AUGUST 82

ISSN 0262–2572

AUSTRALIA	$1 85c
CANADA	$2 95c
EIRE	£1·04p
NEW ZEALAND	$2 20c

RADIO & ELECTRONICS WORLD

75p

18W Power Amplifier
ZX81 Expansion Board
ICOM's IC25

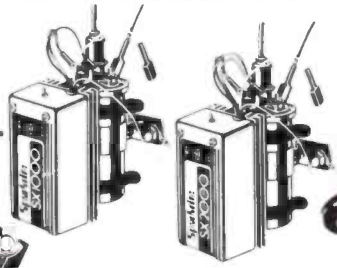
Meteosat
VHF Up-Converter
Wide Band RF Transformers

Step-by-step fully illustrated assembly and fitting instructions are included together with circuit descriptions. Highest quality components are used throughout.

Sparkrite

BRANDLEADING ELECTRONICS

NOW AVAILABLE IN KIT FORM

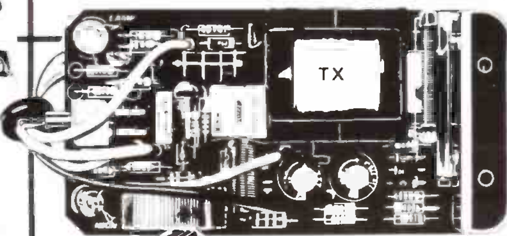


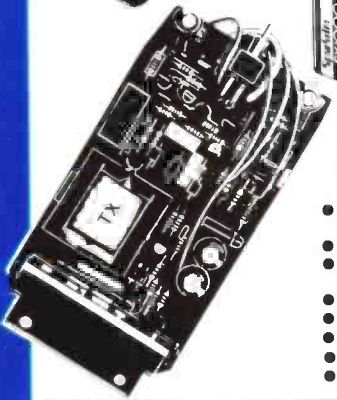
SX1000
Electronic Ignition

- Inductive Discharge
- Extended coil energy storage circuit
- Contact breaker driven
- Three position changeover switch
- Over 65 components to assemble
- Patented clip-to-coil fitting
- Fits all 12v neg. earth vehicles

MAGIDICE
Electronic Dice

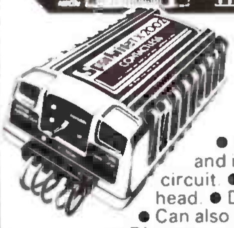
- Not an auto item but great fun for the family
- Total random selection
- Triggered by waving of hand over dice
- Bleeps and flashes during a 4 second tumble sequence
- Throw displayed for 10 seconds
- Auto display of last throw 1 second in 5
- Muting and Off switch on base
- Hours of continuous use from PP7 battery
- Over 100 components to assemble





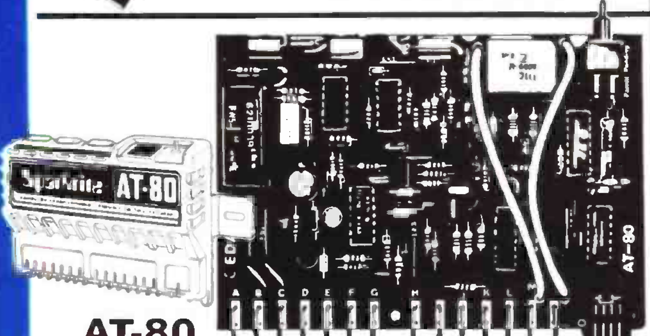
SX2000
Electronic Ignition

- The brandleading system on the market today
- Unique Reactive Discharge
- Combined Inductive and Capacitive Discharge
- Contact breaker driven
- Three position changeover switch
- Over 130 components to assemble
- Patented clip-to-coil fitting
- Fits all 12v neg. earth vehicles



TX2002
Electronic Ignition

- The ultimate system
- Switchable contactless.
- Three position switch with Auxiliary back-up inductive circuit.
- Reactive Discharge. Combined capacitive and inductive.
- Extended coil energy storage circuit.
- Magnetic contactless distributor trigger-head.
- Distributor triggerhead adaptors included.
- Can also be triggered by existing contact breakers.
- Die cast waterproof case with clip-to-coil fitting
- Fits majority of 4 and 6 cylinder 12v neg. earth vehicles.
- Over 150 components to assemble



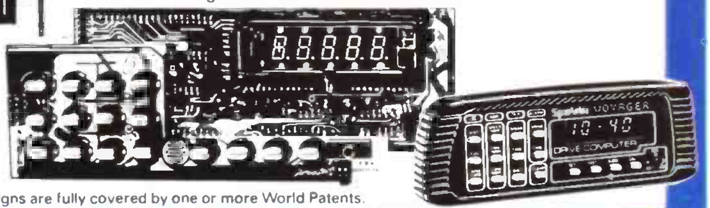
AT-80
Electronic Car Security System

- Arms doors, boot, bonnet and has security loop to protect fog/spot lamps, radio/tape, CB equipment
- Programmable personal code entry system
- Armed and disarmed from outside vehicle using a special magnetic key fob against a windscreen sensor pad adhered to the inside of the screen
- Fits all 12V neg earth vehicles
- Over 250 components to assemble

VOYAGER Car Drive Computer

- A most sophisticated accessory.
- Utilises a single chip mask programmed microprocessor incorporating a unique programme designed by EDA Sparkrite Ltd.
- Affords 12 functions centred on Fuel, Speed, Distance and Time.
- Visual and Audible alarms warning of Excess Speed, Frost/Ice, Lights-left-on.
- Facility to operate LOG and TRIP functions independently or synchronously.
- Large 10mm high 400ft-L fluorescent display with auto intensity.
- Unique speed and fuel transducers giving a programmed accuracy of + or — 1%.
- Large LOG & TRIP memories. 2,000 miles. 180 gallons. 100 hours.
- Full Imperial and Metric calibrations.
- Over 300 components to assemble.

A real challenge for the electronics enthusiast!



All EDA-SPARKRITE products and designs are fully covered by one or more World Patents.

