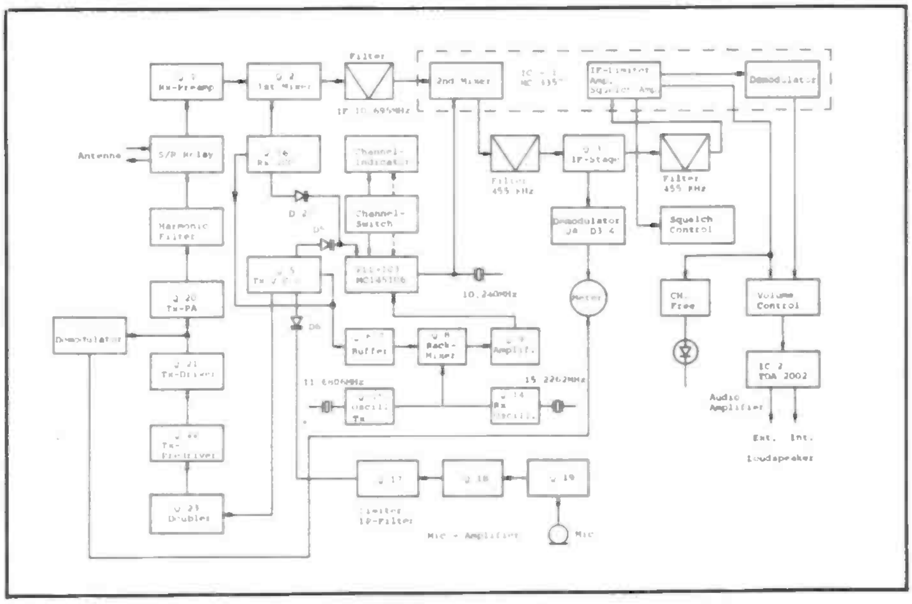
	SYNTHESISER RANGE	VCO RANGE (CB)	VCO RANGE (10M)	MIXER CRYSTAL (10M)	FREQUENCY RANGE
Rx	1.68005MHz-2.07005MHz	16.90625MHz-17.29625MHz	18.605MHz-18.995MHz	16.9249MHz	29.300MHz-29.69MHz
Tx(normal)	2.1200125MHz-2.315015MHz	13.800625MHz-13.995625MHz	14.650MHz-14.485MHz	12.5299MHz	29.300MHz-29.69MHz
Tx(−100kHz)	As Above	N/A	14.600 MHz-14.795MHz	12.4799MHz	29.200MHz-29.5900MHz

10M FM TRANCEIVER

Converting a CB set to the 10M band is one of the cheapest ways of HF operation. The DNT (and its LCL equivalent) is a basically good radio which offers a very simple conversion.

Modifications to Rx and Tx oscillators.





Block diagram of the M40FM.

CONVERTING DNT M40 TO 10M AMATEUR BAND

The DNT is one of only a few rigs that don't use an LC7137 dedicated synthesizer. The system used in the M40FM is based around a CMOS synthesizer which operates at about 2MHz. The required output frequency is achieved by mixing the VCOs down to the synthesizer's operating range. This means that by changing two crystals and returning the set it is fairly simple to convert this set for use on the 10M band.

A switch (the high/low power switch) is located conveniently close to the crystals and may be used to switch from normal operation to -100KHz transmit offset for repeater use.

Table 1 gives the frequencies present at various parts in the circuit. The operation of the synthesizer was fully described in our review published in March 1982.

In order to change the operating frequency of the set, the mixer crystals X2 and X3 must be changed to the frequencies given in *Table 1*. If the -100KHz transmit offset is required, SW2 should be rewired to switch two crystals in place of X3. The track between X3 and Q16 must be cut and replaced by the switch. If SW2 is removed, a replace its function by adding a link as shown.

SETTING UP

After changing the capaciters and crystals as indicated in *Table 1*. Set the channel selector to CH20 and monitor the voltage on pin 8 of the MC145106 (IC3). Adjust the RX VCO coil, L18, until pin 8 goes high (synthesizer in lock). Continue to tune L18 until pin 8 goes low. Set the core to the middle of these two positions. Check that the synthesizer remains in lock over all 40 channels. Using a local signal or, if possible, a signal generator peak L1, L2 and L3 for best signal to noise.

Connect a dummy load and power meter. Monitor pin 8, IC3 and switch to transmit. If the synthesizer is not in lock, the transmit condition will be inhibited. In order to tune the TX VCO, L6, press and release the PTT whilst adjusting L6 until pin 8 goes high. Set the core of L6 in the centre of its operation range as for the RX VCO. Tune the transmit amplifier chain (Q20 to Q23) for maximum power output starting with L17. Initially, tune the transmitter at the centre of the band coverage then check that the power remains fairly constant over the range.

Finally set both transmitter and receiver exactly on channel by adjusting the relevant trimmer (CV2, CV3 and new 2-22pf).

The modified 10M FM tranceiver is probably one of the cheapest ways of getting on the HF bands. Conditions on the 10M band are such that given a quiet channel the 4 watts output of this set can be all that is needed to work stations in many continents. If more power is wanted, there are some quite good (and bad, so be careful) CB power amplifiers which will work very well on the 10M band,. The extra power, although not always necessary, will make communication much easier especially while the sunspot activity is declining.

■ R & EW

Your Reactions..........	Circle No.
Immediately Interesting	100
Possible application	101
Not interested in this topic	102
Bad feature/space waster	103

COMPUTING NEWS

Gary Evans with news of a new Spectrum rival and of a UPS.

THE PRESS LAUNCH of the Sinclair Spectrum saw Clive Sinclair making a few pointed barbs about the BBC micro and about the competition in general. The general theme of the Sinclair advertising is to compare the Spectrum's performance with that of other low cost machines. A comparison that reveals the Spectrum in a favourable light. Now, to paraphrase a well known saying, there are lies, damned lies and advertising, while not suggesting that anything in the Sinclair adds is a falsehood, the odds are certainly weighted in the Spectrum's favour by virtue of the characteristics chosen for the performance comparison.

The 'knocking copy' of the Sinclair adverts has, not surprisingly, upset some people in the trade and Sinclair may, according to some, find themselves in court over some aspects of the campaign.

In view of this it is not surprising that other manufacturers may see the Spectrum as fair game when it comes to promoting their machine.

The Oric I computer due for launch this month (October) is billed as the micro to challenge Sinclair.

The Oric range will feature two models, a 16K machine at £99 and a 48K version at £169. Both will provide 16 colours and have a teletext/viewdata compatibility with a 24 row x 40 character screen format.

Both models have a 57 key keyboard with 'moving keys' and boast a sound capability with a six octave, dedicated sound generator chip. This device has been pre-programmed with some popular (?) sounds-laser zaps, explosions etc.

The machine is designed around a ULA and it is pointed out that, in the Oric's case, the answer to the question - which came first, the computer or the ULA?, the answer is very definitely, the ULA. Other machines have tended to have the ULA designed around the computer rather than designing the ULA and building the computer around it. This according to Oric, the company not the computer, is the reason for the troubles experienced by the likes of Acorn and Sinclair with their ULA's.

The marketing of the Oric machines will initially follow the Sinclair mail order pattern with 'buy off the page' adverts appearing in a number of magazines during the month.

On paper the Oric looks a good machine - we'll wait for a review sample before giving any further judgement.

AVOID OOPS WITH AN UPS

Powering your micro computer system via an Uninterruptable Power Supply (UPS) has a number of advantages-not the least being that your laboriously entered programs won't dissappear into randomness in the event of a power failure. if the UPS also features a filter to supress any mains voltage spikes as well, it becomes a very attractive piece of equipment.

Power Testings Power Bank is just such a unit a we had a sample of their UPS in our offices the other day. The Power Bank comes in two power ratings (12oVA and 230 VA) and both feature an advanced specification.

The UPS operates by powering the micro computer via a battery supply and inverter, the battery being charged continually while a mains input to the unit is present. In the event of a power failure, the supply to the equipment is truly uninterupted as the battery/inverter is already in circuit. This is in contrast to some UPS's which use a relay to switch from mains supply to batteries, missing a few cycles in the process. The inverter provides a true sine wave 50Hz output, again in contrast to some units that produce a square wave output.

The power bank's batteries provide sufficient power to keep a typical micro system going for enough time to dump any material in avolatilestorage area to a more permanent form of storage if the UPS's warning buzzer should indicate a power supply failure.

The first day of the PCW show could not have been better for Power Testing as a power failure on the first day left their stand the only one with any thing to show the visitors - they must have a good PR company.

FUN AND GAMES

Thorn EMI are to increase their involvement in the area of software marketing. Thorn have been involved with software for the past five years or so with their first efforts being four language courses licensed directly to Atari. A further nine titles were test marketed by the Atari distributor in the UK until a few months ago, Ingersol.

The launch package of the Thorn EMI Video Programmes division is to consist of 21 titles, including two programs for the VIC-20 and a host of titles for the Atari 400/800 range.

Heavy advertising and point of sale displays in retail outlets should mean a healthy level of sales during the run up to Christmas.

For details of your nearest stockist contact:

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Your Reactions..........	Circle No.
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'PROJECTBOARDS'

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'PROJECTBOARDS'

AUDIO BRIEF

The first part in a new series of articles investigating all aspects of audio from a 'professional' viewpoint. Written by our resident Audio Engineer, David Strange, this series will build into a comprehensive reference library of information and projects. This month, we begin with the design of a high specification Peak Programme Meter.

SERIOUS AUDIO is a huge and interesting subject. So many magazine projects have standards of performance and design that are, unfortunately, either randomly chosen, or based loosely upon what is practised by the domestic audio marketing people, rather than what is really necessary. **R&EW** hopes that this new series of audio projects will not follow that trend, but will be of interest both to the professional and non-professional alike.

The justification for such a series comes from the increasing popularity of 'audio visual'. There are also numerous non-professional contributors to local radio, all requiring better and cheaper audio equipment. Even in the field of professional audio, self-build will always be necessary because of custom and budget requirements.

So, our series will concentrate on maintaining high standards of specification and compatibility, since previously it is in these areas that the 'constructor end' of audio has always been the poor relation. In radio, for instance the standard you must comply with is set by the Home Office; though, there are receivers and transmitters and *receivers and transmitters*. Audio, however, is open to subjective assessment and can be much looser in its constraints and specifications. Therefore, we have chosen as our guide on audio, the **IBA Code of Practice for Independant Local Radio Studio and Outside Broadcast Performance**. This code is particularly good because:-

1. It is well known and easily recognised.
2. It covers a wide range of equipment and practises.
3. It's tolerances are reasonable.
4. It *defines* methods of measurement.

Before we can get under way, however, we need a set of measuring instruments... and it just so happens, near the beginning of the code it mentions perhaps the most important - the British Standard Peak Programme meter or PPM.

Next month, we'll present a constructional project on the PPM, but for now we will consider the design parameters.

The PPM is a most valuable measuring tool, not only for getting the level right, but also for resolving visually the ear's perception of the sound level (*Figure 1*).

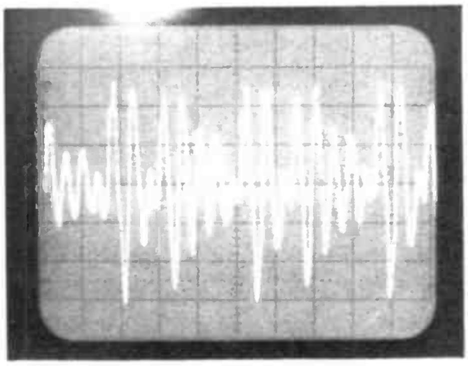


Figure 2: A typical speech audio signal.

If the incoming audio signal was always a pure tone, half wave rectification would suffice--by its very nature a sine wave goes equally positive and negative and measurement of either half reveals the same result. However, most audio signals lack the symmetry (*Figure 2*) of a pure tone and therefore require full wave rectification. In fact, it is not uncommon to find that this assymmetry results in either cycle of an audio signal differing in amplitude by 2.5 times.

As well as being able to rectify all types of audio signals, the rectifier should be free from any type of threshold effect. A simple diode bridge will not suffice because diodes do not conduct until a voltage threshold is reached. This means any meter connected to such a system suddenly becomes live when the audio level passes a certain point. So, to get around this problem, an active rectifier (*Fig. 3*) is used with diodes placed in the feedback loop of an op-amp. This has the effect of linearising the diodes by removing their conduction threshold. Such a rectifier can be used down to very low signal levels and has the advantage of low output resistance.

It is important for the rectifier to have a flat frequency response, throughout the whole audio frequency spectrum (40Hz to 16KHz + 0.3dB is specified). Once the audio signal has been rectified (i.e. it's unidirectional), it is not enough to put a

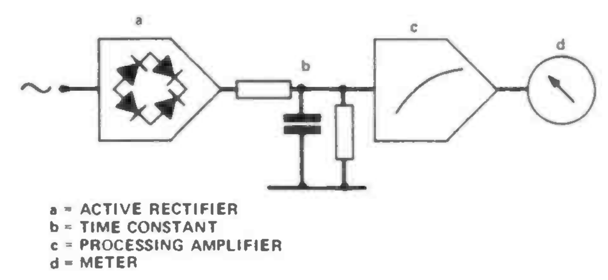


Figure 1: Schematic diagram of a basic PPM.

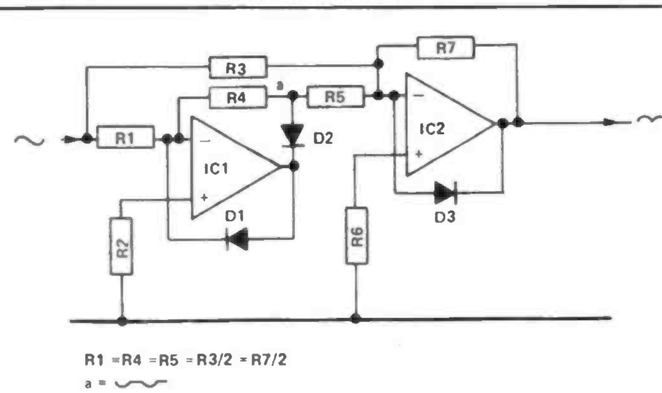


Figure 3: An active rectifier circuit.

meter across it. This is because, in the case of a moving coil instrument, the average rather than peak value would be indicated and although a light column may show the signal peak, readings would be very confusing. For instance, it may be *wrongly* assumed that an instant response by the meter is the ultimate goal of a PPM and that this is reflected in the general popular market shift away from mechanical meters to light columns. However, two things should be taken into account when setting the response speed of a meter: firstly, the ears' perception of distortion and secondly the perceived level of sound pulses.

The ear only recognises distortion if it lasts for a certain period of time. Hence a click will always sound like a click, even if it is over the top. The perceived level of the sound depends on its duration as much as its actual level. A high speed meter can present very confusing information. Two totally different signal levels may be perceived by the ear as the same level simply because duration being taken into account (*Fig. 4*). One way in which a PPM can combat this and take into account the ear's response to pulses of sound, is to have a finite attack time. A resistor and capacitor will produce this time constant function and the circuit is shown in *Fig. 5*.

Sounds of sufficient duration will cause C1 to be charged up to the voltage on the input side of R1, while shorter ones will be over before C1 has time to charge fully. The voltage across C1 is therefore a measure of duration as well as the amplitude of the incoming signal. The charge stored on C1 is leaked away by R2 and determines the recovery time of the meter needle when the signal is removed. A fairly long time--two seconds or so from full scale deflection--does much to relieve eye fatigue when watching the meter.

SCALE MARKING

When the input is not pulsed, but steady, the perceived level is virtually dependant on the amplitude (within the normal frequency response of the ear). The relationship between perceived and real level is logarithmic (*Fig. 6*). For example, two level changes of 10mV to 100mV and 100mV to 1000mV are interpreted by the ear as being equal, even though the actual voltage range covered by the second is much greater than the first.

Put another way, the ear perceives as equal changes what are, in fact, equal *ratio* changes (10:1 in each case). The temptation, when faced with this logarithmic relationship, is to reflect the perceived level using a linear response meter with a non-linear scale--the VU meter is a classic case. However, close scrutiny reveals the scale to be far from ideal; one third is taken up with a red overload region (where, presumably, the needle is not supposed to go), another with a region where most audio is never consistant enough to remain, and the other third has scale markings which are cramped and lack resolution--especially since this part of the scale is where most resolution is actually needed.

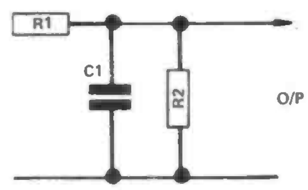


Figure 5: Time constant circuit.

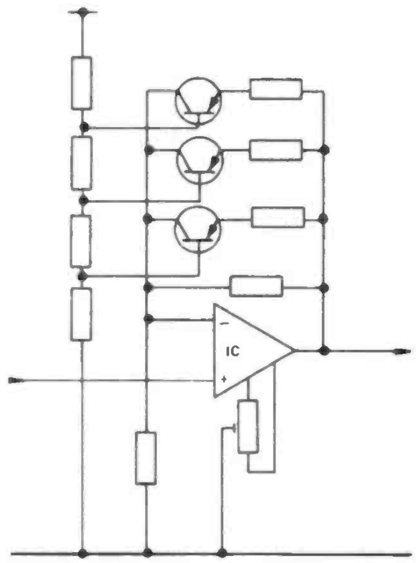


Figure 8: A typical PPM programming amplifier.

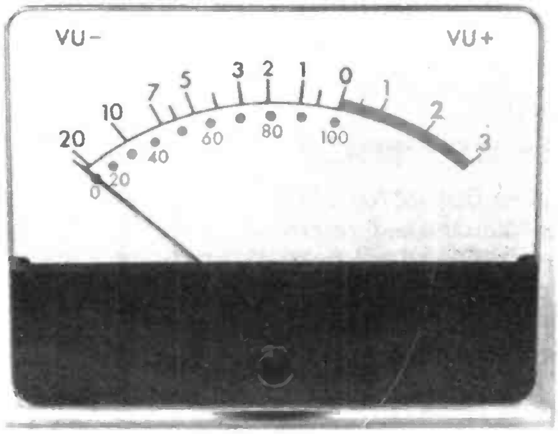


Figure 7: The VU meter.

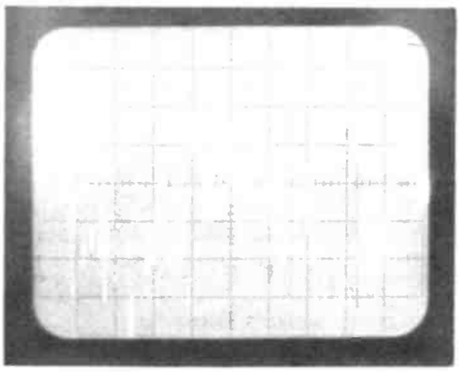


Figure 4: Two audio signals can sound similar, but an oscilloscope reveals the difference is

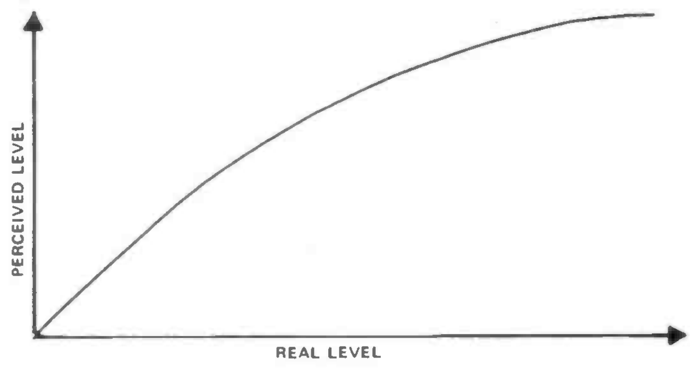


Figure 6: How the ear perceives sound levels.