EDA SPARKRITE LIMITED 82 Bath Street, Walsall, West Midlands, WS1 3DE England. Tel: (0922) 614791

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SX 2000	£19.95	£39.90
TX 2002	£29.95	£59.90
AT. 80	£29.95	£59.90
VOYAGER	£59.95	£119.90
MAGIDICE	£ 9.95	£19.90

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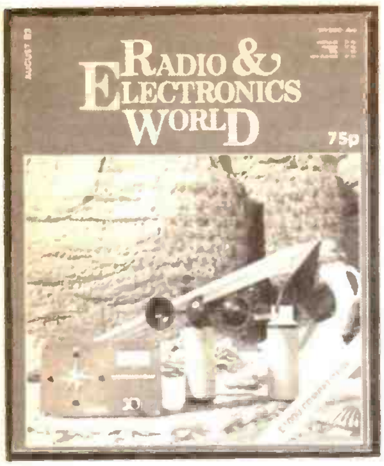

R&EW

AUGUST 1982

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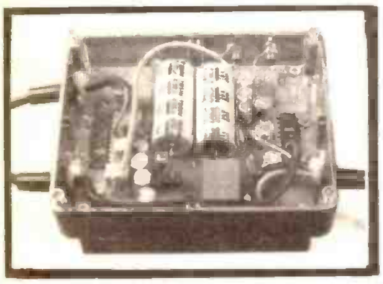

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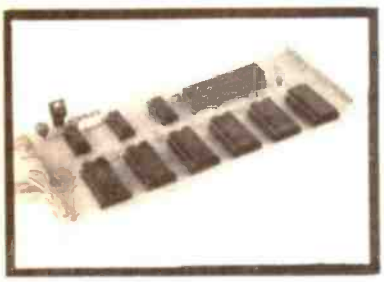

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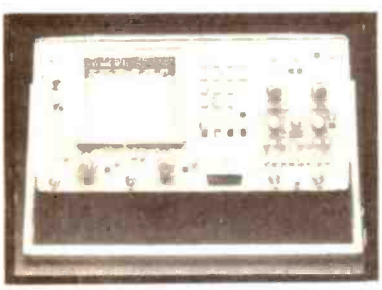

Information

See Page 62 for details of our £1,000 competition.

Cover Photo: Tim Sheldon Box no. 303 Brentwood

Props: Boating Scene, Laindon, Essex

ICOM

TRIED, TESTED AND TRUSTED

See revue in February Rad.Comm.

IC-720A
Possibly the best choice in HF. £883.inc.

The main problem that the amateur of today has to deal with is deciding just which rig out of the many excellent products available he is going to choose. Technology is advancing at such a rapid rate and getting so sophisticated that many cannot hope to keep up. Some go too far!

Perhaps one way of dealing with the problem is to look at just what each model offers in its basic form without having to lay out even more hard earned cash on "extras". The IC-720A scores very highly when looked at in this light. How many of its competitors have two VFOs as standard or a memory which can be recalled, even when on a different band to the one in use, and result in instant retuning AND BANDCHANGING of the transceiver? How many include a really excellent general coverage receiver covering all the way from 100kHz to 30MHz (with provision to transmit there also if you have the correct licence)? How many need no tuning or loading whatsoever and take great care of your PA, should you have a rotten antenna, by cutting the power back to the safe level? How many have an automatic RIT which cancels itself when the main tuning dial is moved? How many will run full power out for long periods without getting hot enough to boil an egg? How many have band data output to automatically change bands on a solid state linear AND an automatic antenna tuner unit when you are able to add these to your station?

Well you will have to do quite a bit of hunting through the pages of this magazine to find anything to approach the IC-720A. It may be just a little more expensive than some of the others – but when you remember just how good it is, and of course the excellent reputation for keeping their secondhand value you will see why your choice will have to be an IC-720A!

IC-PS15 Mains PSU £99

IC-2E £159.inc.
IC-4E £199.inc.
The World's most popular portables

Nearly everybody has an IC2E – the most popular amateur transceiver in the world – now there is the 70 cm version which is every bit as good and takes the same accessories. Check the features.

Fully synthesized – Covering 144 – 145.995 in 400 5KHz steps. (430-439.999 4E)
Power output – 1.5W with the 9v. rechargeable battery pack as supplied – but lower or higher output available with the optional 6v or 12v packs. Rapid slide-on changing facility.
BNC antenna output socket – 50 ohms for connecting to another antenna or use the Rubber Duck supplied (flexible ¼ λ whip – 4E)
Send/battery indicator – Lights during transmit but when battery power falls below 6v it does not light, indicating the need for a recharge.
Frequency selection – by thumbwheel switches, indicating the frequency. 5KHz switch – adds 5KHz to the indicated frequency.
Duplex simplex Switch – gives simplex or plus 600KHz or minus 600KHz transmit (1·6MHz and listen input on 4E)
Hi-Low switch – reduces power output from 1.5W to 150mW reducing battery drain.
External microphone jack – if you do not wish to use the built-in electret condenser mic an optional microphone speaker with PTT control can be used. Useful for pocket operation.
External speaker jack – for speaker or earphone. This little beauty is supplied ready to go complete with nicad battery pack, charger, rubber duck.

A full range of accessories in stock.

		£ p			
ICML1	10W mobile booster for IC2E	49 00	BC25	Mains charger as supplied	4.25
BP5	11 volt battery pack	30 00	DC1	12 volt adapter pack	8.40
BP4	Empty battery case for 6 x AA cells	5.80	HM9	Speaker microphone	12.00
BP3	Standard battery pack	17 70	CP1	Mobile charging lead	3.20
BP2	6 volt pack	22 00	IC1 2 3	cases	each 3.60
BC30	Base charger for above	39 00		All prices include VAT	

The IC4E is going to revolutionise 70 CM!

ICOM

Free carriage on direct sales – call us.

Remember we also stock Yaesu, Jaybeam, Datong, Welz, G-Whip, Western, TAL, Bearcat, RSGB Publications.

Please note: Access/Barclaycard owners – goods must be sent to address registered with credit card company.