THE PPM SCALE

The PPM overcomes scale calibration problems by processing input voltages via an amplifier (*Fig. 8*) that reduces gain logarithmically, as the input level increases. This logarithmic processing is generally achieved 'piece-wise' by a series of straight-line approximations (*Fig. 9*) that minimise errors at various points along the scale. The actual error allowed at each point of the scale, is closely specified and at important points as low as + 0.2 dB-- despite the apparent crudeness of the scale.

The scale preferred by british broadcasters is shown in *Fig. 10* and represents 24dB in 4dB steps, with an infinite number of dB's below mark 1 (in theory at least). It should be said, also, that the meter movement used for the PPM is of special design to provide a fast reliable response with minimal overshoot. Mark 4 on the scale corresponds to the zero level (0.775V RMS), so any indication below this is refered to as -NdBs and any indication above as + NdBs.

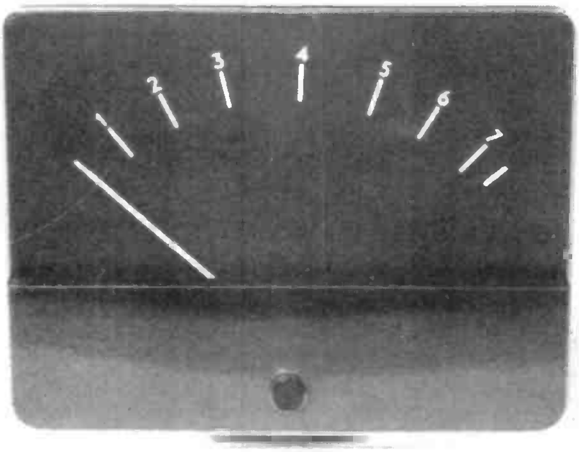


Figure 10: A PPM with 1-7 scale.

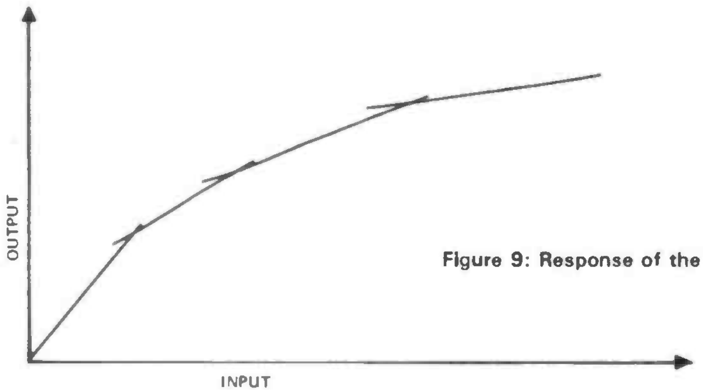
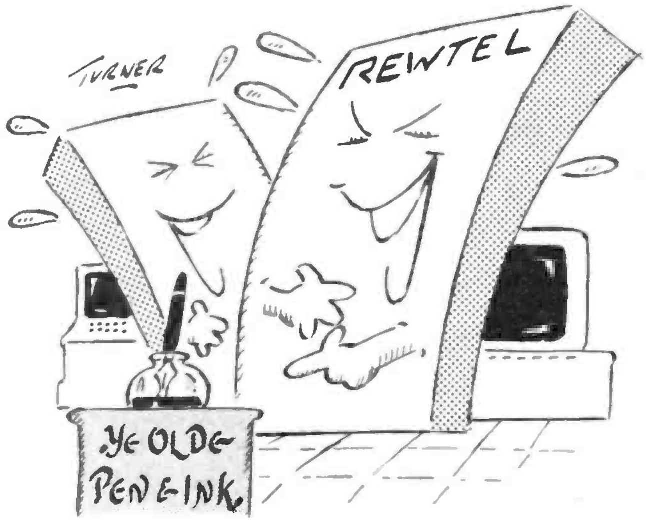


Figure 9: Response of the PPM amp.

Your Reactions..........	Circle No.
Immediately Interesting	24
Possible application	25
Not interested in this topic	26
Bad feature/space waster	27

REWTEL LIVES!



Development of the first 'public domain' phone-in computer information service installed, written and operated by a monthly magazine continues apace....

THE REWTEL 'PHONE RANG the other night at about 9.30 pm, and since REWTEL was temporarily off-air whilst system maintenance was being carried out, the phone was answered by human voice, instead of whistling modem.

The gentleman at the other end of the line expressed some surprise, wondering if perhaps we had succeeded in another *R&EW* first, and managed to put a speech recognition and synthesis unit on the database I/O. Not so (yet), and the ensuing conversation revealed that the caller was the founder and operator of the TRS80 user group service in Hull, the pioneering FORUM80 service.

The call then developed into a fascinating discussion of the various other phone-in data services that exist (mainly in the USA where they are now to be numbered in hundreds), and the rather pedestrian way in which the UK micro user is taking to the idea.

GET RICH SLOW

Maybe the 'market' has been overwhelmed by PRESTEL and the indifferent press that it has managed to attract (unfairly, perhaps) since its inception. It seems that the American experience bears out the philosophy of letting private enterprise get on and do its own thing: the art of the telephone accessible database is certainly alive and well out there, although most people have now agreed that there is little short term hope of the system provider ever making any money from such ventures.

Indeed, more than ever it seems that such services are offered as adjuncts and complements to existing activities, with the faint and remote hope that one day they may be viable in their own right.

It is thus appropriate to remind you lot that friends of REWTEL are asked to subscribe the meagre sum of £10 pa, to help towards the system upkeep, and ensure that you have the priviledged user status to get to inner sanctum services of electronic mail, telex, direct enquiry services etc.

FLATTERY

The recent PCW show saw the launch of another 'phone in database. Or rather, it didn't quite, since the exercise was strictly 'paperware'. You've heard of software and hardware? Well, *paperware* is the buzzword for computerised kite flying, although in this instance we are confident that it will happen in January 1983.

We were interested to discover that PRESTEL had set up a deal with another publisher who is seeking to invest in the future, and the possible demise of the ink/paper trade. EMAP (the publishers of *Motor Cycle News, Tackle & Guns, Pet Product Marketing, What Computer, Which Computer inter alia*) MICRONET 800 is being contrived as the personal computer users end of the PRESTEL service, and in view of the increased awareness that is going to be brought about by the service, we are delighted to see that there is now likely to be more interest and effort in getting the PC user to use dial-up databases.

We could be bitchy and suggest that PRESTEL might have had the perspicacity to connive with the only publisher who had actually progressed past the 'paperware' stage with their endeavours, but we're not like that, are we?

The key to the success of the public database is apparently the much vaunted £50 modem, although judging by the number of manufacturers waiting for the arrival of the equally much vaunted 'modem on a chip' from AMD, there could be quite a logjam when it all starts to happen. So we've been working away on a rather less glamorous multi-IC solution which will be published shortly in this magazine.

It would seem more obvious that the real answer is for messrs. Acorn and friends to supply a built-in modem and line interface option on their machines with RS232 capabilities, with a few lines in the handbook to spell out just what it means to be able plug your terminal into a 'real' computer system.

WHAT'S ON REWTEL

Standby for a mixture of fact and 'paperware' - here's a list of the REWTEL services currently planned and in operation:

Press and news releases
All the news thats fit to magnetise and rotate.

Supporting R&EW
Background information on R&EW features and projects, mistakes corrected, cumulative indexing etc.

Book Reviews
An ideal use of the keyword system that allows you to search out the book you need.

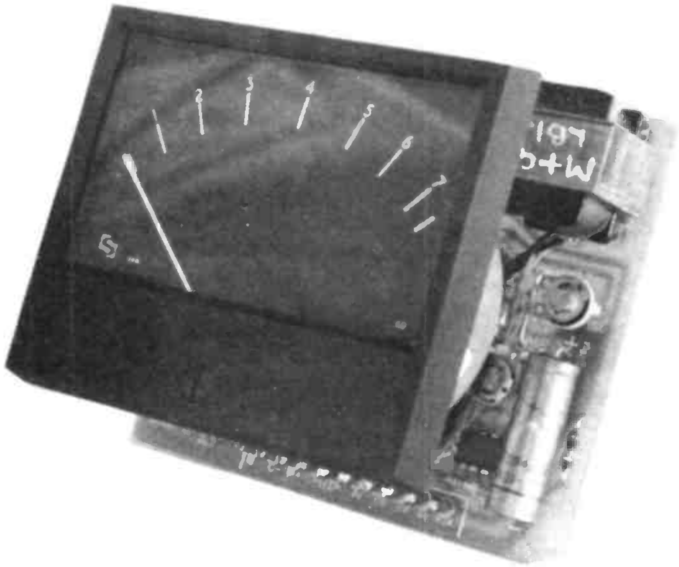
Data sheets
Background information and support for the WR&E catalogue.

REWSHOP (on-line facilities available to subscribers only)
Place your orders for subs, books and parts - with a full on-line facility starting around November.

Mailing list
Add your name and address to our list to receive updates and information from our advertisers.

Ad-update
On-line news from companies on prices, products and offers.

Your Reactions..........	Circle No.
Immediately Interesting	32
Possible application	33
Not interested in this topic	34
Bad feature/space waster	35



KEY ELECTRONICS PPM 3

David Strange reviews a compact Peak Programme Meter.

The Peak programme Meter submitted for review, consisted of a PPM drive amplifier mounted on the rear of a Sifam (Director 34) taut-band meter movement. Accompanying the assembly was an instruction booklet and computer derived test certificate. An LED was also supplied.

The ten page booklet contained a full circuit diagram, parts list and circuit description in addition to recalibration instructions and various application notes. Attention to detail was very good, though the booklet is obviously due for some revision since it made no reference to BS5428 the latest specification only to the older BS4297. Furthermore, the tolerances for static accuracy were quoted wrongly; even from BS4297. Assuming a typographical error, we have reprinted them correctly.

However, BS5428 has additional requirements: a tone burst of 0.5ms, a tighter static tolerance of + 0.2 dB at -8dB and +8dB, a +6 + 0.5dB indication for the 10mS tone burst and a frequency response of 31.5Hz to 16KHz + 0.3dB (incidentally when mentioning BS5428 the test certificate wrongly quotes the static tolerances, at -8dB and +8dB, to be + 0.3dB instead of + 0.2db, but rightly quotes the 10mS tone burst response).

The drive amplifier was designed to bolt directly onto the meter's input terminals, but being 85mm x 102mm, was larger than the front panel of the meter - no chance of mounting several meters side-by-side in a mixer, say.

The PPM3 audio input is transformer balanced and only suitable for standard levels since it is without gain adjustment. There is also no fuse, for protection of a power supply, on the PCB. One good feature however is a built-in drive for an external LED overload indicator, as required to be fitted to 'on-air desks' by the **IBA Code of Practice For Local Radio**. It is possible to drive an additional external meter from the amplifier, but 'slugged' meter operation requires an external capacitor to be hung elsewhere, since only the resistive divider exists on the PCB.

The LED output, external meter output, and slugging capacitor connections all appear--along with the various inputs--as a row of turret tags on the lower edge of the PCB. The tags, and all components, are identified by silk screening on the board. We tested the PPM3 for the following:

1. Static alignment accuracy
2. Frequency response
3. Decay time
4. Attach time
5. Reversability error (symmetry of rectification)
6. Power Supply tolerance
7. Overload indicator range

MANUFACTURERS SPECIFICATIONS

Meter Movement:	Ernest Turner Type 643
Supply Requirements:	Nominal 24V Dc. Instrument will operate over range 18 to 35V Drain at 24 volts typically 12·15mA + 10mA LED current.
Connections:	Turret solder tags on bottom edge of PCB. Alternative types of connection to special order.

Attack Time:
Defined as response to 5kHz tone bursts.

100ms	+8 ± 0.5dBm
10ms	+5.5 ± 0.5dBm
5ms	+4.0 ± 0.75dBm
1.5ms	−1.0 ± 1.0dBm

Decay Time:
Time taken for meter to fall between +12dBm and −12dBm 2.5 to 3.2 secs.

Calibration at 1kHz:	Zero	−infinity
	1	−12± 0.5dBm
	2	−8 ± 0.3dBm
	3	−4 ± 0.3dBm
	4	0 ± 0.0dBm
	5	+4 ± 0.3dBm
	6	+8 ± 0.3dBm
	7	+12 ± 0.5dBm
	FSD	undefined
Frequency Response:	40Hz to 15kHz ± 0.3dBm	
Input Impedance: (Transformer Isolation)	Less than 0.2dB level drop in 600 ohm circuit (40Hz - 15kHz) on connection of the meter to the circuit.	

After the tests were carried out, the amplifier was deliberately mis-aligned and re-alignment attempted using the instructions from the booklet. It was found, unfortunately, that there was some interaction between the law controls. However, by cycling through them three or four times, errors began to minimise themselves. In any case, the alignment was just within BS5428 after one pass of the adjustments.

CONCLUSION

This is a satisfactory PPM that performs to BS5428 and BS4297 specifications. The LED indicator is a good idea and should make the PPM a choice for the ILR stations. The decay characteristic is much smoother than most - the break points hardly show.

It is a pity that the card is on the large side and unfortunate that *open* cermet pots are used for the pre-sets. They may be vulnerable during transit or installation, making it a bit pointless to issue a test certificate. Even so it *was* found, during re-alignment, that the adjustments were very fine.

Price of the PPM3 with meter £59.70 (VAT not included) from:
Key Electronics,
Bournemouth,
BH7 7BS.

TEST RESULTS

Static alignment (1kHz, Input 0.775V RMS)

Mark	BS5428 requirement	Test result	Stated on Certificate
1	−12± 0.5dB	−11.63dB	−11.84dB
2	− 8± 0.2dB	− 7.82dB	− 8.01dB
3	− 4± 0.3dB	− 3.97dB	− 4.12dB
4	0± 0.2dB	+ 0.06dB	0 exactly
5	+4± 0.3dB	+ 4.25dB	+ 4.23dB
6	+8± 0.2dB	+ 8.05dB	+ 8.05dB
7	+12±0.5dB	+12.03dB	+11.96dB

Frequency Response (31.5Hz to 16kHz)

Mark	BS5428 requirement	Test result	Stated on certificate
1	not specified	not required	test not entered
2	± 0.3dB	± 0.38dB	test not entered
3	± 0.3dB	± 0.22dB	test not entered
4	± 0.3dB	± 0.12dB	test not entered
5	± 0.3dB	± 0. 8dB	test not entered
6	± 0.3dB	± 0.02dB	test not entered
7	not specified	not required	test not entered

Decay Time

BS5428 requirement	Test Result	Stated on certificate
2.8± 0.3 sec	2.59 sec	2.71 sec.

Attack Time

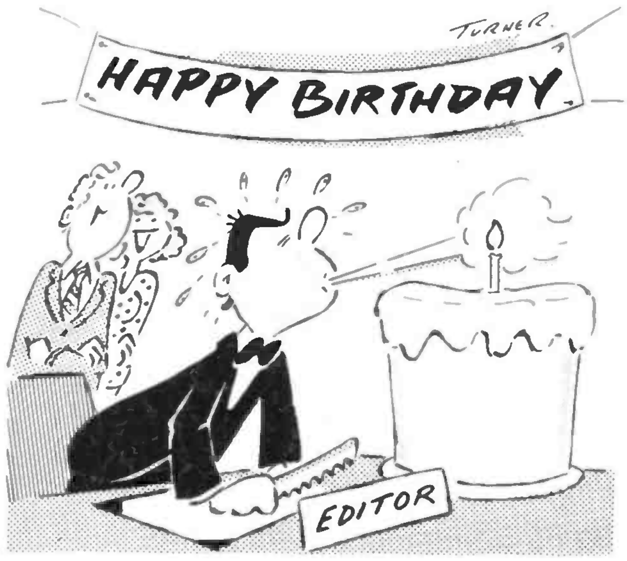
Burst Width	BS5428 requirement	Test result	Stated on certificate
100mS	+8± 0.5dB	+8.0dB	+8.2dB
10mS	+6± 0.5dB	+5.8dB	+6.0dB
5mS	+4± 0.75dB	+3.8dB	+4.1dB
1.5mS	−1± 1dB	−1.7dB	−1.4dB
0.5mS	−9± 2dB	−8.5dB	−9.5dB

Reversability Error

BS5428 requirement	Test result	Key Elec. test certificate
< 0.5dB	not measurable within tolerances of test apparatus.	not specified

CAPTION COMPETITION

The Caption Competition this month was due to feature a Mike Turner cartoon as is our usual practice. When this picture came our way, however, we felt obliged to let the keen wit of R&EW reader loose upon the master piece.
Printable suggestions please to
Caption Competition
Radio and Electronics World
117A High Street
Brentwood
ESSEX
Closing date is November 30th and the Editor's decision will be final.



"Give him another five minutes and then tell him that it's a Hologram"

The winner of last month's Competition is Mr. L.Nunn who will receive the original Cartoon as the prize.

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158 for further details

Burning the cakes again, Ken?

WELL, it would be churlish of us not to welcome the recent announcement by Mrs T's technology supremo, Mr. Kenneth ('the only MP who can change a set of torch batteries') Baker that we are 'in for' 30 channels of cable TV. But that's never stopped us before....

Unless someone at the DoI proposes to repeal a few of the laws of physics, someone is going to have to get moving rather rapidly just to produce the volumes of fibre optic cables that are going to be required.

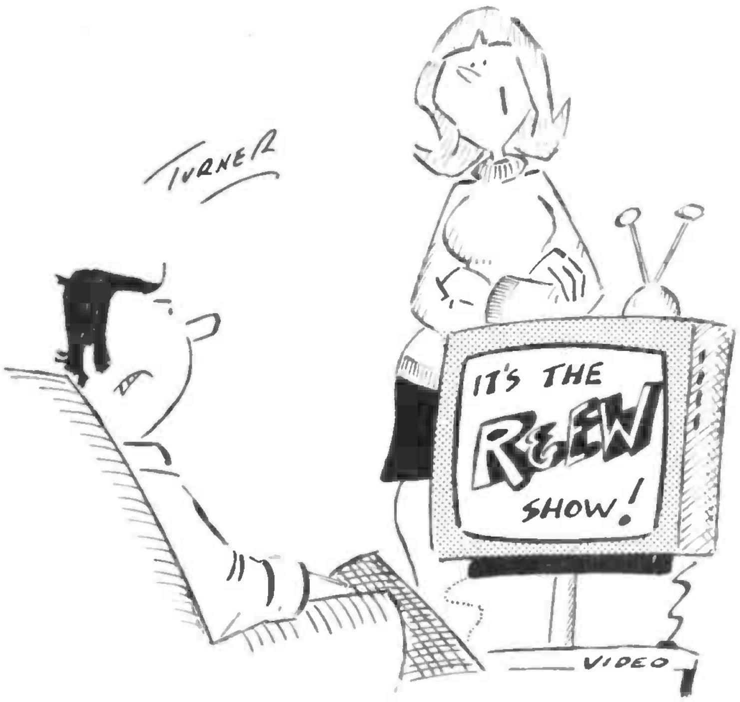
Being of immediate relevance to the media, this particular pronouncement appears to have been picked up and Pursued rather promptly with all sorts of grandiose pronouncements from all sorts of pundits; but judging by the lack of technical background information and proposals, dare we say it, but it seems a trifle 'half-Bakered'. In the land of the blind, the one eyed man enjoys a lot of media coverage.

Notwithstanding all this, the general concept of even more mass communication is very appealing. We still haven't had a 'real' reply to the proposal **R&EW** made concerning the experimental narrow band VHF broadcasting system, which is eminently more viable and possible 'now' - but that's life.

Judging by the standards of TV in other nations, perhaps the last thing we need do is substitute quality for quantity. The availability of VCR systems has reached a level where maybe even cable TV systems might be considered an unecessary expense and encumberance, since 28 of the 30 channels are likely to be showing material that could just as easily be made available on cassette/disc anyway.

The various experiments that have been made with 'interactive' TV in the US do not seem to have set many people's enthusiasm afire, and it is certainly not too obvious just how to implement this on the scale of the recent proposals.

The broader concept of providing wideband telecommunications facilities to every home in the land (within the boundaries of economics) sounds like jolly good fun. But in times when the tedium of finding enough money to pay the mortgage/rent, buy enough food, pay the TV rental are uppermost in most mortals' minds, the thought of what BT would charge for the facilities hardly bears thinking about. None of the proposals seem to claim any form of improved efficiency or rationalisation in its *Raison D'etre*, so we must assume that the charge is going to be in addition to all the overheads of life in the eighties.



" I DON'T CARE HOW NEW THE IDEA IS — IT'S TIME FOR CROSSROADS! "

WORTH (1000 x 50 x 60 x 30) WORDS?

In keeping with our policy of 'boldly going' where conventional electronics publishing knows better, we have been experimenting with the 'R&EW video cassette.' A small investment has been made in studio equipment, and various members of the **R&EW** team have been practising their impressions of TV pundits ranging from Alan Whicker to Jeremy Beadle.

It seems that the electronics industry could use a more dynamic record of events than has hitherto been possible with static media such as ink/paper. We don't propose to bid for Channel 5 with this programme - but we *do* intend to provide 30 minutes or so of interesting information and entertainment each month.

We intend to use the medium to back up the content of the issue - hopefully our demonstrations of setting up things like airband receivers will proceed more smoothly than *Tommorow's World* generally manage when going out live. There are very many possibilities for such a magazine programme, and we invite readers with access to video equipment (and that's an ever increasing proportion) to submit their own offerings (plus return postage, please) on VHS/Beta or the portable UMATIC format, and we will endeavour to distill an interesting collection of material for each month's issue, and reward all those whose material we use.

The trial cost will be £3 a month, plus a basic £10 deposit for the VHS or Beta format cassette. You can keep the tape for 4 days from the date of posting (1st class), and we are delighted if you lend it to your friends, or show it to gatherings at college, university or companies with the necessary facilities. But if you hang on too long, we will charge a further £1 per day overdue. Recording quality may not be quite as good as as we would all like - but if there's enough interest shown, we will be encouraged to press on and invest some more.

If you're game for a laugh, then send us £13 and an SAE (for your deposit), and you're off with number one - which features an introduction to REWTEL, a roundup of news, a look at some new products - plus an interview or two if we can persuade some of our unsuspecting visitors to have a go.

■ R&EW

Your Reactions..........	Circle No.
Immediately Interesting	49
Possible application	50
Not interested in this topic	51
Bad feature/space waster	52

NOTES FROM THE PAST

Although the term hi-fi had not been coined at the time, centre tap's article from the fifties shows that things have not changed much when it comes to marketing audio products.

With so many branches of radio and electronics to occupy the interest of the constructor to-day, it is not surprising that many find it impossible to keep up with so wide a range, and tend towards greater specialisation.

The pre-war enthusiast, if he was not greatly attracted by short-wave listening or amateur communication radio, usually turned his attention to high quality reproduction. Despite their considerable numerical strength, the quality fan has perhaps not been as full catered for in radio journalism and text books as he deserves. At one time there were several flourishing clubs catering for him but he seems to be something of a lone wolf. Yet who can doubt his importance in the face of so steady a demand for high quality speakers, amplifiers, expensive pick-ups and elaborate labyrinth baffle speakers?

Many constructors possess an acute ear, or a feeling for music, and to them the problem of sound reproduction with its many complexities becomes so absorbing that they find little interest in other branches of the hobby. Indeed, the quest for a truly balanced and life-like reporduction leaves little time for much else.

OSTRACISM

The perfect reproduction would, of course, be indistinguishable from the original sound, but has any reader ever been deceived that he has been listening to the natural voice or the live orchestra instead of a reproduction?

Again, too, the question of maintaining high quality at low volume levels, as well as at high, is a difficult one.

The first real step forward in widening the range of reproduced sound was at the bass end of the scale. Older readers will well remember the early moving coil speakers and the thrilling 'woof' they made at the bottom end of the musical register. The radio- man and the general public fell for them in a big way. We put them on to enormous baffle boards just to be sure we made the most of their ability to thump out the low notes. Happily, one did not need to be a millionaire or a black marketeer to get hold of a few square yards of 5-ply in those days.

Did they rattle the ornaments on Mrs. Nextdoor's mantelpiece? I'll say they did, and the enthusiast often encountered social ostracism as a consequence.

THE BBC, TOO!

Then the studios took a hand. Orchestral instrumentalists found themselves shuffled all around the studio, and the double bass was often put right up beside the microphone. The big grunting boom was selling point No. 1, and manufacturers and salesmen ecstatically cried 'Just listen to the bass.' No invitation was necessary really - it simply jumped out and hit you. In fact I was once solemnly assured by a listener that the thirty cycle sound waves from an early moving-coil speaker impinged so violently on the wall of his stomach when he stood facing it, that they produced a feeling physical sickness!

It would seem that the ordinary listener does not want good reproduction. His ears have, by the continual acceptance of 'pleasing' noise, been drugged by distortion and he finds an imagined realness behind what is often a travesty of the original. Listeners have grown to dislike a different 'tone' from the one to which they have become accustomed. It is far from infrequent to find extension speakers that are twenty years old, and to have their owners tell you they prefer them to anything else they have ever heard! Possibly more people than we suspect are tone deaf, but in any case there is but little improvement in the performance of the cheaper class of speaker. I am sure many would be unable to distinguish by sound alone between a speaker of 1936 vintage and a 1950 model when connected to a properly adjusted receiver.

BRILLIANCE

Perhaps it is human perverseness, but many quality enthusiasts go to the other extreme and make all sorts of sacrifices to get that little bit of extra top, even to tolerating a terrific needle hiss on gramophone reproduction. More than once I have been assured 'You don't notice it after a while'. This strikes me as a funny attitude. If one can adjust one's hearing not to notice it, surely it would be just as easy to adjust oneself not to notice other deficiencies.

Radio manufacturers, even if they are not psychologists, are at least good business men, so they gave the public what they demanded. Probably the maufacturer shrugged his shoulders and decided there was no sense in getting rid of on lot of imperfections (for which the public had acquired a taste) merely for the sake of trying to educate them to accept another (which they might not like so much after all). Anyway, their business is to sell sets, and to do that they have to give the purchaser what he likes best.

PLENTY OF SCOPE

Personally, I have always regarded the striving after super reproduction as something of an illusion, and it has been a source of mild surprise to me when I think of the trouble and money enthusiasts have expended on getting a little more emphasis at either end of the musical register. I shouldn't be, really. Having been a rainbow chaser most of my life, I know just how much fun it is chasing something that is tantalisingly beyond your reach.

When we get back to earth, we must remember that, even with the most perfect amplifying systems, there are still other factors to be taken into consideration. Firstly, the acoustics of the average room need to be taken into account, but given that, one still finds that there is a lot of correction to be done to balance the intensity of the pianissimo and fortissimo passages. Both in broadcast and recording studios the contrast is 'compressed'. This is essential while the normal output stage is unable to handle the loud passages if adjusted to give a satisfactory level on the soft passages. With record reproduction, the pianissimo must be at least strong enough to overcome needle noise, and a proportionate fortissimo would not only overload the amplifier, but also damage the record surface.

Many thoughtful enthusiasts have an instinctive dislike of what must truthfully be described as 'faking'-by the balancing of one imperfection against another. Generally speaking, that is the principle that must be exploited in the search for better quality.

If you have an acoustically good room, plenty of time and a taste for it, you can get years of fun in the quest for high fidelity. Personally I would advise making a start with improved, and simplified, methods of contrast expansion-to put back what the studios take out before you receive it!

SANYO VPR 5800

PORTABLE VIDEO RECORDER

Peter Luke looks at Sanyo's portable recorder and concludes that although it performs well it has been upstaged by Sony's F1.

IF IT SEEMS deliberate policy for **R&EW** to review only portable machines let us put the record straight, while most of the **R&EW** staff believe that portable systems are probably the best buy for anybody thinking of spending around £600 on a video system, it is not our intention to ignore mains powered models. Next month we have the Hitachi 9500 lined up for review but it just so happens that over the past months its portable models that have become available for review by ourselves.

The system under the microscope this month is the Sanyo VPR 5800, its tuner/timer the VTT 5800 and the VSC 5800 colour camera - it's nice to note that at least one manufacturer of equipment uses a fairly logical system to identify the various components of the system with one generic family number (5800) and a fairly obvious derivation for the prefix letters (Video Portable Recorder, VPR - Video Tuner Timer, VTT etc).

Also provided for review was the VPA 5800, an AC adaptor that can be used to power the recorder and to charge its battery pack.

LEADING QUESTION

The recorder and tuner timer is fairly straightforward to set up with the aerial lead being taken to the VTT 5800 and one of the leads supplied with the outfit taking the signal from the tuner/timer to the TV. A multi way lead connects the recorder to the timer and carries various power and control signals, the RF signal being fed between the two units via a, separate, co-ax lead.

Tuning of a spare TV channel to the modulators output is aided by a test signal generator producing the familiar black and white pattern on the TV screen. A test signal generator is nowadays almost a standard feature on recorders, although the Sanyo, unlike some models, does not provide a sound test tone.

Up to 12 channels may be pulled in by the tuner and these are selected by thumbwhell knobs concealed behind the hinged panel on top of the tuner. Many people, including this reviewer, prefer the simple arrangement of manual tuning rather than the often obscure operation of some of the electronic tuners now appearing. The provision of AFT on the tuner will compensate for any minor inaccuracies when tuning in stations and as the tuning operation is a once off, it seems that any attempt to speed up the procedure with the provision of an electronic tuner is an exercise of very little point.

VISION ON

With the channels selected, the next step is to set the timer. The timer controls are housed in a draw under the clock display. Pressing the front panel causes the draw to slide out with a well damped and smooth action.

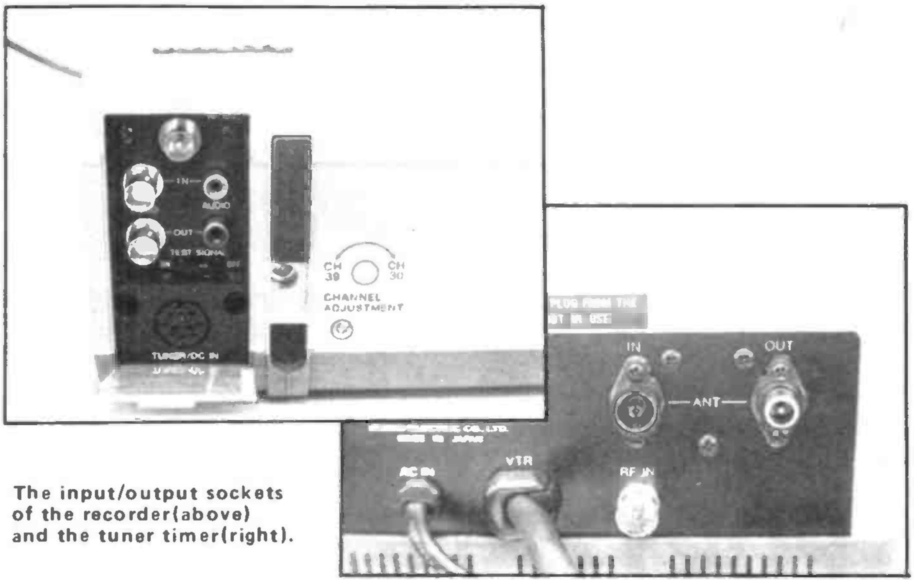
The timer is an area in which a lot of care and attention to detail on behalf of Sanyo is evident. Operation of the controls is very logical, with separate buttons to sequence through Day, Hour and Minute setting control of the 5 event 14 day timer is by 'start' and 'stop' times rather than a 'duration' entry together with start time. The timer will display an error message if any step in the start time entry procedure (enter day, channel, start time) is omitted before setting the stop time.

The care and attention to detail is evidenced by the fact that when in the programming mode, pressing the day button will display the current day from which to advance, and that when setting the stop time, the start time is displayed as the 'base' figure.

The draw containing the timer's controls also features the display brightness control that provides three levels of brightness for the clock. The clock is of a 24 hr format and the display also indicates which, if any, of the 5 events have been set up for a timed recording.

The timer controls are housed in a draw beneath the tuner/timer's clock display.

SANYO VPR 5800 PORTABLE VIDEO RECORDER



The input/output sockets of the recorder(above) and the tuner timer(right).

WHEELS IN MOTION

With the restricted front panel room available on the recorder, Sanyo have done a good job on the layout of the controls, in particular the large stop bar was much appreciated. The usual complement of facilities is provided, Pause/Still, Audio Dub and Fast Search - the fast rewind and forward buttons engage this function when operated from Play, less convenient than 'dedicated' visual search controls but a compromise made on most portables because of the lack of space.

All the motion controls are solenoid operated with the exception of eject which has a distinctly mechanical feel to it, although of course overall operation is under electronic control as the tape must be onwound from the heads when a cassette is ejected.

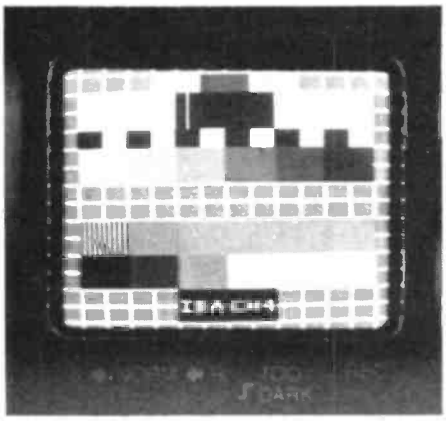
A mechanical tape counter, with memory - stop at 0000 - facility provided.

To put the machine into record, a rec lock button and the record button must be pressed simultaneously, rather than the more common practice of 'record' and 'play'. Another unusual feature is the operation lock control which if set to 'on' will effectively disconnect the control panel. Leaving the machine in whatever mode was selected when the lock was activated none of the transport controls having any effect.

An editing button will, when set to on engage a back space editing feature which causes the tape to be rewound slightly before a new recording is commenced in order to minimise picture breaks between different recordings. With this switch on, the machine will go to the pause mode when the record lock and record buttons are pressed.

QUALITY COUNTS

The playback quality offered by the VPR 5800 was excellent, a good point was the way in which, when play is selected while monitoring an off-air recording, the screen instead of being blanked, continues to display the off-air source until the video circuits have stabilised, when the recorders output is selected. This lack of this feature has been a source of annoyance on other machines, particulary when cueing up a tape in a bit of a panic while trying to watch some interesting off- air programme. The 5/6 seconds of blank screen during which the recorder is stabilising seems an age and time that could just as well have been spent with the off-air source.



The camera's viewfinder features the usual LED indicators for White Balance, Low Light etc.

The search facilities provide a 5 times playback - not as fast as some but quite adequate. The familar noise bars were apparent (for an explanation of noise bars see video news elsewhere in this issue).

The pause facility did not work as well as some of the other machines we have encountered, with, as often as not, a noise bar running across the screen. Circuitry on other machines ensures that the noise bar is out of sight at the top or bottom of the screen. The frame advance, seemed not exactly to be a frame advance (advancing the picture in discrete steps of one frame) but seemed to crawl through each frame - too slow to be of very much use.

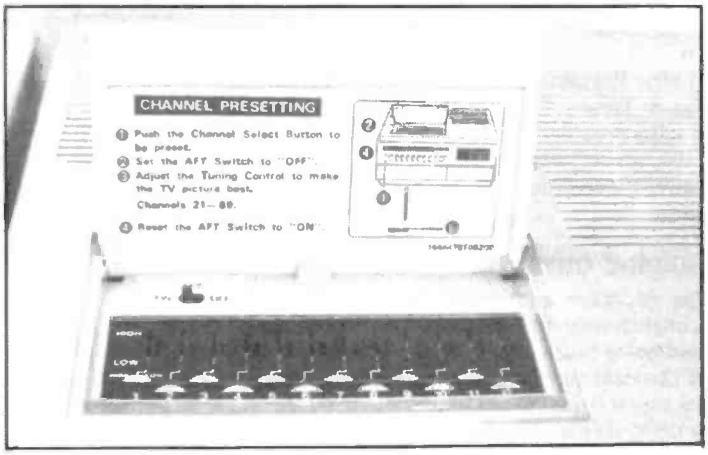
REMOTE REACTION

The remote control unit duplicates most front panel controls and is of the wired sort. Although providing a comprehensive range of control facilities, the remote is connected to the recorder by a two core lead terminated in a standard 2.5mm tack plug. This approach is rather more elegant than the multi-way cables and obscure plugs featured on some wired remote units.

The remote unit does not allow the channel selected on the tuner to be changed as it is plugged into the recorder and there is evidently no provision for a channel change signal to be sent down the recorder tuner connecting cable. This is an irritating omission as one of the most often used remote facilities is channel change, assuming you don't have an IR remote with your TV.

The recorder/tuner cable does however provide a signal that alerts the tuner to the fact that the recorder is recording and thus a record channel interlock that prevents the channel being recorded from being accidentally changed.

The tuner/timer features a manual, rather than electronic system.



ON THE MOVE

Going portable with the Sanyo means unplugging the two leads between the recorder and tuner/timer and strapping the 4.8 kg of VPR 5800 to your side. The VSC 5800 camera plugs into the side of the recorder via a 14 pin connector.

The camera is a fairly standard, electronic viewfinder model but it does have some useful features that are not seen on many models, namely full remote control of recorder functions and a two speed zoom.