ASK ABOUT THE NEW RANGE OF CUE DEE ANTENNAS....the winners in recent tests!

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FOR QUALITY CRYSTALS — AT COMPETITIVE PRICES. POPULAR FREQUENCIES IN STOCK

2 METRE STOCK CRYSTALS. Price £1.96 for one crystal. £1.74/crystal when two or more purchased.

	HC6/U 30pF TX	HC6/U 30pF TX	HC25/U 30pF and 40pF TX	HC25/U 20pF and 30pF RX	HC25/U 25pF and 20pF TX	HC6 & 25/U SR RX
R0	4.0277	8.0555	12.0833	14.9888	18.1250	44.9666
R1	4.0284	8.0569	12.0854	14.9916	18.1281	44.9750
R2	4.0291	8.0583	12.0875	14.9944	18.1312	44.9833
R3	4.0298	8.0597	12.0895	14.9972	18.1343	44.9916
R4	4.0305	8.0611	12.0916	15.0000	18.1375	45.0000
R5	4.0312	8.0625	12.0937	15.0027	18.1406	44.0083
R6	4.0319	8.0638	12.0958	15.0065	18.1437	45.0166
R7	4.0326	8.0652	12.0979	15.0083	18.1468	45.0250
S8	—	—	12.1000	14.9444	18.1500	44.8333*
S9	—	—	12.1020	14.9472	18.1531	44.8416*
S10	—	—	12.1041	14.9500	18.1562	44.8500*
S11	—	—	12.1062	14.9527	18.1593	44.8583*
S12	—	—	12.1083	14.9555	18.1625	44.8666*
S13	—	—	12.1104	14.9583	18.1656	44.8750*
S14	—	—	12.1125	14.9611	18.1687	44.8833*
S15	—	—	12.1145	14.9638	18.1718	44.8916*
S16	—	—	12.1167	14.9667	18.1750	44.9000*
S17	—	—	12.1187	14.9694	18.1781	44.9083*
S18	—	—	12.1208	14.9722	18.1812	44.9166*
S19	—	—	12.1229	14.9750	18.1843	44.9250*
S20	4.0416	8.0833	12.1250	14.9777	18.1875	44.9333
S21	4.0423	8.0847	12.1270	14.9805	18.1906	44.9416
S22	4.0430	8.0861	12.1291	14.9833	18.1937	44.9500
S23	4.0437	8.0875	12.1312	14.9861	18.1968	44.9583

SR = Series Resonance *HC25 only

Also in stock: R0 to R7 and S8 to S23 for following: Belcom FS1007, FDK TM56, Multi 11 Quartz 16 and Multi 7, Icom IC2F, 21, 22A and 215, Trio Kenwood 2200, 7200. Uniden 2030 and Yaesu FT2FB, FT2 Auto, FT224, FT223 and FT202

Also 4MHz. TX in HC6/U for 145.8MHz. Icom crystals TX for 145.6MHz (RRO). 44MHz RX crystals in HC6 for 145.8 and 145 (RRO). All at above price.

4 METRE CRYSTALS for 70.26MHz in HC6/U at £2.25. TX 8.78250MHz. RX 6.7466 or 29.78MHz in stock.

70cm CRYSTALS in stock 8.0222 and 12.0333 in HC6 £1.86. Pye Pocketfone PF1, PF2, PF70 and Wood and Douglas £4.50 a pair or TX £2.25, RX £2.50, SU8 (433.2) RB0, RB2, RB4, RB6, RB10, RB11, RB13, RB14 and RB15.

CONVERTER CRYSTALS IN HC18/U at £2.86. In stock 38.666, 42.000, 70.000, 96.000, 101.000, 101.500, 105.666 and 116.000MHz. 26.000HC6 £2.00

TONE BURST AND I.F. CRYSTALS in HC18/U at £2.25 in stock. 7.168MHz for 1750kHz and 10.245MHz for 10.7MHz IF's.

FREQUENCY STANDARDS in stock £2.75, HC6 200kHz, 455kHz, 1000kHz, 5.000MHz and 10.000MHz. HC13 100kHz, HC18 1000kHz, 7.000MHz, 10.700MHz, 48.000MHz and 100.00MHz. 4.0000 HC18 £2.00

MADE TO ORDER CRYSTALS SINGLE UNIT PRICING

	Price Group	Adjustment Tolerance ppm	Frequency Ranges	Price and Delivery A	Price and Delivery B
Fundamentals	1	200 (total)	10 to 19.999kHz	—	£23.00
	2	200 (total)	20 to 29.999kHz	—	£16.50
	3	200 (total)	30 to 159.999kHz	—	£10.50
	4	200 (total)	160 to 999.999kHz	—	£6.00
	5	50	1.00 to 1.499MHz	£10.50	£6.00
	6	10	1.50 to 1.999MHz	£4.75	£4.40
	7	10	2.00 to 2.599MHz	£4.75	£4.40
	8	10	2.60 to 3.999MHz	£4.55	£4.10
	9	10	4.00 to 20.999MHz	£4.55	£4.00
	10	10	21.00 to 24.000MHz	£6.00	£5.40
3rd OVT	11	10	21.00 to 59.999MHz	£4.55	£4.00
5th OVT	12	10	60.00 to 99.999MHz	£5.00	£4.50
	13	10	100.00 to 124.999MHz	£6.15	£5.50
5th, 7th &	14	20	125.00 to 149.999MHz	—	£6.00
9th OVT	15	20	150.00 to 225.000MHz	—	£7.50

Unless otherwise requested fundamentals will be supplied with 30pF load capacity and overtones for series resonance operation.

HOLDERS — Please specify when ordering — 10 to 200kHz HC13/U, 170kHz to 170MHz HC6 or HC33/U, 4 to 225MHz, HC18 and HC25.
Where holders are not specified crystals above 4MHz will be supplied in HC25/U.

DELIVERY Column A 3 to 4 weeks. Column B 6 to 8 weeks.