Controls along the top of the camera allow Record, Play, Reverse Search, Forward Search and Stop to be selected. This is a particularly useful facility, as with the recorder slung from your side it is rather difficult to operate the recorder's function controls - a fault common to all portables and nicely overcome with the VSC 5800.

The two speed zoom offers at slow and not so slow zoom speed, a nice feature although operation is controlled by a slide switch, biased to a centre, off, position with two forward and two reverse positions. This can be rather tricky to operate successfully, in particular when a slow zoom is required, it being easy to overshoot the slow speed.

Other camera controls include the mandatory white balance controls (fine and coarse) - the setting of white balance being accomplished by three viewfinder LEDs they indicate too blue, too red, or balanced. Additional LEDs in the viewfinder indicate too low a lighting level and tape run. The tape run indicator provides the additional information that the recorder is in fact in the record mode. The LED being continually lit when the recorder is in pause, flashing when the recorder is running.

The VSC 5800 camera features full remote control facilities.

Other camera controls include an iris control that allows manual adjustment of the camera's iris opening or closing the iris by about one stop (useful if the subject to be recorded is back lit). The camera can also be switched to high sensitivity if lighting levels are particularly low.

The camera was given a field trial at, amongst other places, the recent PCW show. Its performance was adequate, the quality of played back tapes being about average for a camera of this price.

The pitol grip featured on the camera is just about adequate for 'domestic' work, but any serious applications would demand a more stable means of support, for example a shoulder harness.

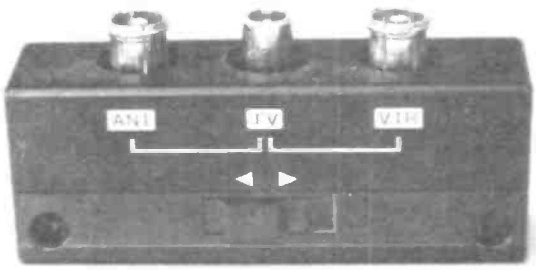
IMPRESSIONS

Overall the Sanyo combination performed well, with acceptable results being obtained in both domestic and portable roles.

This reviewer has been slightly spoilt by a close encounter with the Sony F1 which one may describe as being a second generation Beta portable. The Sanyo is a first generation model, performing well in comparision to its peers but in areas such as remote control facilities, size and 'ergonomics' being a step or two behing the F1.

■ R & EW

The recorder's remote contol unit is shown left while the antenna selector is shown below.



Your Reactions..........	Circle No.
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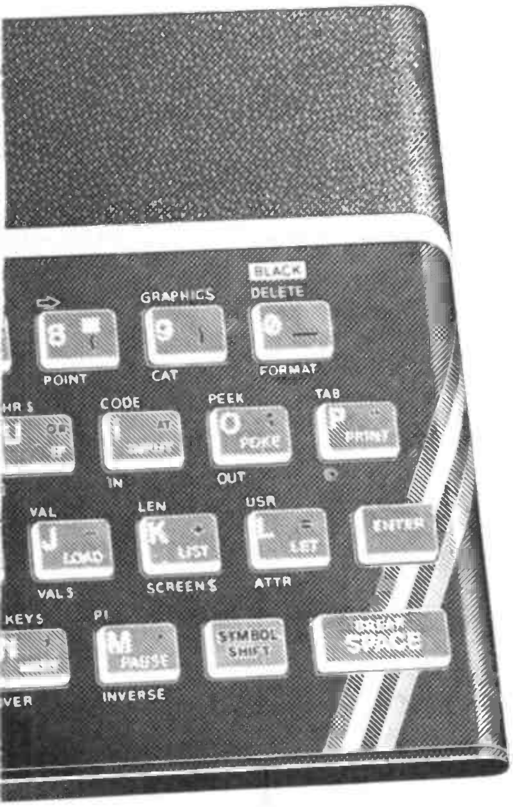
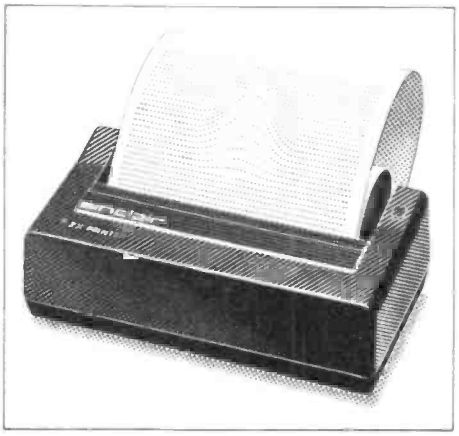


The ZX Printer – available now

Designed exclusively for use with the Sinclair ZX range of computers, the printer offers ZX Spectrum owners the full ASCII character set – including lower-case characters and high-resolution graphics.

A special feature is COPY which prints out exactly what is on the whole TV screen without the need for further instructions. Printing speed is 50 characters per second, with 32 characters per line and 9 lines per vertical inch.

The ZX Printer connects to the rear of your ZX Spectrum. A roll of paper (65ft long and 4in wide) is supplied, along with full instructions. Further supplies of paper are available in packs of five rolls.



The ZX Microdrive – coming soon

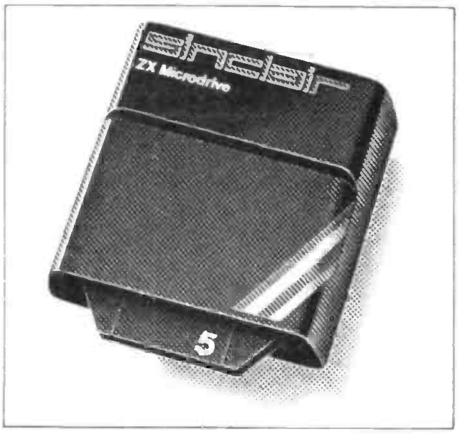
The new Microdrives, designed especially for the ZX Spectrum, are set to change the face of personal computing.

Each Microdrive is capable of holding up to 100K bytes using a single interchangeable microfloppy.

The transfer rate is 16K bytes per second, with average access time of 3.5 seconds. And you'll be able to connect up to 8 ZX Microdrives to your ZX Spectrum.

All the BASIC commands required for the Microdrives are included on the Spectrum.

A remarkable breakthrough at a remarkable price. The Microdrives are available later this year, for around £50.



RS232/network interface board

This interface, available later this year, will enable you to connect your ZX Spectrum to a whole host of printers, terminals and other computers.

The potential is enormous. And the astonishingly low price of only £20 is possible only because the operating systems are already designed into the ROM.

ZX Spectrum

Available only by mail order and only from

sinclair

Sinclair Research Ltd,
Stanhope Road, Camberley,
Surrey, GU15 3PS
Tel: Camberley (0276) 685311

How to order your ZX Spectrum

BY PHONE – Access, Barclaycard or Trustcard holders can call 01-200 0200 for personal attention 24 hours a day, every day. BY FREEPOST – use the no-stamp needed coupon below. You can pay by cheque, postal order, Access, Barclaycard or Trustcard.

EITHER WAY – please allow up to 28 days for delivery. And there's a 14-day money-back option, of course. We want you to be satisfied beyond doubt – and we have no doubt that you will be.

To: Sinclair Research, FREEPOST, Camberley, Surrey, GU15 3BR. **Order**

Qty	Item	Code	Item Price £	Total £
	Sinclair ZX Spectrum – 16K RAM version	100	125.00	
	Sinclair ZX Spectrum – 48K RAM version	101	175.00	
	Sinclair ZX Printer	27	59.95	
	Printer paper (pack of 5 rolls)	16	11.95	
	Postage and packing: orders under £100	28	2.95	
	orders over £100	29	4.95	
			Total £	

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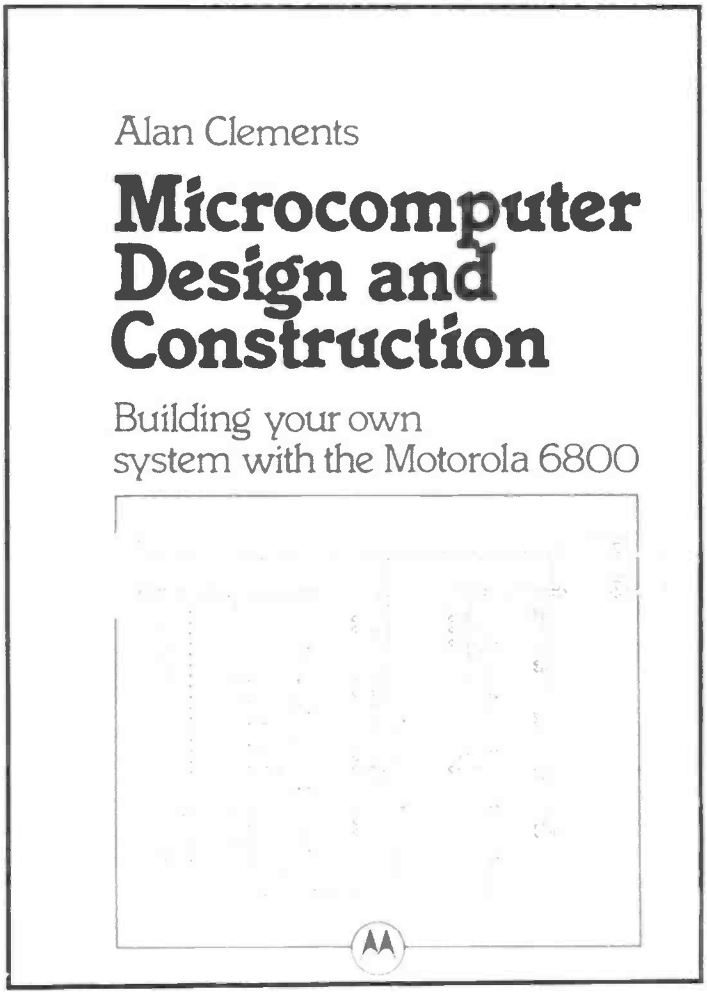

MICROCOMPUTER DESIGN AND CONSTRUCTION

By Alan Clements

1982; 520 pages; 180 x 240mm; Hardcover **19.75**

The approach of this book to the subject is very refreshing to one of the editorial team associated with the former 'R&E Constructor', as the emphasis is one building your own system. However the author emphasises that the book is not a 'Heathkit' construction manual. It is assumed that the reader will have knowledge of basic electronics, digital circuitry, microprocessor fundamentals and programming.

The basic plan of the book is to deal in general terms with each component part of a microprocessor system and then a particular arrangement is chosen as part of the microprocessor system which is developed during the course of the book. The system chosen being the TS1.

Chapter 1 is of an introductory nature describing the evolution from early electronic computers using valves to the silicon chip of today.

The author had to chose a particular microprocessor for the TS1 so that the design system could be considered in detail. The author chose the Motorola M6800, and gives his reasons for doing so, but remarks that many other popular 8-bit microprocessors would have been quite suitable.

The structure of the TS1 is dealt with in depth. Much more briefly, consideration is given to the power supply the objective being to make the designer aware of the penalties if it is inadequate. The following two chapters deal with the clock circuit which generates the timing signals and then the electrical characteristics of the buses which link together the various modules. Chapter 5 commences with an introduction into the properties of semiconductor memories followed by a discussion of the way in which memory devices are connected to the system address bus.

The final chapters discuss the broad subject of input and output techniques and take a brief look at the way the TS1 microprocessor is constructed and gives hints on debugging.

Each chapter concludes with a summary and sets out problems which can arise often in the form of questions by considering which the reader can expand his knowledge.

There are four valuable appendices at the end of the book giving background information not readily assimilated into the main text. In addition to the appendies there is an extensive bibliography related to the subject matter of each chapter.

RADIO BOOKS

AMATEUR ANTENNA TESTS AND MEASUREMENT
by H D Hooton £7.45

BEGINNERS HANDBOOK OF AMATEUR RADIO
By C Laster £9.70

CB RADIO CONSTRUCTION PROJECTS
by Len Buckwalter £2.95

FERROMAGNETIC CORE DESIGN
by M F Doug DeMaw £19.95

MICROWAVE DEVICES AND CIRCUITS
by Prof S Liao £28.00

QUESTIONS AND ANSWERS ABOUT CB OPERATIONS
by L G Sands £2.85

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by M J Salvati £8.20

GENERAL BOOKS

ABCs OF INTEGRATED CIRCUITS
by R P Turner £4.45

ACTIVE FILTER COOKBOOK
by Don Lancaster £11.20

BASIC ELECTRICITY/ELECTRONICS Vol 3 Understanding Electronic Circuits 2nd Edition
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BEGINNER'S HANDBOOK OF IC PROJECTS
by D L Heiserman £10.35

CMOS COOKBOOK
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DESIGN OF OP-AMP CIRCUITS - with experiments
by H M Berlin £8.20

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EFFECTIVELY USING THE OSCILLOSCOPE
by R G Middleton £7.45

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by Christopher Robin £7.15

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by R P Turner £4.90

LINEAR INTEGRATED CIRCUITS
By S D Prensky & A H Seidman £15.95

LOGIC AND MEMORY EXPERIMENTS USING TTL BOOK 1
by D G Larsen & P R Rony £8.95

LOGIC AND MEMORY EXPERIMENTS USING TTL BOOK 2
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OSCILLOSCOPES
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by Herbert Friedman £4.45

PRINCIPLES OF BIO-MEDICAL INSTRUMENTATION & MONITORING
by R J Traister £19.95

SECURITY ELECTRONICS (2nd Edition)
by J E Cunningham £5.65

SON OF CHEAP VIDEO
by Don Lancaster £7.45

SCRS & RELATED THYRISTOR DEVICES
by C Laster £9.70

TTL COOKBOOK
by D Lancaster £8.95

THE 555 TIMER APPLICATIONS SOURCEBOOK - with experiments
by H M Berlin £5.65

UNIQUE ELECTRONIC WEATHER PROJECTS
by Tom Fox £6.70

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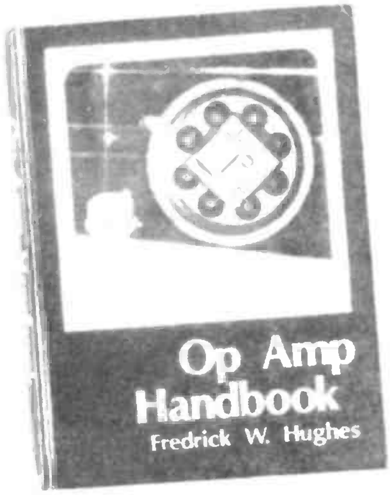

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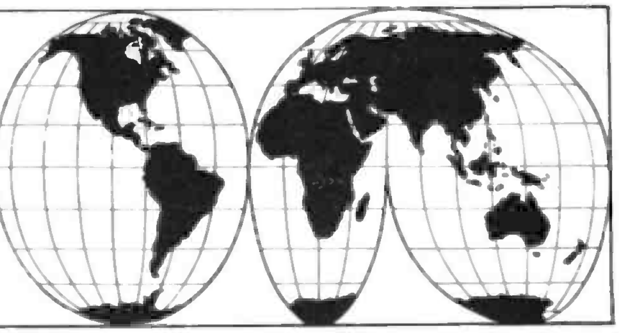
SHORT WAVE NEWS FOR DX LISTENERS



Frank A. Baldwin

All times in GMT, bold figures indicate the frequency in kHz.

In the world of short wave listening, some Dxers tend to specialise in the reception of certain parts of the world for reasons best known to themselves. There are the Latin American fans, the Indonesian enthusiasts, the African specialists and the Far East or China watchers. I tend to be jack of them all and master of none but my long time colleague Bob Iball of Costhorpe, near Worksop does tend to be one of the foremost China watchers in the UK.

In a recent letter, Bob lists some 159 channels on which he has logged signals from China, these including those from Radio Peking together with many of the Chinese regional stations. Some of these regional transmitters are quite difficult to log and one needs a fairly selective receiver to have any hope of success. In case you are interested, have a go at the following.

In Nanning there is the Guangxi People's Broadcasting Station which can sometimes be logged during the winter evenings, the frequency being **4915**. Transmissions commence at 2110 and this part of the schedule ends at 0500. Listen from around opening until about 2330 for the best chance of reception but take note that Accra in Ghana is on channel until 2305 and there are a couple of South American stations also helping things along. However, you are hardly likely to mistake Chinese for English, African vernaculars or Portuguese.

Then there is the Inner Mongolia People's Broadcasting Station in Hohhot, operating on **7300** (it also transmits in parallel on **3970** but the chance of hearing this channel is rather remote). I have found that the most favourable time to log this one is around 1500 to 1550, at which latter time it closes. Again, winter is the favourite season here in the UK for reception of this one.

Or what about the Liaoning People's Broadcasting Station in Shenyang? Listen on **4832** from around 2100 onwards. Standard Chinese is the main language of these regionals.

AMATEUR BANDS

Despite the unwelcome bangs and crashes of the summer static I did manage to log a few stations on Top Band but only a very few as the following list shows.

TOP BAND (1800-2000kHz)

Operating in the CW (Morse Code) mode — and that goes for all the Amateur Band loggings in this article — some DX was apparent on this band provided one was able to cope in some measure with the natural QRM abounding during the late summer period.

From the log I note DK2QAl from Germany, from Czechoslovakia there was OL2VAH vainly calling CQ at the time I heard him, from Sweden SM6ESY was putting a good signal into the UK whilst from the Faroe Islands signals from SM5FUG/OY were logged which was rather pleasing, this being the first time I have heard OY on Top Band. Oh well, I suppose that after over a half century of short wave listening there is always something new and yet another first to be heard and entered into the log.

40 METRES (7000-7100kHz)

The CW end of this band has always been a favourite hunting ground of mine but for any hope of success with the Dx, one needs to operate here either late at night or during the very early mornings. Of course, one could also stay up all night! The loggings shown were all obtained during the late evenings.

CO2VG in Cuba was heard busily working away with various Europeans whilst KC4TK presumably on Navassa Island (QRM wiped out the QTH if there was one given) was working the States. KP4V in the QRM jungle managed to get through to some Europeans as did PY2RRG (a regular on the band). W4CQR could be counted as Dx on this band I suppose whilst YS9HH in Salvador most certainly could. The latter was logged at 0400. Lastly on this band was ZC4YC in Cyprus putting a good signal into the UK and looking for G contacts I presumed.

20 METRES (14000-14350kHz)

On this band - the favourite Dx hunting ground of many SWL's — the following were heard and entered into the log book.

From Cuba there was CO2PY, from the area of Japan JA4DZ and JR3JXM filtered through, from Guyana KA3BUJ/8R1 put in an appearance whilst the ubiquitous KV4AA came on the scene early one evening. Argentina in the form of both LU2KB and LU6KAT were well to the fore and late the following evening Australia was represented by signals from VK2ALH and VK6RA. Early one morning and by that I mean 0500, XE1EK in Mexico came pounding in whilst a few evenings later ZC4YC in Cyprus again entered the log.

15 METRES (21000-21450kHz)

For this band the log simply records the following calls. C31JX, JA0HMB, LU1EPQ, LU2EMK, M1C, PY2MS, PY4SW, UG6GAF, and VO2AM. Nothing much there to get excited about but at least I tried - especially with the LU2 — he obviously uses a side-swiper judging by the speed of his fist.

All of that just about wraps up the Amateur Band cavortings for the month, so now — on to the Broadcast Bands with the usual mixture of items for the short wave listener and the Dxer.

AROUND THE DIAL

On this occasion a start is made in this section by taking a quick look at Peru. In years past this was one of the most difficult countries to receive here in the UK, in fact it was some years after the last world war before I finally succeeded in logging this Andean area. Most Peruvian transmitters exhibit relatively low powers, those most often reported by SWL's being on the 60 metre band and having a rating of 1kW.

PERU

La Voz de la Selva in Iquitos operates on **4825** with a power of 1kW from opening at 1000 until closing at 0500, although it has been noted closing as late as 0540 on occasions. This one was logged at 0351 when radiating a programme of local pops, the OM announcer interjecting at times with various announcements in Spanish. A good clear signal.

Radio Andina is located in Huancayo and has occupied **4996** for many years now, an old 'friend' of mine this one, I have logged it many times and use it as a marker to ascertain the possibility of receiving Peru on any given night. The schedule is from 1000 through to 0500 although the closing time varies on occasions. The power is 1kW.

ECUADOR

Radio Atahualpa, Quito on **4780** at 0347, YL with songs in Spanish complete with a local orchestral backing. The schedule is from 1045 to 0435 and the power is 1kW.

Normally one mostly logs La Voz de Carabobo, Venezuela on this channel, the schedule being 0855 to 0400 (Sunday from 1000 to 0300). Needless to say, Radio Atahualpa was logged on a Sunday!

Radio Luz y Vida, Loja on **4852** at 0355, OM with a pop song in Spanish to a liltish samba backing. At the time the tape was running whilst recording some local wildlife, the microphone being outside the shack. A great pity, I should have liked a recording of that particular Ecuadorean pop rendition!

Radio Luz y Vida is listed on **4851** and operates to the schedule 1045 to 0430 with a power of 2kW.

HONDURAS

La Voz Evangelica, Tegucigalpa on **4820** at 0432, OM with announcements followed by a religious programme in English. This one operates in Spanish from 1030 to 0300 and from 0500 to 0600 but from 0300 to 0500 it uses English recorded programmes of a religious nature, the tapes being USA productions. LV Evangelica has a power of 5kW.

COSTA RICA

Emisora Radio Reloj, San Jose on **4832** at 0442, OM announcer in Spanish presenting a programme of typical Costa Rican folk music - all very colourful stuff. The schedule is around-the-clock and the power is 1kW.

COLOMBIA

Emisora Nuevo Mundo, Bogota on **4755** at 0340, OM with a ballad in Spanish complete with guitar backing. This one also works around-the-clock and has a power of 1kW.

NOW HEAR THESE

Just in case you thought we had finished with Peru - we haven't! Try these.

Radio Chincaycocha, Junin on **4860** where it operates from 1100 to 0500 (Sunday until 0400 but also sometimes around- the-clock) with a power of 0.5kW and Radio Imagen, Tarapoto on 5035, schedule unknown.

Have I logged them? The former at 0447 with a programme of local pops most certainly. The latter, somewhat doubtful — although I did hear some slow sombre orchestral music preceding a newscast in Spanish at 0503 one morning but missed the station identification — grrr!

POLAND

Warsaw on **7125** at 2000, OM with station identification and a newscast in the English transmission to Africa, scheduled from 2000 to 2030. Also logged in parallel on **7145**.

Warsaw on **7270** at 0600. OM

with station identification at the start of the French programme for Europe, timed from 0600 to 0630.

ITALY

Rome on **7275** at 1934, bird song interval signal followed by station identification, announcement of frequencies and times of transmissions. YL (Young Lady) announcer with a newscast in the English programme for the UK, scheduled from 1935 to 1955.

Rome on **7290** at 1524, YL with a newscast in the Slovene programme for Europe, listed from 1520 to 1535.

YUGOSLAVIA

Belgrade on **7240** at 1940, YL with the news in the French transmission to Europe, the Middle East and Africa, scheduled from 1930 to 2000.

HUNGARY

Budapest on **7215** at 2016, YL with the English programme for Europe presented daily from 2000 to 2030. All about industry and agriculture in Hungary. I came to the conclusion some years ago that some of the highest quality jam in the world comes from Hungary. It really is comprised of solid fruit and little else - just like mother used to make! Look carefully at the label on the jar for country of origin.

WEST GERMANY

Cologne on **7235** at 2020, OM (Old Man = male announcer) with a commentary on world events in the Spanish programme for Europe, listed from 2000 to 2050.

Cologne on **7175** at 2022, OM with sports commentary in the German programme for Europe, Africa and South America, scheduled from 2000 to 2200.

Cologne on **7130** at 1507, OM with the news in the Macedonian transmission for Europe which is aired from 1500 to 1510 daily.

Cologne on **7150** at 0442, OM with station identification in the English programme intended for Central and East Africa and listed from 0430 to 0515.

Cologne on **17705** at 1954, OM with news of Polish events in the English programme beamed to West Africa from 1930 to 2020.

GREECE

Athens on **15050** at 1949, Greek music, OM with songs in Greek. This transmission also logged in parallel on **15040**. As neither of these channels are listed in their schedule, I presume these transmissions were experimental. My thanks are due to my old colleague Bob Iball of Costhorpe, near Newark for putting me on to these broadcasts.

VATICAN CITY

Vatican on **7250** at 1929, interval signal followed by YL with station identification and then the English programme to the UK, scheduled from 1930 to 1945. Also logged at 0605 on this channel when radiating Latin Mass to Europe from 0530 to 0615 on a Sunday (Monday to Saturday 0600).

ROMANIA

Bucharest on **11775** at 1520, OM and YL alternate with announcements followed by local music and songs in the English programme intended for Asia, timed from 1500 to 1530.

SPAIN

Madrid on **9765** at 1932, YL with a newscast of world events in the English transmission to Europe, listed from 1900 to 2100.

CZECHOSLOVAKIA

Prague on **7345**at 1958, interval signal followed by OM with station identification at the commencement of the English programme for the UK, Eire and Western Europe, schedule from 2000 to 2030.

EAST GERMANY

Berlin on **21575** at 0900, OM with news of both internal and external events in the English programme directed to the Far East and timed from 0845 to 0930.

SWITZERLAND

Berne on **21695** at 0910, OM with a programme all about whale conversation in the English transmission for Australasia, the Far East and South Asia timed from 0900 to 0930.

FRANCE

Paris on **7160** at 1924, OM with a talk in French to Africa, scheduled from 1800 to 2130 on this channel.

Paris on **7280** at 0555, YL with station identification in French, announcements of frequencies, transmission times and address for reports at the end of the French programme for Central and Eastern Europe, scheduled from 0500 to 0600.

CANADA

Montreal on **7170** at 1919, OM with the English programme for Europe - all about Canadian politics - scheduled from 1900 to 1930 (not Saturday or Sunday). This is a Daventry relay.

Montreal on **7130** at 1912, OM with a programme all about the Canadian economy in the English programme for Europe, timed from 1900 to 1930 weekdays (to 1920 Saturday and Sunday). This is also a relay from Daventry.

Montreal on **11825** at 0629, OM with a newscast in the English and French programme for Africa, scheduled from 0600 to 0700. Into French at 0630.

ISRAEL

Jerusalem on **17585** at 1300, jingle for Coca Cola, time pips, YL with station identification and a newscast in the Hebrew languaged Domestic B Service to Europe and North America.

ASCENSION ISLAND

BBC Relay on **7105** at 0528, OM and YL with the French programme to Africa, timed from 0430 to 0700.

Your Reactions.........	Circle No.
Immediately Applicable	53
Useful & Informative	54
Not Applicable	55
Comments	56

DX-TV Reception Reports

Compiled by Keith Hamer and Garry Smith.

At a recent gathering of long-distance television (DX-TV) enthusiasts in East Anglia, it was generally agreed that activity during the 1982 Sporadic-E Season fell somewhat short of the good conditions which had been anticipated. Some experienced DX-ers expressed the feeling that the recent sun-spot maximum and the associated enhanced F2-layer conditions had a bearing on the lack of sustained reception. Even though we have passed through the sun-spot peak, activity within the Sun's photosphere is still occurring. Indeed, during mid-July there was a sun-spot count of over 300 which, incidentally, brought havoc to various short-wave broadcasts. We may still be able to experience further reception via F2 propagation later in the year as such a high sun-spot count during the equinoxes would be unusual, let alone in the middle of summer!

July's reception didn't start at this location until the 3rd. At 0825BST, broadcast television signals were noted from the USSR (TSS) on channel R1. At 0943 on E2, weak reception from RTVE-Spain was observed with standard colour bars followed by the electronic test card carrying the identification 'tve tve 1'. At 1025, the PM5544 test card from Italy was seen on channel IA with the inscription 'RAI 1' at the top. Strong signals from Italy were also received on the 4th with a programme interlude caption entitled 'Intervallo'. Several days then passed by with little or no sign of DX reception. At this point it is worth reminding newcomers to DX-TV that such days do occur and often lead even the experienced DX-ers to wonder whether their installation has developed a fault.

Conditions improved dramatically on the 8th with programmes on R1 and R2 at 0718. Strong video from Poland (TVP) was noted at 0735 on channel R1 with their modified PM5544 test card (see September's column). The signal was good enough to resolve SECAM colour on a JVC CX-610GB monitor. In the late afternoon period, strong signals from TSS were detected on R2 with a Current Affairs programme and a USSR News programme was seen on channels R1 and R3 a few minutes later. Reception from RAI was noted on channel IB with programme material.

At 1606 BST on the 8th, weak signals from Switzerland were noted on channel E4. Reception consisted of the FuBK electronic test card with the identification '+PTT SSR 1' which originated from the French-language outlet at La Dole (150kw ERP). At 1610, the Swiss test card was noted on channel E2 from the German-language transmitter at Bantiger (50kw, located near Berne) with the identification '+PTT SRG 1'. Although the signal was not especially strong, PAL colour information was detected. The FuBK test card was radiated until 1712 at which time a programme schedule caption was shown with the abbreviation 'tv drs'. This was also seen on channel E3 from the Uetliberg transmitter which has an ERP of 60kW.

Few transmissions from the Continent were noted on the 9th. In fact Sporadic-E (Sp.E) conditions only managed to bring in Hungary (MTV) with commercials at 1812 BST followed at 1816 by a curious keep-fit programme (Eastern-bloc countries love keep-fit programmes) on R1 and Spain on channels E2, E3 and E4. Improved tropospheric conditions (Trop) allowed early morning reception from the Netherlands (NOS) on channels E4(VHF), E29, E32, E45 and E54 (UHF) at 0728 with their 'EBU Bar' test card carrying the familiar identification 'PTT-NL AVVC-HVS'.

Reception on the 11th started bright and early with an identification caption at 0748 from NCT in Italy on channel IA/E3. NCT is one of the illegal pirate television systems which operate in Italy, Sicily and Sardinia. At 1020 on E2 the 'black- white-black' pattern from RTP-Portugal was noted and at 1030 it made a brief appearance on E4 from the new, and only, outlet on this channel. At 1031 the usual 'RTP 1' FuBK electronic test card was seen on channels E2 and E3.

An anticyclone of 1028mbs perched over north-east Scotland brought improved trop conditions on the 12th with NOS-1 and NOS-2 appearing on several UHF channels. A 'KRO' caption was received on E29 at 1800 which was followed by a cartoon with Dutch subtitles. There are numerous organisations in the Netherlands (including KRO, AVRO, TROS, VARA) which contribute programme material to NOS. Each organisation has its own identification captions and announcers although the test card and clock captions are radiated only by the Dutch telecommunications administration and NOS. Transmissions from Spain were noted on E2, E3 and E4 during the day including sample pages from their teletext service (similar to the BBC's CEEFAX) known as 'Teletexto'.

The enhanced trop conditions prevailed on the 13th and at 0720 the Danish PM5544 test card was received in Band III on channel E10 (210.25MHz) with PAL colour and the identification 'DR. DANMARK'. At 0830 on E9 (203.25MHz) the ubiquitous PM5544 was noted from Norway with transmitter information which confirmed reception from the 30kw outlet at Lyngdal. Also on the 13th, at 1850 BST, Auroral Reflection (AR) activity was noted. This manifests itself as severe video distortion with a 'sleigh bell' effect on sound. Apart from the severe interference which it caused to short-wave transmissions in various parts of the world, channels E2, R1, E3, R2, E4 and even E5 were affected although no intelligible video information was resolved.

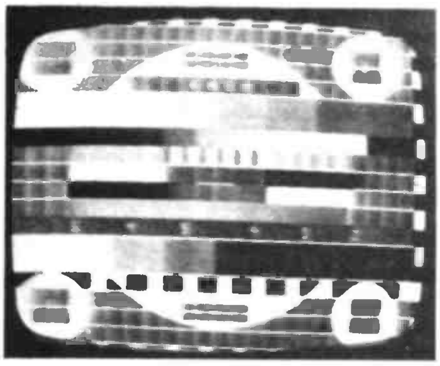


Figure 1: The USSR 'Leningrad' electronic test card from Kiev.

Figure 2: Programme schedule for July 30th from Norway, received in Band III.

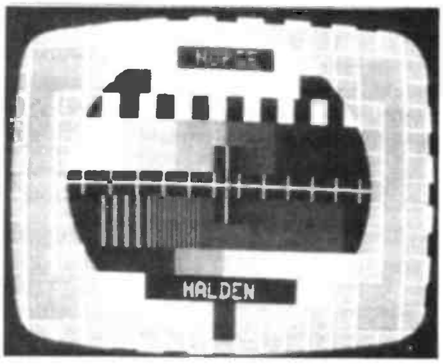


Figure 3: Norwegian test card from Halden received in July on channel E11.

July 15th was quite an eventful day with no fewer than 12 countries being received. Sp.E activity commenced at 1620 with a cartoon on channel IA from RAI. Ten minutes later the NCT identification caption was noted on E3/IA and at 1640 on E3, Spain was received with a regional colour pattern identified by the inscription 'rtve GOMONITEIRO 3'. The Norwegian test card was observed on E3 from the NRK transmitter at Hemnes. The PM5544 included a digital clock showing 1656 (BST + 1hr). Also from Scandinavia came the Swedish PM5544 on E3 with the usual 'TV 1' at the top and 'SVERIGE' at the bottom. Another PM5544 was noted on this channel and after rotation of the aerial system, the country was confirmed as Iceland as the test card carried the information 'RUV' at the top and 'ISLAND' in the lower black rectangle. Yugoslavia was the next country to appear on channel E3 with three different identifications used on the PM5544 test card which included 'JRT RTV-LJNA', 'RTV-1' LJUBLJANA' and 'JRT BGRD 1'. The latter incorporated a digital clock at the top. At 1758 on the 15th, a programme schedule caption was received from SRG - Switzerland on E3. At the same time a 1st Network caption from ORF-Austria was noted on channel E4 from the transmitter at Patscherkofel. Later in the evening (at 2202BST) the Polish News programme 'dt' was seen on R2, and on R1 the USSR were radiating a closedown caption with some rather sombre music. Following programme closedown, standard colour bars were shown for a few seconds. At 2219 on R1, CST's closedown sequence was in process showing the Czechoslovak flag. This was followed by the FuBK electronic test card and then CST switched to the 'RS-KH' test card for a few moments.

Reception on the 16th was very brief but interesting with RAI present on IA during the late afternoon and then at 1720 a 'ztv' identification caption from Zimbabwe was noted on E2. At 1935 colour reception from Iceland and logged on E4 and E3 with a transmission of the test card.

on the 17th, seven countries were received including Italy (RAI and NCT), the USSR (TSS), Yugoslavia (with the FuBK test card from the Zagreb studios carrying the identification 'JRT ZGRB 1'), Spain (RTVE), Norway (with the NRK PM5544 on E4 showing 'NORGE KONGSBERG'), Sweden (SR) and Iceland (with excellent quality colour and sound from RUV on E4).

At 0835 on the 19th, the PM5544 was received from the channel E2 outlet at Gwelo in Zimbabwe. Signals from ZTV have not been noted here before at such an early time and we wonder whether anyone else saw it? At the other end of the day, RTE-Eire were seen closing down on channel IH.

July 27th was an interesting day. At 1100 on R2 the TSS 'Leningrad' test card was seen using regional identification. The word 'KNEB' at the top of the test card confirmed reception from the 150kw transmitter at Kiev. At 1120, a similar test card was noted on R2 with the inscription 'UT 0167' at the top. On R3 at 1204, the old monoscopic '0249' test card (see R&EW, September 1982) was received from TSS. Finland made an appearance with the 'YLE TV 1' FuBK test card at 1317 on E3. From 2328 BST on E4, the RUV test card was logged with excellent quality colour. In fact reception continued until 2412 at which time it was decided to call it a night as RUV are notorious for radiating their test card right through the night!

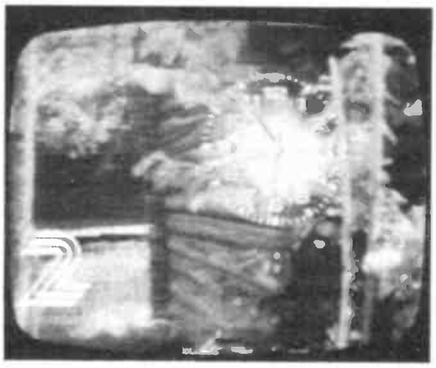


Figure 4: Swedish second network close-down clock caption received during good trop conditions on channel E42.

Reception for the remainder of July was due mainly to enhanced trop conditions thanks to a high-pressure system of 1026mbs centred over Scotland. On the 28th, extremely clear colour signals were received from Denmark on channels E5 (Aalborg transmitter with 50kw ERP) and E10 (Vestjylland, 60kw). The PM5544 test card was noted on these two Band III channels until well after midnight.

On 29th, Danmarks Radio were noted on channel E8 from Aarhus (60kw) again using the PM5544 at 2149BST. Band III signals from NRK-Norway were observed with the PM5544 and several transmitter identifications including 'NORGE, HALDEN' (channel E11) and 'NORGE LYNGDAL' (E9). A Norwegian test card was also noted with the inscription 'NORGE TELEVERKET' on E11 at 2156 which was radiated for only a few seconds. Sveriges Radio (SR-Sweden) were logged on the UHF channel E42 (Boraas, 1000kw) with the closedown clock caption at 2143. The 1st Network clock caption was seen on E9 at 2254. The Netherlands (NOS on E6 and E32), Belgium ('BRT TV 1' PM5544 on E10) and West Germany (ZDF, channel E30) were also visitors via tropospheric ducting on the 29th.

Trop conditions continued on the 30th but to a much lesser extent. There was also some Sp.E activity with TSS on R1 and R2, RTVE on E3 plus the Swedish test card which occasionally carries only the inscription 'TV 1' at the top.

July 31st looked like being a reception-free day until severe lightning storms stirred up Sp.E activity. The Italian private station NCT was received using their identification caption at 1953 on IA/E3. Captions in the Cyrillic alphabet were seen on E3 from JRT-Yugoslavia at about the same time. A news programme on R2 at 2006 from TSS rounded off the month.