DISCOUNTS. 5% mixed frequency discount for 5 or more crystals at B delivery. Price on application for 10 or more crystals to same frequency specification. Special rates for bulk purchase schemes including FREE supply of crystals used in UK repeaters.
The above prices apply to small quantities of crystals for amateur use. We would be pleased to quote for larger quantities or crystals for professional use.

EMERGENCY SERVICE SURCHARGES (to be added to A delivery prices). 4 working days £12. 6 working days £7. 8 working days £5. 13 working days £3. Surcharges apply to each crystal not each order and are subject to VAT.

CRYSTAL SOCKETS HC6/U and HC25/U 20p. MINIMUM ORDER CHARGE £1.50.

TERMS. Cash with order, cheques and postal orders payable to QSL Ltd. All prices include postage to UK and Irish addresses. Please note Southern Irish cheques and postal orders are no longer acceptable. Please send bank draft in pounds Sterling.

PRICES ARE EX VAT. PLEASE ADD 15%

QuartSLab

MARKETING LTD. P.O. BOX 19, ERITH, KENT, DA8 1LH
Telephone: 01-690 4889 (9-5) 24 hr. Ansafone: Erith (03224) 30830
Telex: 8813271 GECOMS G (Attention QUARTSLAB).

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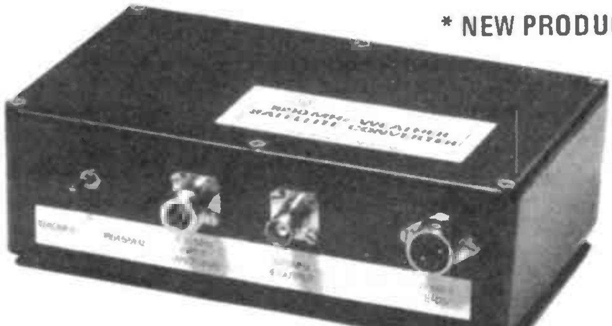
MICROWAVE MODULES LTD

*** NEW PRODUCT ***

1690MHz WEATHER SATELLITE CONVERTER
MMK1691/137.5



PRICE £115.00 inc. VAT (P&P £2.00)

The **MMK 1691/137.5** Converter is intended for the reception of the METEOSAT Weather Satellite, and other weather satellites operating in the 1690 — 1710MHz frequency band. The METEOSAT satellite forms part of a global network of five geostationary satellites distributed around the earth's equator, all of which operate on similar frequencies in the 1690MHz band.

The converter is fed by an antenna such as a parabolic dish or other high gain antenna designed for 1690MHz, and the output of the converter at 137.5MHz is available for driving an existing receiver on the VHF weather satellite band of 136 — 138MHz.

Specification

Input Frequencies:	1691MHz & 1694.5MHz
Output Frequencies:	137.5MHz
Typical Gain:	25dB
Noise Figure:	4.8dB maximum
Oscillator Frequencies:	86.3055MHz & 86.5000MHz
Input Socket:	50 Ohm 'N' Type
Output Socket:	50 Ohm BNC
DC Power Requirements:	11 — 13.8V at 100mA
Power Connector:	5 pin DIN
Size:	187 x 120 x 53mm
Weight:	700gms (1.5lbs)

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9 - 12.30; 1 - 5.00

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Comment

This issue sees the instigation of several new processes in production - specifically the instant 'on-line' editing of the content via our multiuser computer and digital photosetting installation. (See the News Background page for more details). It's part of our move towards the 'all electronic' magazine, in conjunction with the REWTEL system, and whilst we know there are some of our readers who don't appreciate computing as much as some of the other topics we cover, we hope that we are continuing to demonstrate a practical implementation of the art, rather than gratuitous 'fiddling about'.

Now we appear to be well locked into a 'our facilities are bigger than your facilities' war with competitive magazines, we await the reactions of these beleaugered institutions with bated breath.

DON'T FORGET TO WRITE

The initiation of REWTEL's broadly based news service means that we need to remind all of you to ensure that your company press/ public relations department send in copies of all press information to **R&EW** for incorporation in the system. Also, authors wishing to submit manuscripts will soon be able to do so on standard 8" single side, single density floppy disks under 'Wordstar'. It's all happening here. We await the day when PR and news information also arrives on floppy - although we will be far more impressed if the sender uses the REWTEL input facility when its ready.

BLACK BOX REQUISITIONS

We have just heard a tale of the MoD requisitioning all the HF transceivers that one importer could lay his hands on, no doubt for that fracas in the South Atlantic. What an interesting comment on the strategic ability of this country to produce such equipment, when the nation's armed forces are obliged to get hold of Japanese amateur transceivers. And what a wonderful accolade for the manufacturers of the equipment.

We aren't a moment too late in updating our readers on the techniques and modern technology available with our series on HF SSB.

READERS SURVEYED

A limited number of copies of this month's magazine contain a Reader Survey card in place of the usual book order form/reader enquiry card. We've been going for almost a year now and, while the response frames accompanying many articles give us feedback about any one issue of R&EW, we thought it about time that we got an idea of how we fitted into the general scheme of things.

If your issue contains a survey card please fill it in carefully and return it to us as soon as possible, it will not take all that long to do and the postage is paid so it won't cost you anything.

We have to admit that a degree in Origami might come in handy when it comes to folding the completed form but a hint is to fold both ends to the middle then fold in half again and seal with some tape.

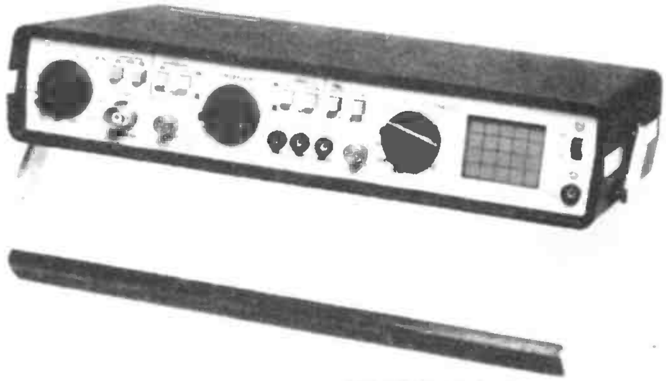
For those of you that complete the task there is a chance to win a **R&EW** chronograph (worth £14.95) these will be sent to five of those who have completed survey cards.