Figure 5: West German (ARD) late-night News programme received in colour on UHF.

RECEPTION REPORTS

From Aguilas in southern Spain, Robert Panknen has written with details about Spanish Television. Apprently RTVE are currently installing a large number of UHF transmitters which gives rise to speculation that phasing out of the VHF channels may commence in due course. In the Canary Islands, RTVE now broadcasts a second network programme from Mount Izana and in the Spanish enclaves of Ceuta and Mellila in Africa, RTVE now have transmitters in operation.

In Lahti, Finland, Petri Popponen has been experiencing generally poor reception via Sp.E with signals originating mainly from Switzerland (SRG), Italy (RAI), the USSR (TSS) and some BBC transmitters. Petri recently noted some good quality signals from Eire (RTE). He tells us that copies of R&EW are difficult to obtain in Finland. We'll be sending him details about the subscription service as soon as possible.

Finally, from the Netherlands Gosta van der Linden has written with details about television networks in neighbouring countries. TDF (France) occasionally radiates a PM5544 test card with the identification 'CENEX-BCH'. It is used on some third network (FR- 3) outlets especially during strikes! In West Germany the American Forces television station 'AFN' is planning on using a low-power transmitter at Soesterberg using System M (525 lines scanning) with NTSC colour. Earlier this year the West German service SFB were noted using a transmitter on channel E25 with a vision-only link carrying programmes from the Polish network, TVP-1 converted from SECAM into PAL colour. The test card was of the FuBK type with the identification 'FuuStBLn' which was an abbreviation used for 'Funk Uebertragung Stelle Berlin'. It's amazing what you can learn by reading R&EW!

■ R & EW

Your Reactions..........	Circle No.
Immediately Interesting	1
Possible application	2
Not interested in this topic	3
Bad feature/space waster	4

Compound op- amps can be designed to give very high slew rates, high output currents, or output voltage swings of up to hundreds of volts. Ray Marston explains.

Data File No. 12

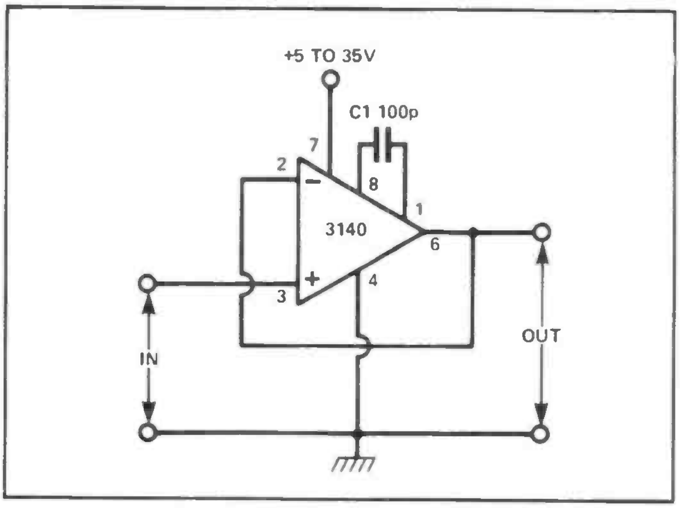


Figure 1: Standard op-amp voltage follower circuit can supply only a few mA of output current.

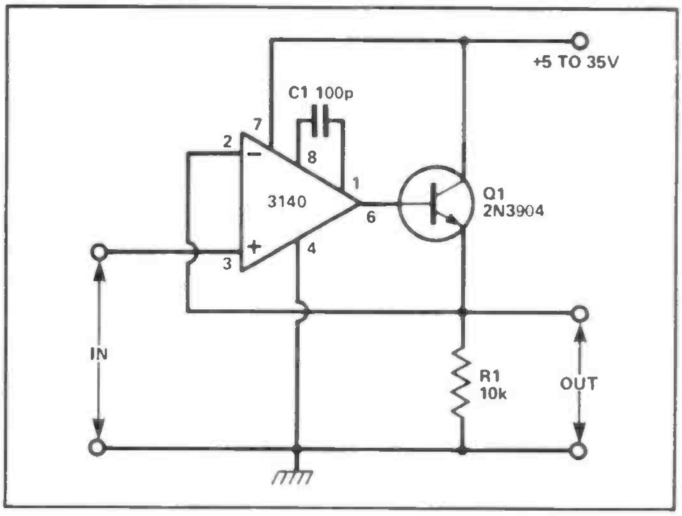


Figure 2:'Compound' op-amp with boosted output current. This circuit can typically supply output currents of up to 50 mA.

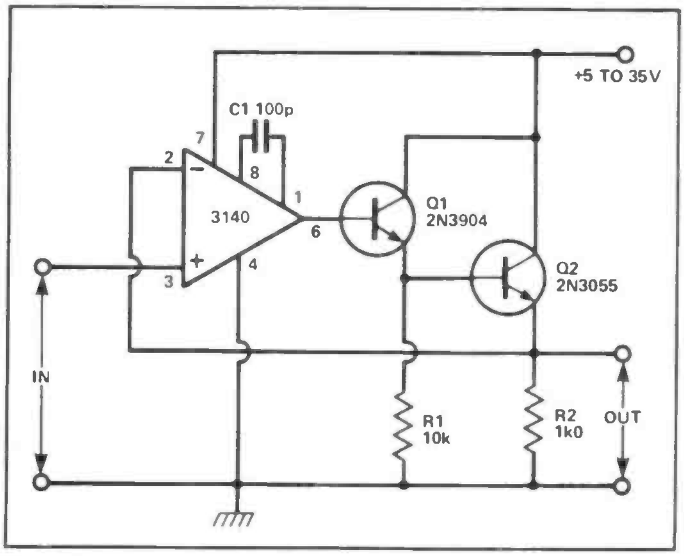


Figure 3: This version of the 'follower' can supply output currents of up to 1 Amp.

THE PERFORMANCE of a standard IC op-amp can be greatly enhanced or modified by connecting one or more bipolar transistors into its output feedback loop, to make a 'compound' or hybrid op-amp. Compound op-amps are inexpensive and quite easy to design. They are specifically intended to give output characteristics that are not economically available from conventional op-amps. Typical examples are as follows:-

The output current of an inexpensive op-amp such as the 3140 is limited to only a few mA, but can easily be boosted to several amps by compounding it with a couple of common-collector transistors. Again, the output voltage of the standard 3140 op- amp swings to within only a few volts of the supply rail voltage, is limited to a maximum swing of about 32V, and has a slew rate limit of about 9V/uS. When the output of the 3140 is compounded with a single common-emitter transistor, however, the output of the resulting compound op-amp can easily swing to within a few tens of mV of the supply rails, can have a swing of up to several hundred volts, and can have a slew rate of 100 V/uS.

Compound op-amp design has rarely been mentioned in the technical press, but is a subject of enormous practical value. The subject is fairly large, with hundreds of op-amp/transistor combinations being possible, so for the sake of simplicity we'll confine this month's 'Data File' specifically to compound designs intended for use in single-ended supply applications and based on the 3140 op-amp (which has input and output terminals that can swing all the way down to zero supply-rail volts); the principles that we'll explain can, however, be fairly easily adapted for use with other types of op-amp and with alternative supply arrangements. Many of the techniques that we'll mention have never before been published in this country.

HIGH-CURRENT COMPOUND OP-AMPS

The best known application of the compound op-amp is as a 'boosted current' voltage follower. *Figure 1* shows the 3140 wired as a standard DC voltage follower in a single-ended supply circuit. The output is wired directly to the inverting terminal of the op-amp, and the circuit acts as a unity- gain non-inverting amplifier in which the output 'follows' the input signal to within a few mV of the zero-voltage rail and to within a couple of volts of the positive supply rail. C1 (wired between pins 1 and 8) reduces the slew rate of the circuit and enhances circuit stability.

A major defect of the *Fig. 1* circuit is that its output current is limited to a few mA by the internal circuitry of the op-amp. This snag can be overcome by compounding the op- amp with a common-collector transistor, as shown in *Fig. 2*. Note that the Q1 base-emitter junction is wired into the negative feedback loop of the op-amp, and that zero phase inversion occurs betwen Q1 base and emitter. Consequently, the output of the circuit (taken from Q1 emitter) continues to follow the input signal, but the output current is limited only by Q1 and its power-handling capability.

In practice, the safe output current of the *Fig. 2* circuit is limited to about 50 mA by the power rating of Q1. The available current can be boosted to an amp or so by replacing Q1 with a Darlington pair of transistors, as shown in *Fig. 3*, Q2 being a high power device. The base-emitter junctions of the transistors are again wired into the feedback loop of the circuit.

The *Fig. 2* and *3* circuits give unidirectional current boosting, i.e., they can source high currents but can sink only relatively low ▶

ones. They are thus not suitable for use with low-impedance AC-coupled loads. This snag can be overcome by using a complementary emitter follower as the 'componding' device, as shown in the basic circuit of *Fig 4*. D1-D2 provide offset biasing to the two output transistors, which can supply output currents of up to 50 mA each.

COMPOUND VOLTAGE FOLLOWER CIRCUITS

The current-boosting 'compound' techniques shown in *Figs 2* to *4* are well known and are probably familiar to most of our readers. They simply rely on the fitting of an additional non-inverting stage to the existing op-amps, and are very easy to understand. In the remainder of this article, however, we'll be introducing new compounding techniques that rely on the fitting of additional INVERTING stages to op-amps, and which are slightly less easy to understand. Let's start off by seeing how these techniques can be applied to voltage follower circuits.

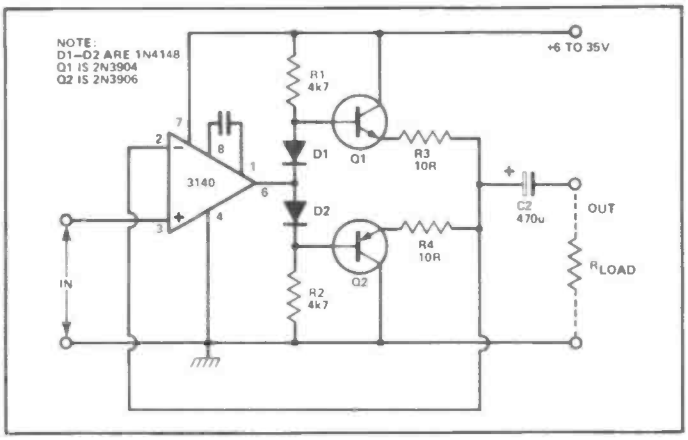


Figure 4: 'Compound' op-amp with boosted bidirectional output current.

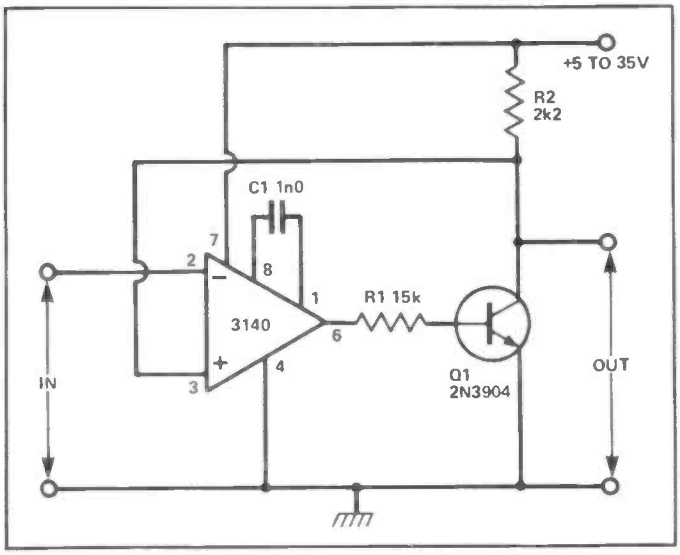


Figure 5: Basic compound 'follower' circuit.

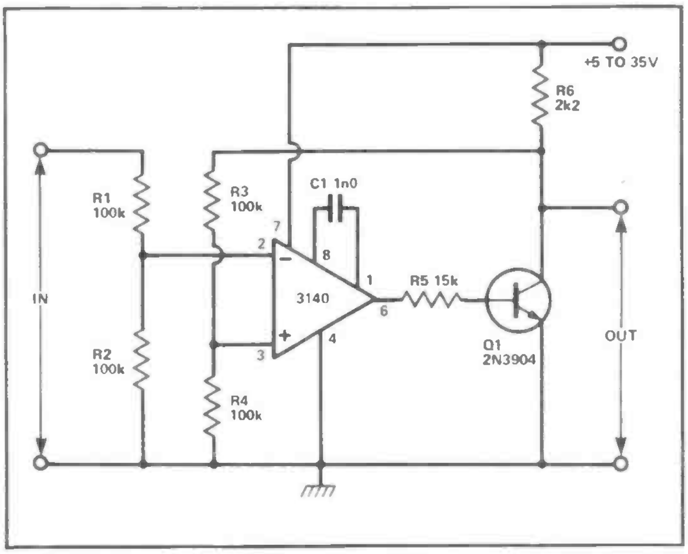


Figure 6: This compound circuit 'follows' input signals to within 50 mV of either supply rail.

Figure 5 shows the circuit of a compound voltage follower or unity-gain non-inverting amplifier, in which common emitter transistor Q1 is wired to the op-amp output and has its collector wired into the negative feedback loop of the circuit. The design should be compared with the 'standard' circuit of *Fig. 1*. Note in *Fig 5* that, since an additional inverting stage (Q1) has been added to the op-amp, the input terminal notations of the 3140 must be mentally transposed to understand circuit operation.

Thus, the input signal is applied to the 3140 terminal marked 'inverting' (pin 2), which now acts as the non-inverting terminal of the compound op-amp, and the feedback connection from the compound output (Q1 collector) goes to the 3140 terminal marked as 'non-inverting' (pin 3), which now acts as the inverting terminal of the compound op-amp. The *Fig. 5* circuit is thus, **in theory**, identical to that of *Fig. 1*, and gives a virtually identical performance.

When the input of the *Fig. 5* circuit is at zero volts, the 3140 drives Q1 on and pulls its collector to saturation (typically within 50 mV of zero volts). When the input is above zero but more than a couple of volts below the supply rail voltage, the 3140 forces Q1 collector to take up a value identical with the input signal. The basic 3140 can not 'follow' signals that are within less than a couple of volts of the supply rail value, so the 'follower' characteristics of the *Fig. 5* circuit are virtually identical to those of *Fig. 1*, except that it can't quite follow signals down to zero volts. Note, however, that the signals appearing on Q1 collector are amplifed and phase-inverted versions of those appearing at the output of the 3140, so the slew rate of the compound follower is typically ten times faster (100 V/uS) than that of the *Fig. 1* circuit. If care is not taken in the layout, this high slew rate can cause instability; this problem can be overcome by increasing C1 to 1n0, as shown.

So far, the *Fig. 5* circuit does not seem very useful. This situation can be drastically changed, however, by modifying the circuit as shown in *Fig. 6*. Here, the compound op- amp still acts as a non-inverting amplifier, but is given a gain of x2 via R3-R4, and the input signal is attenuated by a factor of two via R1-R2, so the circuit still acts (overall) as a unity- gain voltage follower. Note in this case, however, that the input to the 3140 is at only half supply volts when the input and output of the circuit are at full supply volts, so this version of the circuit can follow input signals to within 50 mV of either supply rail and has a high slew rate. The circuit is thus greatly superior to the basic *Fig. 1* design.

An even more dramatic improvement of circuit performance is available from *Fig. 7*. Here, the 3140 is powered from a 30V supply and Q1 is powered from a 50V supply, so this compound follower can accurately follow input signals with peak values of up to 50V.

Figure 8 shows how the above circuit can be further modified to make a 0-50V 1-Amp regulated DC supply. In this case the output of Q1 is buffered via Darlington emitter follower Q2- Q3, which can supply output currents of an amp or so, and the feedback loop to the 3140 is taken from Q3 emitter, rather than from Q1 collector. Q1-Q2-Q3 are powered from an unregulated 60V supply, and the 3140 is powered from a zener-regulated 33V rail. The compound op-amp is configured as a x2 non-inverting amplifier, with its input derived from the slider of RV1, and the potential of RV1 slider is fully variable over the range 0 to 25V. The regulated output of the circuit is thus fully variable over the range 0 to 50V via RV1, and output currents of up to an amp or so are available.

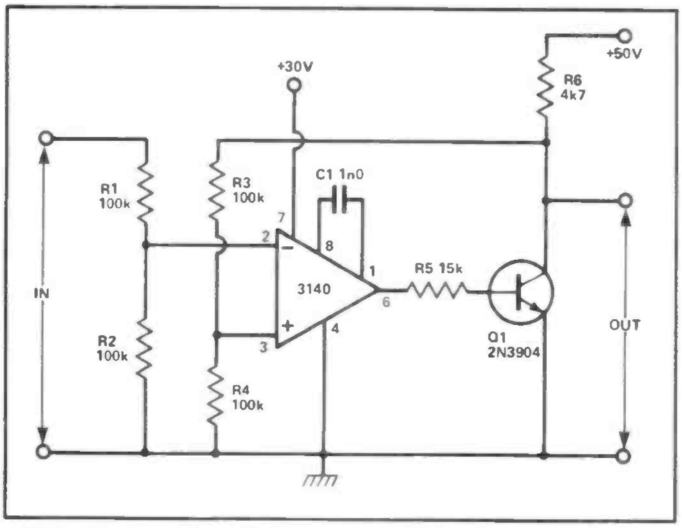


Figure 7: This version of the circuit can follow input signals of up to +50V peak.

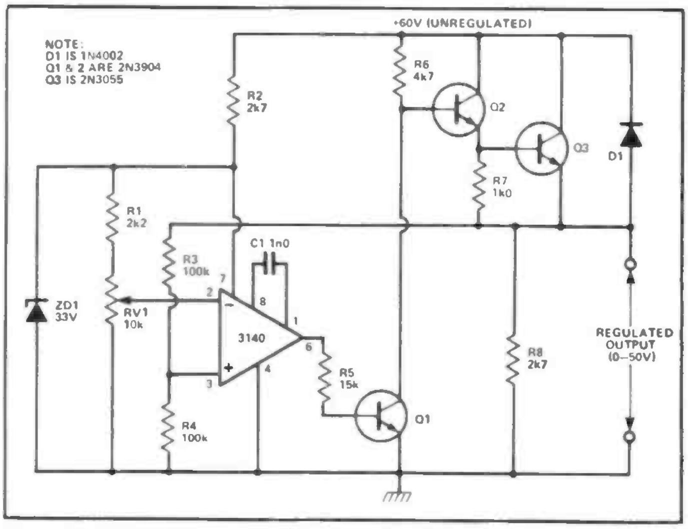


Figure 8: 0-50V 1-Amp regulated DC supply.

Finally, *Fig. 9* shows how the output stage of the above circuit can be modified to incorporate 1 Amp overload protection (limiting). R9 monitors the circuit's output current, and when this exceeds 1 Amp the resulting R9 volt-drop biases Q4 on and causes it to rob base-drive current from Q2-Q3, thereby limiting the available output current. Note that the feedback connection to R3 is taken from the R8-R9 junction.