Zip Grip

A new type of zero-insertion-pressure grid socket designed for hand-test and burn-in applications on different-sized or multiple devices is now available from Verospeed. Known as the *Grid* Zip socket, it contains 294 countersunk points on 0.1-inch centres, each of which can be drilled to accept a component lead. Socket pins are then inserted under the appropriate points, and a simple cam mechanism is used for component retention.

The Grid Zip allows several devices to be mounted at the same time for burn-in purposes, and because only the appropriate sockets are exposed the chances of operator error are minimised. The socket can be mounted on a printed-circuit board or hard-wired into a test circuit.

Circle No. 1



New Neon

Recently introduced by BOSS Industrial Mouldings Ltd is a new all-polycarbonate miniature indicator which, by virtue of the high insulation material from which it is moulded, is ideally suited to both consumer and industrial applications.

Designed to accept any of over 35 different styles and ratings of filament or neon bulbs, this new M series indicator is fitted with 150mm long PVC stranded lead-out wires and incorporates the ballast resistor for the neon version within the lead-out assembly.

Although currently only available with a 6.86mm (.27'') dia., 5.4mm (.21'') high integral lens, two additional styles will be introduced shortly all of which can be ordered in a choice of 12 transparent or opaque colours.

Retained in a 6.4mm (.25'') dia. hole by nut and lock washer, panel thicknesses of up to 9mm (.35'') can be accommodated.

Circle No. 2

Small wonder

Thandar Electronics announce the launch of a new 2" mains battery portable oscilloscope, designated the SC110A. It has a bandwidth of 10 MHz and a sensitivity of 10 mV per divisions thus offering the performance of a standard bench model yet remaining truly portable.

Housed in the new-style Thandar case with a thickness of only 50mm and a weight of 925gms it will suit the requirement of most engineers, technicians and service personnel. The SC110A is priced at £149.00 + VAT.

Circle No. 3

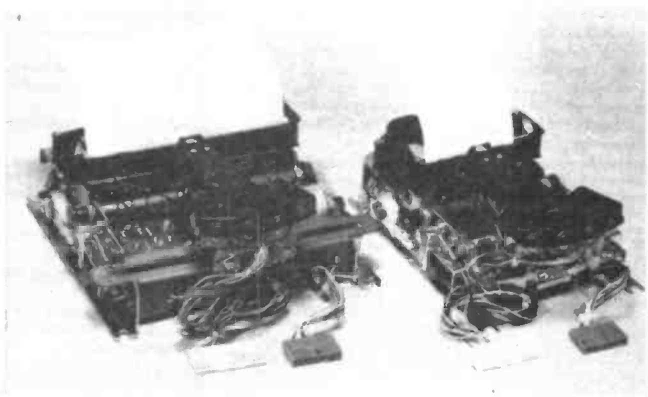
Dotting the 'I's

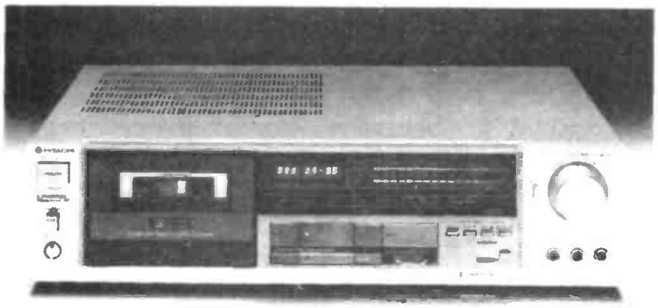
Roxburgh Printers now offer a range of impact dot matrix printer mechanisms based on their standard DP822 and DP824 21 and 40 column units. These are now available with friction or sprocket feed and with standard or a highly accurate graphics printing head. The 21 column versions require a 12 Vdc supply but the 40 column printers are available in 12 or 24 V versions.

Simplicity of design with a minimum of moving parts contribute to the DP822 and DP824 range's low cost. Alphanumeric characters or high resolution graphics are printed on standard 2" or 4" wide normal paper costing much less than thermal or electrosensitive papers. The mechanisms can also print on labels or 2 ply carbonless paper.

For details on driving the mechanisms are supplied, though a range of serial or parallel interfaces are also available. Full information is included in a comprehensive booklet

Circle No. 4





Top Flight Deck

Hitachi have launched new micro-computer controlled cassette deck, model DE 66, which has been designed to incorporate the very latest technological developments.

It has a double Dolby noise reduction system - Dolby C and Dolby B. The Dolby C system provides 20dB of noise reduction at 1kHz and achieves superior linearity in the high frequency range. Noise is suppressed to negligible levels with subjective uniformity across the audible bandwidth so it's even 'cleaner' and quieter than Dolby B type noise reduction. The greatly expanded dynamic range it offers not only permits lower and more easily established recording levels but it's to a point where the limiting noise level is no longer that of the tape but of the source programme material itself. Dolby B and C switching is by means of a button on the front panel.

The DE 66 also features a close gap R & P head which combines two separate gap widths for both recording and playback in a single housing. They are critically aligned to optimum micron tolerances and placed extremely close together for accurate head to tape contact, yet no signal loss or leakage occurs.

An elapsed time electronic digital tape counter is a feature of the DE 66 and plays a vital role in that it's used to govern a variety of auto-rewind and memory features, available on this model.

Using the auto rewind switch in the play position, the tape will automatically rewind at the end of the tape and start playback over again - up to 16 times automatically. In the stop position, the tape will rewind automatically and stop. the memory rewind feature on the DE 66 uses a microcomputer which memorizes the position of the tape when the play button is pressed and will rewind to that point, replaying if required.

Another important benefit of the DE 66 is acceptance of metal tapes which gives a greater dynamic range, better signal to noise ratio and improved frequency response. In addition normal, Cr02 and FeCr tapes can also be used.

The DE 66 enables the user to get top quality professional type results and the record mute function is just another of the many refinements of this model. Using this feature, 4 seconds of black space can be placed between selections on a tape.

Other features include timer record/play capability, 4 position tape selector, remote control and MPX filter.

The recommended retail price of the DE 66 is £229 inc. VAT.

Circle No. 5

DATONG
YET MORE INNOVATION

New

MODEL DF DISPLAY UNIT

DOPPLER DIRECTION FINDER

Model DF is a direction finding attachment for use with existing narrow band FM receivers and transceivers.

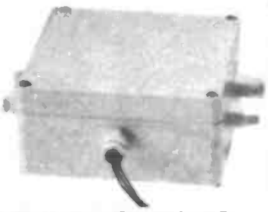
Two units, the display unit and the special antenna combiner convert your NBFM transceiver plus four omnidirectional antennas into a radio direction finder. A built-in r.f. activated antenna relay diverts the transceiver's output to the normal antenna during transmit or when the DF attachment is switched off.

Features

- Works with any existing narrow-band FM receiver or transceiver. No modifications are needed. The only connections required are to the external speaker and antenna jacks.
- Gives a clear directional readout on a circular array of sixteen bright green LEDs.
- Display holds last reading when signal drops out.
- Very easy to use and install.
- Only a single coaxial cable needed between display unit and antenna combiner.
- Professional quality at remarkably low cost. Display unit uses two PTH circuit boards. Gasket sealed combiner unit houses two conventional double-sided PCBs.

Applications

Model DF costs between ten and a hundred times less than conventional RDF systems, and therefore opens up new application areas for both professional and hobby users. Possible applications include:- VHF amateur radio, Citizen's Band radio, aircraft spotting, tracking gliders and light aircraft, locating lost model aircraft, private mobile radio systems, coastal and marine radio, tracking and locating anti-social radio operators, locating 'tagged' animals in the wild, helping to identify or trace unknown transmissions, law enforcement.



MODEL DFA2 COMBINER UNIT

A complete system needs the display unit and the antenna combiner plus four antennas mounted at the corners of a square spaced apart by 0.05 to 0.3 wavelengths.

For fixed station use, four dipoles are suitable while four magnetically mounted quarter wave whips are ideal for mobile use. Depending on the choice of antenna, the system will operate from 20 to 200 MHz.

Suitable magmount quarter wave whips are available from Datong for VHF use.

***BASIC DF SYSTEM** (Model DF display unit with Model DFA1 combiner) £125.00 - VAT (£143.80)

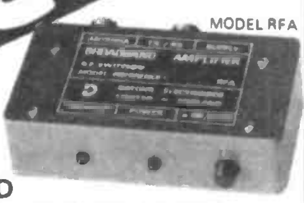
***DF SYSTEM**, as above but with mobile version of combiner Model DFA2 (as DFA1 but fitted with magmount and 4 metre coaxial downlead terminated with PL259 plug) £131.00 - VAT (£150.70)

COMPLETE MOBILE DF SYSTEM (Model DF display unit Model DFA2 combiner, and four Model MA1 quarter wavelength magmount antennas cut for 145 MHz) £173.50 - VAT (£199.50)

* Antennas not included

New

MODEL RFA



WIDE BAND PREAMPLIFIER - MODEL RFA

Eliminates seperate tuned preamplifiers for each band.

Model RFA improves the sensitivity of any receiver or transceiver working in the range from 5 to 200 MHz. It connects in series with the antenna and built-in r.f. activated relay switches the preamplifier out of circuit during transmit or when the power is off.

Features:

- Extra wide bandwidth saves the cost of separate narrow band preamps.
- Handles strong signals without overload thanks to special low-noise negative feedback technique. Intercept point better than + 20dbm.
- Low noise figure.
- Carefully chosen gain level minimises receiver overload and cross modulation.
- R.F. activated bypass relay allows easy use with transceivers.
- Rugged diecast aluminium case with SO239 connectors and PTH printed circuit board.

Applications

Application areas include:- weak signal reception of all amateur and satellite bands from 5 MHz up to 200 MHz, long distance reception of VHF FM Broadcasts and VHF TV Signals, CB transceivers, private mobile VHF radio transceivers, reception of marine and aeronautical bands, VHF scanner receivers, compensating for signal loss in long antenna feeders.

The wide bandwidth of Model RFA makes it ideal for use with broadband antennas and scanner receivers.

Broadband Preamplifier, Model RFA: £25.50 + VAT (£29.32)

New

MODEL S "CODECALL"

"CODECALL" SELECTIVE CALLING DEVICE - TAKES THE FATIGUE OUT OF LONG TERM MONITORING

"Codecall" is ideal wherever there is a need to monitor a well used radio channel for one particular call over long periods. "Codecall" gives the same convenience as a telephone bell, in that the receiver remains totally silent while monitoring. It therefore causes no disruption to other activities.

In fact the user can totally disregard the radio until a loud bleep from "Codecall" warns that the desired signal has been received. The loud intermittent bleep then continues, unless cancelled, for over ten minutes after the call is received.

"Codecall" ensures that the communications channel remains at full efficiency at all times. Without "Codecall" the desired call often blends into the general chatter and is missed by the listener, especially when the volume has been reduced to cut down the radio's nuisance level.

Features

- Each "Codecall" unit acts as a call generator and a call receiver.
- No electrical connection is needed at the transmitter, simply hold "Codecall" next to the microphone.
- At the receiver simply plug "Codecall" into the external speaker jack.
- Over four thousand different codes virtually eliminate the chance of false alarms.
- Internal 9 volt battery has long life since no current is used while monitoring a squelched channel.
- Works over any voice link, whether FM, AM, or SSB.
- Codes selected by either three 16-way switches (Model S) or by altering twelve internal wire links (Model L).
- Compact: only 4 x 2.4 x 1.05 inches.

Two Versions

Model S (as illustrated) has three 16-way rotary switches on the front panel giving a total of 4096 combinations immediately available. Model L has no switches, instead the code is set by altering twelve wire links inside the case.

Both models can be used in the same system. The switched version (Model S) is ideal where frequent code changes are required, whereas the linked version (Model L) is suitable where codes are not likely to be altered often, or for unskilled users who might accidentally set the wrong code.