COMPOUND INVERTING AMPLIFIERS

Figure 10 shows the circuit of a standard x100 op-amp inverting AC amplifier, operated from a single-ended supply. The output of the op-amp is biased at half-supply volts (for maximum undistorted signal swing) via potential divider R3- R4, and the signal gain is set at x100 by the ratios of R1 and R2. The input impedance of the circuit is equal to R1 (10k); the input signal must have a source impedance that is low relative to R1. The output signals of the op-amp can swing to within a few tens of mV of the zero voltage rail and to within two or three volts of the positive rail.

Figure 11 shows how to make a compound version of the above amplifier by simply adding the Q1 inverting stage and transposing the two input connections of the op-amp, as already described for the case of the compound voltage follower. The gain of the *Fig. 11* circuit is again set by the ratios of R1 and R2, and the output (Q1 collector) is set at half-supply volts via R3-R4.

The *Fig. 11* circuit operates in an identical theoretical manner to *Fig. 10*, except that its output voltageswing is limited by Q1,

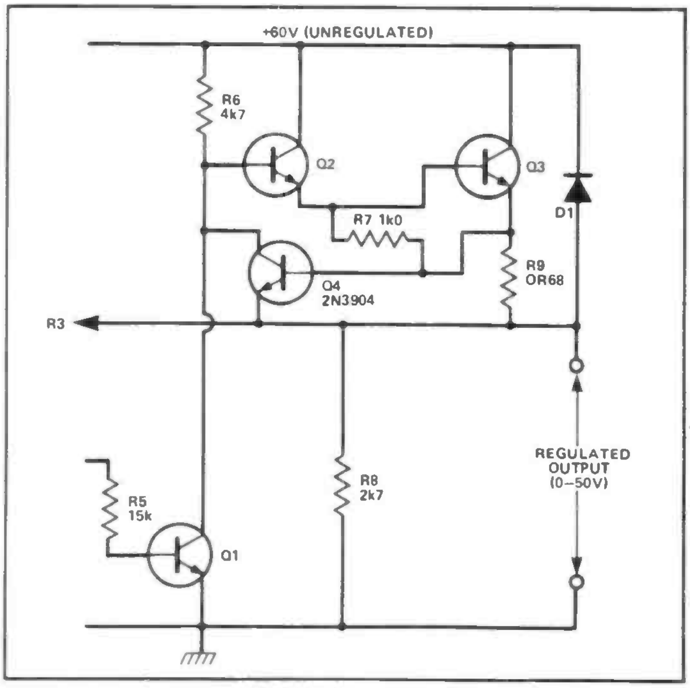


Figure 9: Modified output stage, giving 1-Amp current- limiting to the Fig 8 current.

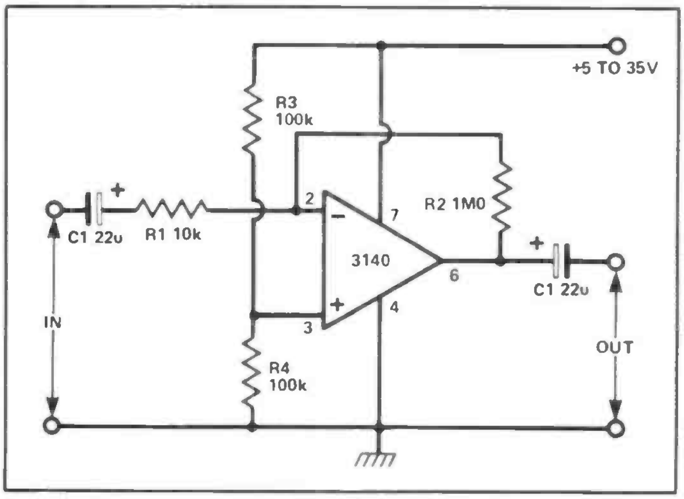


Figure 10: Standard x100 inverting amplifier op-amp circuit, operated from a single-ended supply.

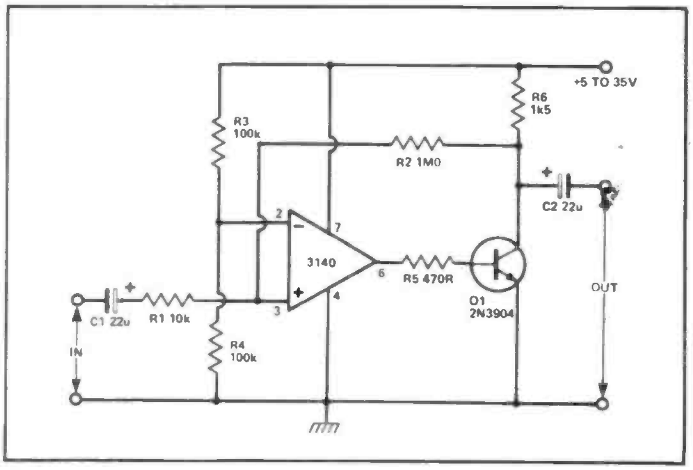


Figure 11: x100 inverting compound amplifier circuit has a full-power bandwidth of several hundred kHz. Output can swing to within 50mV of either supply rail.

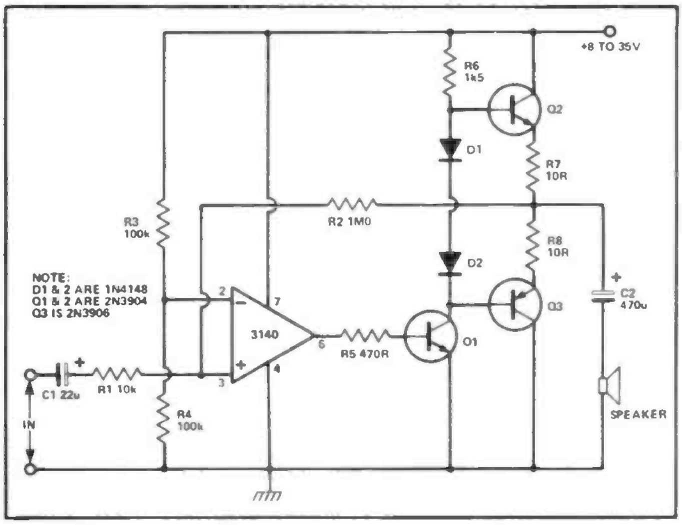


Figure 12: Basic compound 'Hi-Fi' circuit, with x100 voltage gain.

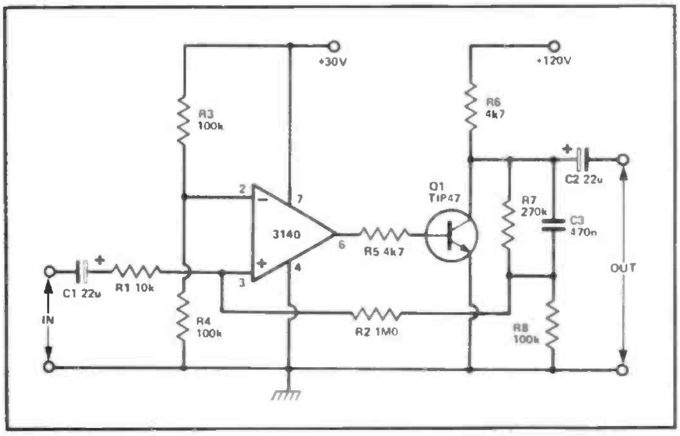


Figure 13: This compound x100 inverting amplifier gives an output of 120 volts pk-to-pk.

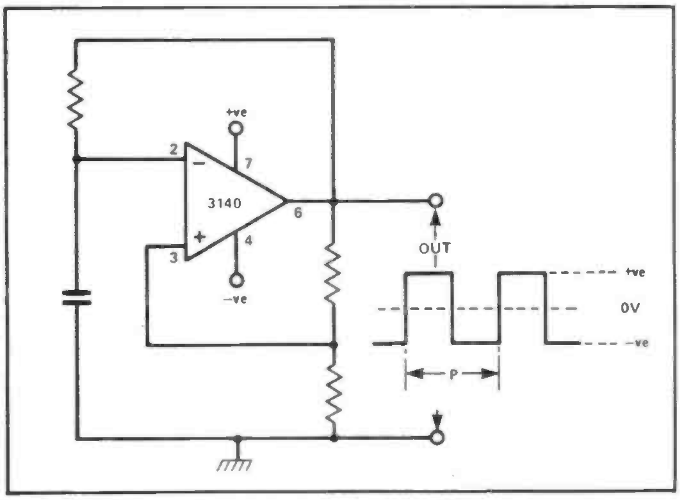


Figure 14: Standard op-amp relaxation oscillator or square-wave generator, using a split supply.

rather than by the 3140 op-amp. In practice, the output of this circuit can swing to within 50 mV of either supply rail before clipping starts to occur; clipping is 'hard' when R5 has the value shown, but can be softened by increasing R5 to 12k. Also, the slew rate and full-power bandwidth of this circuit is some ten times higher than in the case of *Fig. 10*, so this compound circuit is very superior to the basic 3140 circuit. Because of its high slew rate, the circuit tends to become unstable if the input signal

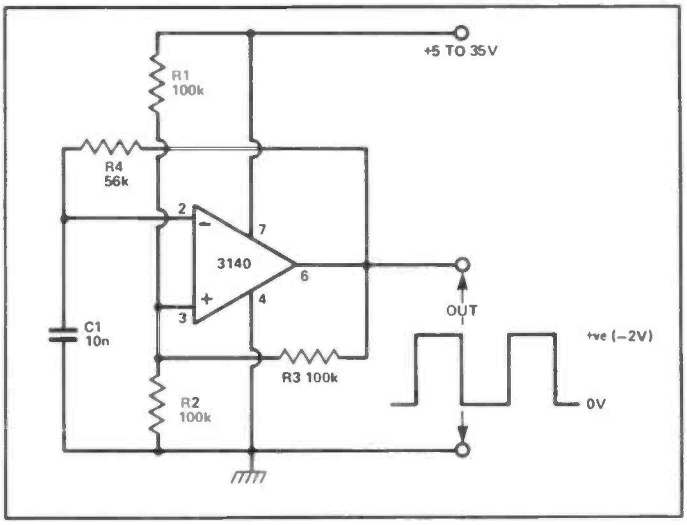


Figure 15: Op-amp relaxation oscillator modified for operation with a single-ended supply. With the values shown and a 15 volt supply, period is 6mS, rise time 12uS, and fall time 7uS.

is disconnected or has a source impedance greater than about 2k2.

The available output current (and power) of the *Fig. 11* circuit is limited to a few tens of mA by R6, but can easily be increased to any desired value by adding a power- amplifier stage to Q1 and incorporating it in the amplifier's feedback loop, as shown in the basic circuit of *Fig. 12*. In practice, this simple D1-D2-Q2-Q3-R7-R8 amplifier can easily be replaced by any standard 'Hi-Fi' type of output stage, making the circuit suitable for use in audio power amplifier systems.

The maximum available output voltage swing of the *Fig. 11* and *12* circuits are restricted to 35V by the supply voltage limitations of the 3140 op-amp. *Figure 13* shows how the available output voltage swing can be increased to 120V (or any other desired value) by powering the 3140 from a 30V supply but powering Q1 from a 120 volt rail.

Some thought must be given to the biasing of the *Fig. 13* circuit, since the 3140 must be biased (for maximum signal swing) to half of its 30V supply, while Q1 must be biased to half of its 120V supply. In the diagram, this is achieved by biasing pin 2 of the 3140 to 15V via R3-R4 and by interposing a 4:1 (approx) R7-R8 DC divider between the output of Q1 and the input to feedback resistor R2, so that 15V appears on pin 3 of the 3140 when Q1 collector is at a quiescent 'half-supply' value of 60V. Note that R7 is decoupled by C3, so that the R7-R8 DC divider has no significant influence on the ac voltage gain (determined by R1-R2) of the circuit.

COMPOUND RELAXATION OSCILLATORS

Figure 14 shows the basic circuit of the standard dual-supply op-amp relaxation oscillator or square-wave generator, and *Fig. 15* shows how the circuit can be adapted for use with single-ended supplies. The *Fig. 15* circuit operates as follows.

The output of the circuit is a rectangular waveform which, at any given moment of time, is either at zero volts or at a positive value that is typically three volts below the supply rail value. Suppose that the output has just switched to a high value. In this case R3 is effectively switched in parallel with R1, so approximately 2/3rds of the supply voltage is applied to pin 3, and C1 charges towards the supply rail voltage via R4 and the op-amp output until, eventually, C1 voltage reaches the pin 3 value, and the op-amp output starts to switch low. At this point a regenerative switching action is initiated, and the op-amp output switches abruptly to zero volts. Under this condition R3 is effectively switched in parallel with R2, so only 1/3rd of the supply voltage is applied to pin 3, and C1 starts to discharge towards zero via R4 and the op-amp output until, eventually, C1 voltage reaches the new pin 3 value and another regenerative switching action is initiated in which the

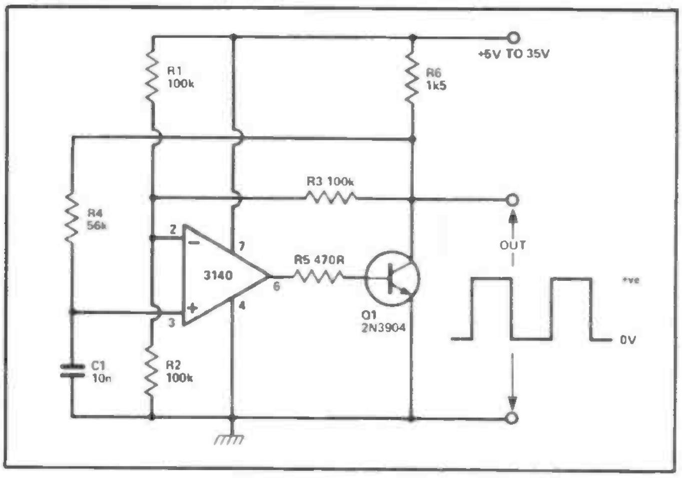


Figure 16: Compound version of the relaxation oscillator. With a 15 volt supply, period is 6mS, rise time 1uS, and fall time 0.7uS.

output switches abruptly high again. The process then repeats ad infinitum.

The *Fig. 15* circuit generates a rectangular waveform with a period determined by the values of R3, R4 and C1 and almost independent of the supply voltage value. With the component values shown, the circuit has a period of about 6 mS, but this can be increased (or reduced) by increasing (or reducing) the values of C1 and/or R4. R4 can have any value from 10k to 10M, and C1 can have any value from 33p to 1000u.

The *Fig. 15* circuit is quite useful, but suffers from a number of defects. First, since the output does not switch to the full supply rail voltage when in the 'high' state, the output waveform is not quite symmetrical, and the period and symmetry varies slightly when the supply voltage is varied. Secondly, the rise and fall times of the output waveform are restricted by the characteristics of the op-amp; when used with a 15V supply, the output of the *Fig. 15* circuit takes 12 uS to rise to 12V, and 7 uS to fall to zero volts again when feeding a 50p load.

Figure 16 shows a compound version of the *Fig. 15* circuit, which is free of all the defects mentioned above. The output waveform is perfectly symmetrical, switches fully between the supply rail voltage and zero, has a period that is independent of the supply rail value, and has rise and fall times of 1 uS and 0.7 uS respectively. The circuit is similar to that already described, except for the addition of Q1-R5-R6 and the transposing of the 3140 input connections.

Figure 17 shows how the above circuit can be modified to that it generates a fixed-frequency rectangular waveform in which the mark-space ratio is fully variable from 25:1 to 1:25 via RV1. The circuit operates in a manner similar to that already described, except that on 'high' parts of the cycle C1 charges via R4-D2 and the R/H half of RV1, and on the 'low' parts discharges via R4-D1 and the L/H half of RV1.

2-WIRE INFORMATION SYSTEMS

To conclude this edition of 'Data File', we'll first introduce a concept known as the '2-wire' information system, and then show how it can be implemented by using compound op-amp comparators. To understand the basic '2-wire' concept, compare the circuits of *Figs. 18* and *19*.

Figure 18 shows the circuit of a conventional op-amp voltage comparator, in which a fixed reference voltage is applied to pin 2 of the op-amp and a variable input voltage is applied to pin 3.

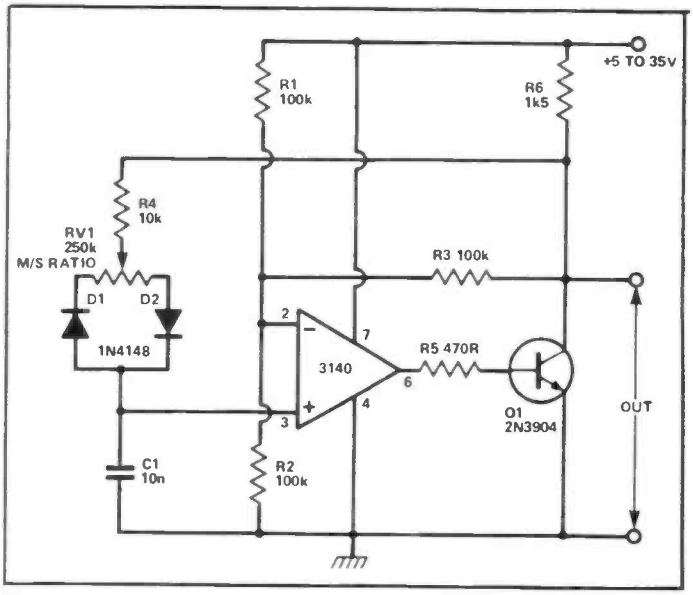


Figure 17: The Mark/Space ratio of this fixed-frequency compound oscillator is variable from 25:1 to 1:25 via RV1.

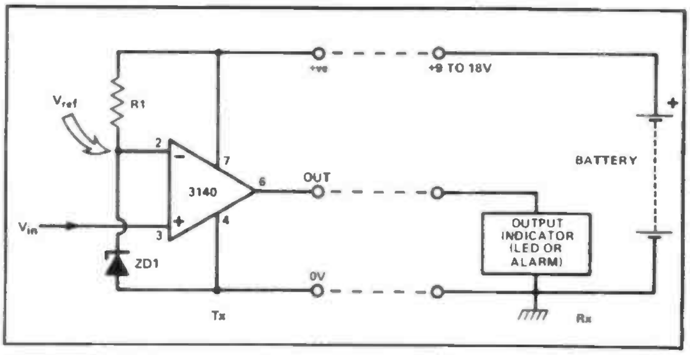


Figure 18: A conventional op-amp comparator acts as a '3-wire' information system.

The op-amp output is normally low but switches high when V_{in} rises above V_{ref}. Thus, the op-amp output is either high or low and carries information about the relative state of the input voltage; this information is translated into a useful form by an output indicator (LED or acoustic alarm, etc) wired between the op-amp output and ground, and the op-amp circuitry is powered via the positive and common lines, so this is a '3-wire' information system.