Note: when used by UK Radio Amateurs all transmissions must be identified as required by the licence conditions.

"Codecall" Model L (Link programmed): £24.00 + VAT (£27.60)

"Codecall" Model S (Switch programmed): £25.50 + VAT (£29.32)

DATONG ELECTRONICS LIMITED

ALL DATONG PRODUCTS ARE DESIGNED AND BUILT IN THE U.K.

PRICES

All prices include delivery in U.K. basic prices in £ are shown with VAT inclusive prices in brackets.

FL1	59.00 (67.85)	AD370	45.00 (51.75)	RFA	25.50 (29.32)
FL2	78.00 (89.70)	AD270 + MPU	37.00 (42.55)	Codecall (Linked)	24.00 (27.60)
PC1	105.00 (120.75)	AD370 + MPU	49.00 (56.35)	Codecall (Switched)	25.50 (29.32)
ASP	69.00 (79.35)	MPU	6.00 (6.90)	Basic DF System ★	125.00 (143.80)
VLF	22.00 (25.30)	DC144/28	31.00 (35.65)	DF System ★	131.00 (150.70)
D70	43.00 (49.45)	DC144/28 Module	25.00 (28.75)	Complete Mobile DF System ★	173.50 (199.50)
D75	49.00 (56.35)	Keyboard Morse Sender	112.20 (129.00)		
RFC/M	23.00 (26.45)				
AD270	33.00 (37.95)				

★ See text for details.

Data sheets on any products available free on request – write to Dept R.C.

DATONG ELECTRONICS LIMITED

Spence Mills, Mill Lane, Bramley, Leeds LS13 3HE, England. Tel: (0532) 552461

237 for further details

NEW PRODUCTS

Quality CB

Martello sound's multi-purpose mobile, hand portable, or base station rig can be powered either by 9 x AA size dry or rechargeable batteries, which fit in the integral battery compartment, or from a standard 12V vehicle battery or power supply.

A non-polarised chassis makes for trouble-free installation in both positive and negative earth vehicles, and the 40 channel PLL synthesised FM transceiver fully complies with MPT 130. Controls consist of on/off volume, squelch, LED channel selector, battery check, battery saver, and anti cross modulation control. An 'S' meter and high S.W.R. indicator are also provided. the rear chassis contains, power plug, external speaker jack, aerial selector and socket and a high and low power switch.

Standard equipment includes lightweight dynamic microphone, locking mobile mounting bracket, flexible aerial, stainless steel mobile aerial complete with lead and plug, DC power lead and a carrying strap.

Circle No. 6

★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★

TTL PAL

House of Instruments announce the availability of the RGB- 11 from Sadelta, aimed at the growing market for both Commercial and Hobby VDU's including Video Games and CCTV. The RGB-11 is a small hand-held Pattern Generator, offering an R/F output and in addition, Red, Green and Blue TTL or lower level signals compatible with VDU or Video Games requirements.

Ideal for the production, installation and service of Monitors and Video Displays, both Mono and Colour, the RGB-11 has 8 basic patterns available which are: Colour Bars - Red, Blue, Green and White Rasters - Grey Scale - Cross Hatch and Vertical Lines. The internal rechargeable battery gives approximately 4 hours use from an overnight charge or can be used continuously via a mains adaptor.

The unit comes complete with rechargeable battery, connecting cable, adaptor/recharge and carrying case. It measure s a mere 131 x 81 x 23mm, weighs 220g inc. battery, is fully guaranteed for 12 months and costs £120 (exc. VAT).

Circle No. 7

Colour plotter boosts personal-computer and instrument graphics capabilities

The new HP 7470A graphics plotter from Hi-Tek Distribution is a two-pen multi-colour plotter which can be used to boost the graphics output capabilities of a wide range of personal computers as well as test instruments fitted with the IEEE Bus. Featuring high-resolution graphics and built-in microprocessor - controlled intelligence for vector and character generation, the 747OA can be linked via GP-IB, HP-IB or RS-232-C interfaces to machines such as the Apple II, Commodore PET, HP-85, HP-87 and the IBM Personal Computer.

The 747OA, costs £969 (plus VAT), is a compat desktop unit which can accept either 11"x8½" or A4 paper sizes as well as overhead transparencies for projection. Resolution is 25um, with a repeatability of 100um, which allows publication-quality charts, maps or mechanical drawings to be produced.

The plotter can produce two-colour plots with automatic pen exchange or multi-colour plots with manual exchange, and easy-to- use conversational software allows users to give type-written commands in plain English.

Plotting is aided by a new grip technique which moves both paper and pen simultaneously, reducing the cost and complexity of the plotting process and increasing the speed, accuracy and resolution.

The 7470A is designed for ease of use. Loading is accomplished simply by pushing in the paper or film and operating a 'hold' level, and automatic or manual control can be carried out from the front panel.

The plotter has five internal character sets, and text can be written in any direction and in different sizes. Symbol plotting and dashed-line facilities are also available, and more than 40 built-in software instructions can be used for simple programming.