In many applications, the power supply and output-state indicator (the 'receiver') of a comparator circuit of the *Fig. 18* type

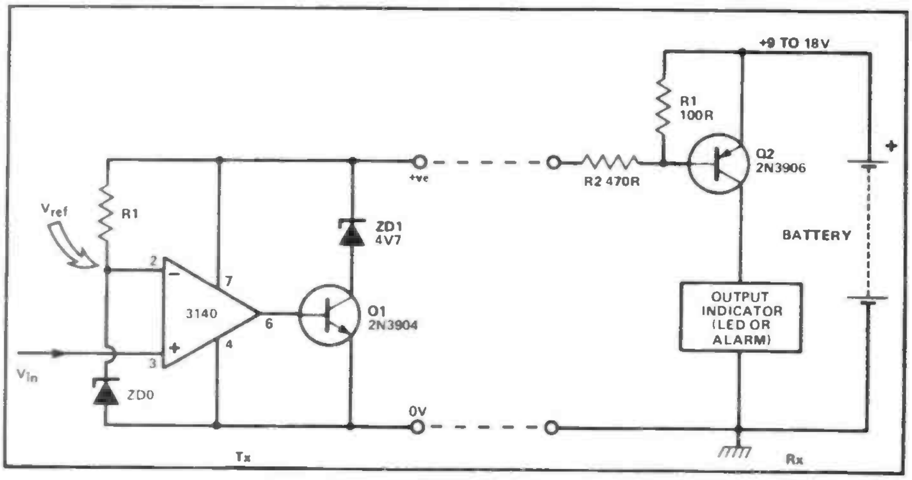


Figure 19: This compound comparator acts as a '2-wire' information system.

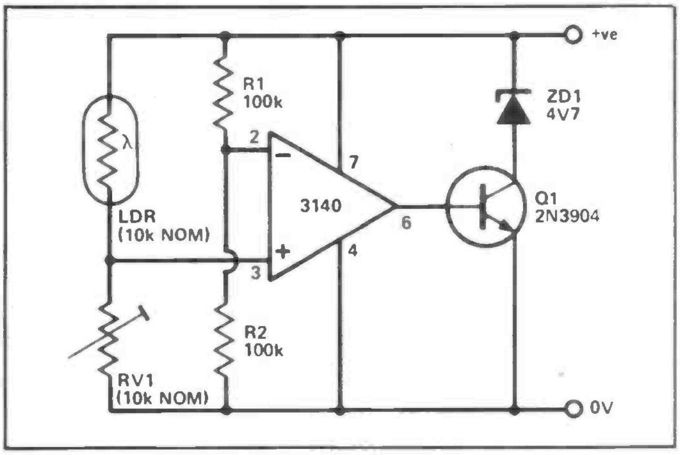


Figure 20: Light-operated 12-wire Tx.

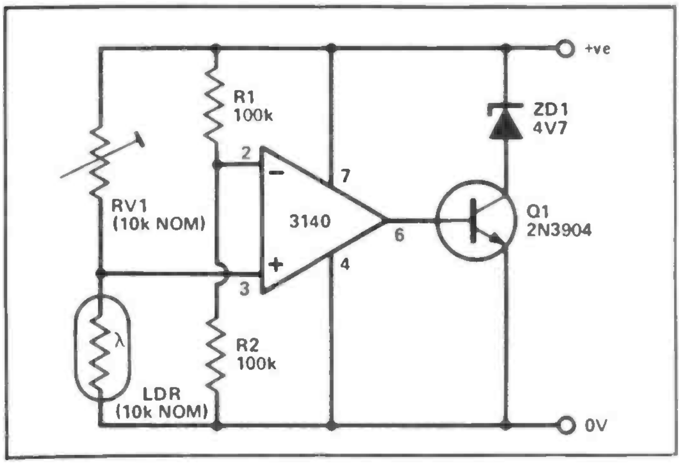


Figure 21: Dark-operated 2-wire Tx.

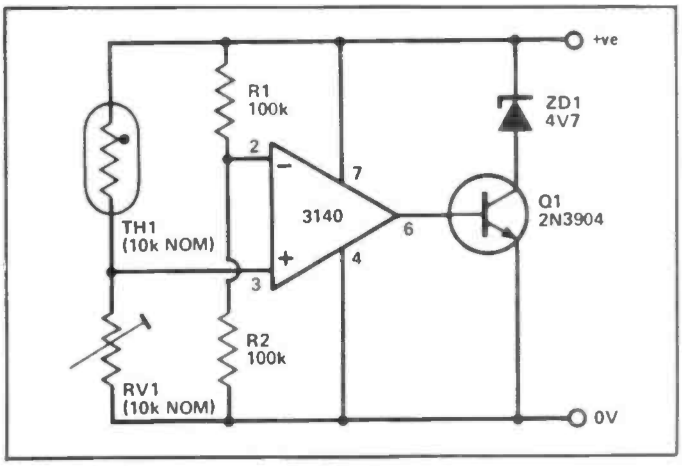


Figure 22: Over-temperature 2-wire Tx.

may be located at a 'base' point or station, and the op-amp and its associated circuitry (the 'transmitter') may be located at a remote point. If the Tx and Rx are spaced a significant distance apart, the cost of the 3-wire interconnecting cable may greatly exceed the total cost of the electronic circuitry.

Figure 19 shows how a compound op-amp voltage comparator can be used to implement a '2-wire' information system, and thus give a significant saving in cabling costs. In this case the positive supply to the op-amp is applied via R1-R2, the base-emitter junction of Q2 is wired across R1, and the output indicator is activated from Q2 collector. The circuit operates as follows.

When V_{in} is below V_{ref}, the output of the 3140 is zero, so Q1 is off. Under this condition the op-amp circuit consumes only 2 or 3 mA, and the R1 volt drop is not sufficient to drive Q2 on.

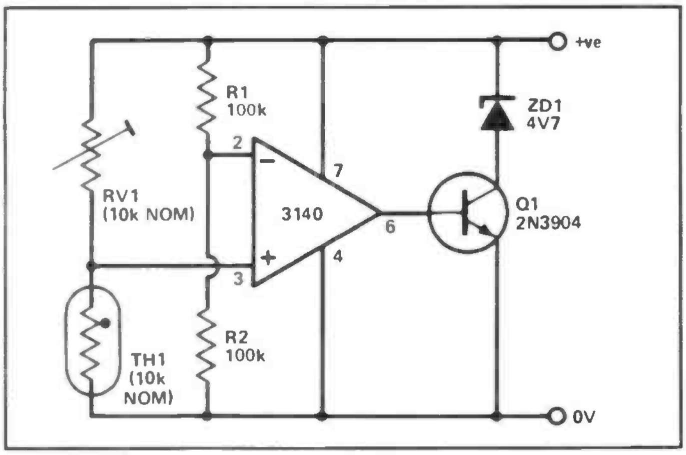


Figure 23: Under-temperature 2-wire Tx.

When V_{in} is above V_{ref}, however, the output of the 3140 switches high and turns Q1 on, causing the circuit to take a high current via R1-R2 and ZD1. Under this condition the 3140 supply is pulled to 4V7 via ZD1, and the supply current rises to between 8 and 25 mA (depending on the Q2 supply voltage value), and the resulting volt drop of R1 biases Q2 on and activates the output indicator.

Thus, the positive Tx supply rail of this '2-wire' system also carries the circuit's 'state' information, which is 'decoded' by the receiver. Note that, for correct circuit operation, the minimum (4V7) supply voltage of this compound op-amp circuit must be at least 2V greater than V_{ref}.

In most practical applications of the *Fig. 19* 2-wire information system, the inputs to the voltage comparator are obtained from a Wheatstone bridge network in which one of the elements is a resistive transducer sensitive to light or heat, etc. *Figures 20* to *24* show five variations of this type of transmitter. In all of these circuits, a half-supply reference voltage is applied to one input pin of the op-amp via R1-R2, and a variable voltage is applied to the other. Since these voltages are bridge-derived, the balance or trigger points of the circuits are independent of the op-amp supply rail values and are determined only by the resistance ratios of the input bridge.

Figures 20 and *21* show light-sensitive transmitter circuits in which a cadmium-sulphide photocell or light-sensitive resistor (LDR) is used as the sensing element. The LDR and RV1 should have nominal values of at least 10k. In *Fig. 20*, the LDR is wired 'above' RV1; consequently, the pin-3 voltage rises as the light intensity increases and the LDR resistance falls, so this circuit acts as a 'light-operated' transmitter. In *Fig. 21*, the LDR is wired below RV1, so the pin-3 voltage rises as the light intensity falls and the LDR resistance increases, and this circuit acts as a 'dark-operated' Tx.

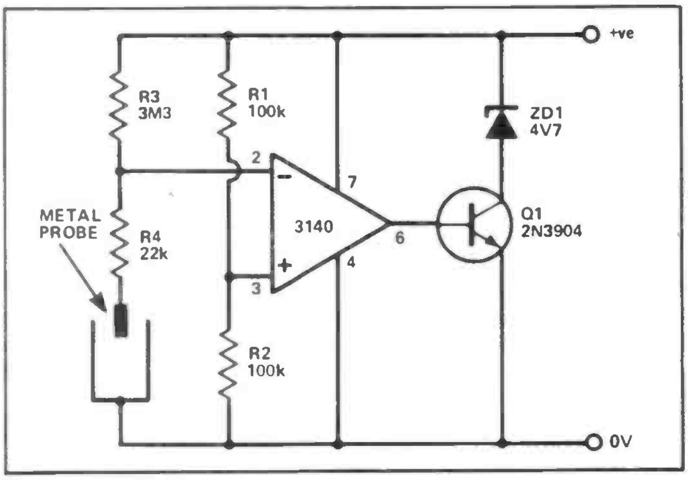


Figure 24: Liquid-level 2-wire Tx.

Figures 22 and *23* show how the above circuits can be modified for use as temperature-sensitive transmitters by using a negative-temperature-coefficient (NTC) thermistor (nominal value 10k) in place of the LDR. The output of the *Fig. 22* circuit switches high (draws a heavy current) when the TH1 temperature exceeds a value pre-set via RV1, and that of *Fig. 23* switches high when the temperature falls below a value pre-set via RV1.

Figure 24 shows the circuit of a 2-wire transmitter that gives a high output when the level of a liquid exceeds a pre-set level. In this case the 3140 pin connections are transposed relative to the earlier circuits. The 'ground' connection is taken to the liquid that is being monitored, and the tip of the metal probe is placed at the required 'alarm' level in the liquid container. When the liquid is below the probe tip, pin 2 of the op-amp is pulled above pin 3, and the op-amp output is low. When the liquid reaches the probe, its resistance pulls pin 2 below pin 3, and the op-amp output switches high. The circuit action can be reversed, so that the output goes high when the liquid falls below a pre-set level, by simply transposing the pin 2 and 3 connections. With the R3 value shown, the liquid resistance must be below 3M3 for correct operation.

Finally, *Fig. 25* shows the circuit of a 2-wire receiver that incorporates an audio-visual output indicator and which can be used with any of the *Fig. 19* to *24* circuits. When a high output is detected from the transmitter, Q1 turns on and its collector is pulled high, simultaneously driving LED 1 on via R3 and activating gated double-astable IC1, which produces a pulsed-tone signal in acoustic transducer Tx, which is a low-cost high-efficiency PB- 2720 type.

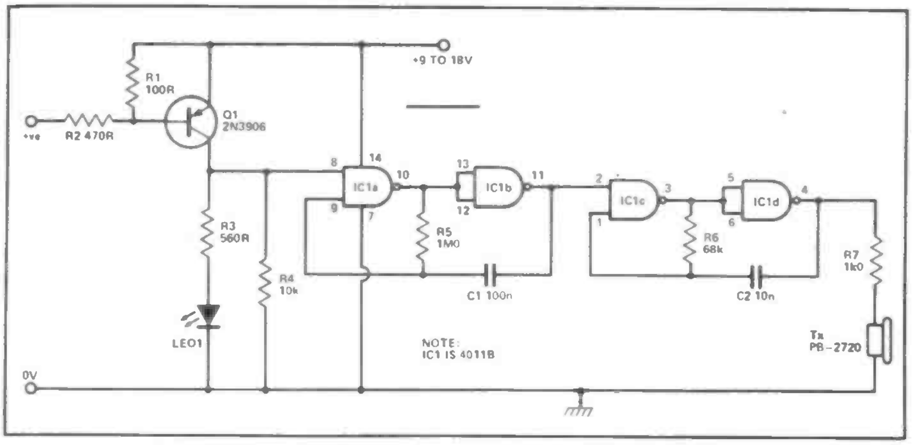


Figure 25: 2-wire receiver unit with audio-visual output indication.

■ R & EW

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Possible Application	148	Bad Feature/Space Waster	150

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Regular readers of **R&EW** will have known of our intention to exhibit at the 5th PCW show and indeed during the preparation of this issue we duly dispatched the **R&EW** road show to the ex-car park now finding a new lease of life as an exhibition hall.

A report on the show in general appears elsewhere in this issue - here we'll take time to grumble about some of the things which made life on the stand about as enjoyable as being beaten around the face with a wet lettuce.

First the heat, while the temperatures in early September were not as low as they had been throughout the rest of the Great British summer, they were not exactly high either. Inside the exhibition halls however, the combination of hundreds of people, low ceilings and inadequate ventilation meant that even the most potent of extra extra dry anti-perspirants was fighting a losing battle. Dehydration was a worry - this leads nicely to the next grumble - the catering facilities.

SKY HIGH

In this area both exhibitors and public suffered the same fate - soggy rolls, minute cups of coffee and long waits for service. The prices charged were as one has come to expect at events of this nature-OTT.

A roll, of uncertain pedigree and rather menacing nature was priced at 60p, coffee - the cups capacity being low in the ml stake - was 30p. At a pub not a million miles from the Barbican, far more attractive food was available at less than half the price - they did not serve coffee though.

For exhibitors thus, there was an alternative: but for the public, the hall's no readmission policy meant paying the bounty if any refreshment was to be partaken of.

We did not question the organisers to determine the reason for these extortinate price levels but suspect it was out of their hands, the catering facilities being provided by a firm that has purchased the right to do so at all exhibitions from the Barbican hall Management, and paid a high price for the privelege. It is the same story at places like the Cunard Hotel and the NEC so it is perhaps unfair to single out the Barbican, but it is hightime that organisers began to insist on an adequate level of catering at respectable price levels as a pre-requesite to them hiring a particular hall's facilties.

ORGANISED CHAOS

There were a few grumblings about the way in which stands had been allocated - in particular about the lack of separate areas for business and consumer exhibitors.

The micro market is becoming more diverse, with the gap between complete business systems ZX81 add ons being vast to say the least. The larger manufacturers, for example Commodore, are represented at either extreme of this spectrum (no pun intended) and some had taken the trouble, and expense, to book two stands to cater for their widely differing products.

Fine if one was sited in the hobby hall and the other in the business hall but not so good if there was no such division. While sticky fingers are an acceptable part of a VIC-20 stand they are not so welcome around a £5,000 accounting package.

One exhibitor related the tale of how he was one of the first to book for this year's show - doing so as last year's finished. Last year's venue was the Cunard hotel and there the division between business and consumer was effected by having Consumer on the upper exhibition hall and business on the lower. Our intrepid exhibitor was assured it would be the same at the Barbican and duly booked one up and one down. On arrival at the Barbican however it became apparent that the theory was to have consumer in hall A (up and down) and business in hall B. Too late to change stand allocation of course - exit an unhappy exhibitor. Many other people were probably caught in the same way and this must in a large part have been responsible for the disorganisation.

Things will have to improve next year if some exhibitiors are to return.

Oh lastly, in spite of giving one of our lab technicians a large ball of string we still have not seen him since he headed off into the depths of the Barbican. He answers to the name Boy and was last seen wearing an R&EW tie. If you see him contact your nearest police station or phone Scotland yard on 230 1212.

THE LAST WORD.

Advertisers' Index

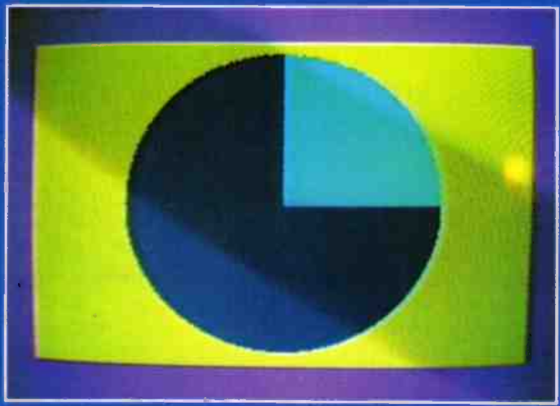
" GOT ANY MATCHES ? "

WHAT'S WRONG WITH THE SPECTRUM?

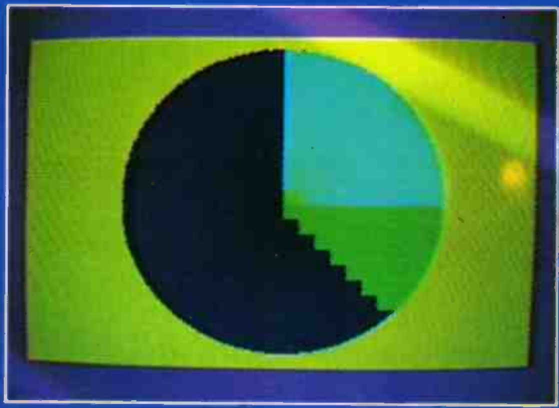
We conclude that the machine is indeed a bargain for the hobbyist but that its limitations may rule it out for some applications.

The photographs below accompany the review on page 52 and have been reproduced here in order that they may be shown in colour.

An example of the good effect to which the Spectrum's colour capability can be put.



A pie graph with one 90° slice. The centre of the pie was carefully chosen to fall in the bottom left pixel of each character cell.



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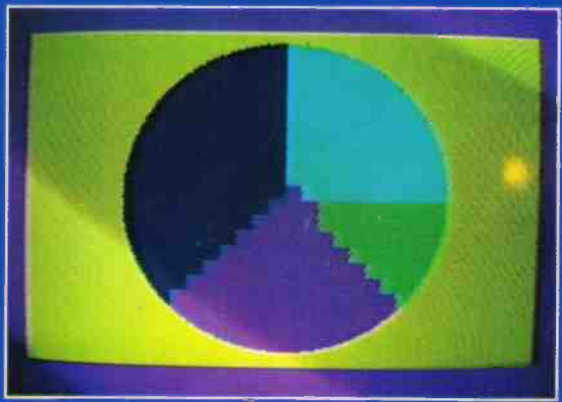

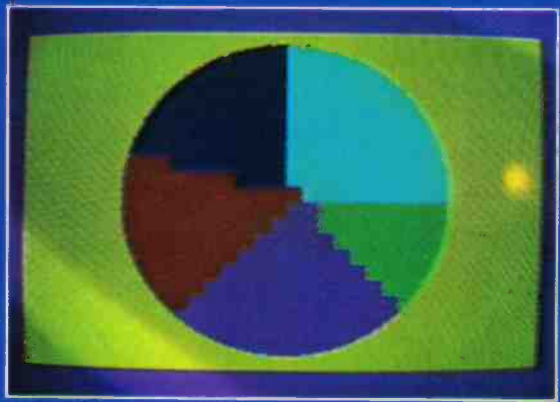

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Read our in depth analysis starting on page 52 of this issue.

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