Circle No. 8

☆ ☆ ☆ ☆ ☆ ☆ ☆ ☆ ☆ ☆ ☆ ☆ ☆

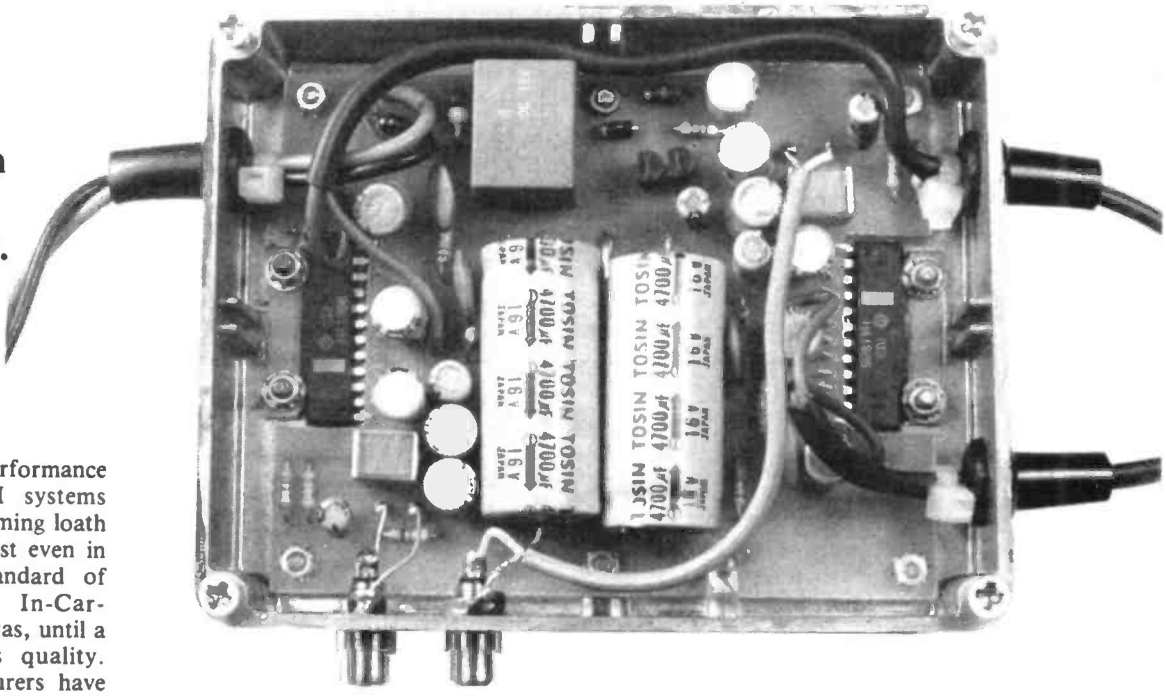
Hi-Tek

Tektronix have introduced a colour version of their DAS 9100 family of digital analysis systems. Featuring a colour CRT display to enhance the use of keyboard-controlled menus, the new analyser establishes a new level of 'ease-of-use' in logic analysis instruments.

The Colour DAS, like the entire DAS 9100 family, is a modular digital analysis system housing both data-acquisition and pattern-generation card modules in the same mainframe. Offered in a variety of data widths and speeds, these modules are combined in the mainframe to match the user's application needs. Data-acquisition widths of up to 104 channels and speeds to 660 MHz give state-of-the-art performance, and the interactive pattern generator allows simultaneous stimulation and acquisition from a device under test.

Circle No. 9

18W POWER BOOSTER



Put new life into your ICE system with this remote mounting Amplifier.

Design by J. Oliver.

AS THE STANDARDS of performance offered by Domestic HI-FI systems increase, the consumer is becoming loath to accept anything but the best even in portable equipment. The standard of reproduction offered by In-Car-Entertainment (ICE) systems was, until a few years ago, of dubious quality. Recently, however, manufacturers have started to produce equipment capable of very high quality reproduction for in car use.

Not only has the performance of the 'Electronics' been improved but also the specifications of the car's speakers. Today, instead of low quality 'cocoa tin' speakers, the ICE brigade are offering two and even three-way speakers that can reproduce very high levels of sound across the full frequency range.

The power amplifier stages of many cassettes/radios are, as often as not, not man enough to drive such speakers, and while the signal is of good quality, some form of 'power boost' is needed to take advantage of the current generation of speakers.

The R&EW power booster will provide 18W of high Quality stereo sound and will provide a means of revitalising many ICE systems.

BOOTSTRAP

The power booster is designed for remote mounting in the vehicle's boot. It is built in a die cast box to provide protection from any adverse environmental conditions - excuse the jargon - and incorporates a circuit that automatically switches the amplifier on when a signal is applied to its input.

CONSTRUCTION

Construction of the power booster is straightforward, there being no critical components. Pay carefull attention to the overlay of *Fig. 4*, in particular the orientation of polarity sensitive components.

The installation of the booster will vary from vehicle to vehicle but under the real parcel shelf is generally a good place as this keeps speaker leads short.

The booster should be connected to a fused line in the vehicles 'Aux' circuit. Be careful to connect the supply the right way round, incorrect connections will result in a blown fuse.

Applying a signal to the amplifier will automaticaly apply power, illuminating the LED, and if all is well you will be blessed with 18W of clean power.

Power Amp IC	Connection
HA1339	Input (Pin 5)
TDA1010	Input (Pin 6/8)
LM380	Output
TDA2002	Output

Table 1 connection information for some commonly encountered power amp ICs.

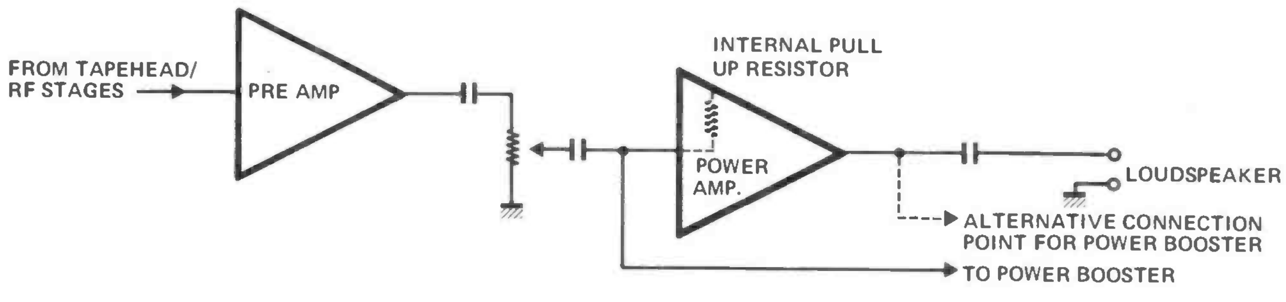


Figure 1. The power booster is turned on by a DC voltage superimposed on its audio input signal. The feed to the 'Booster' should either be taken from the existing amp's output - before DC blocking capacitor, or for better quality sound from the power Amp's input pin. See table 1 for connection details for some popular power amp ICs.

18W POWER BOOSTER

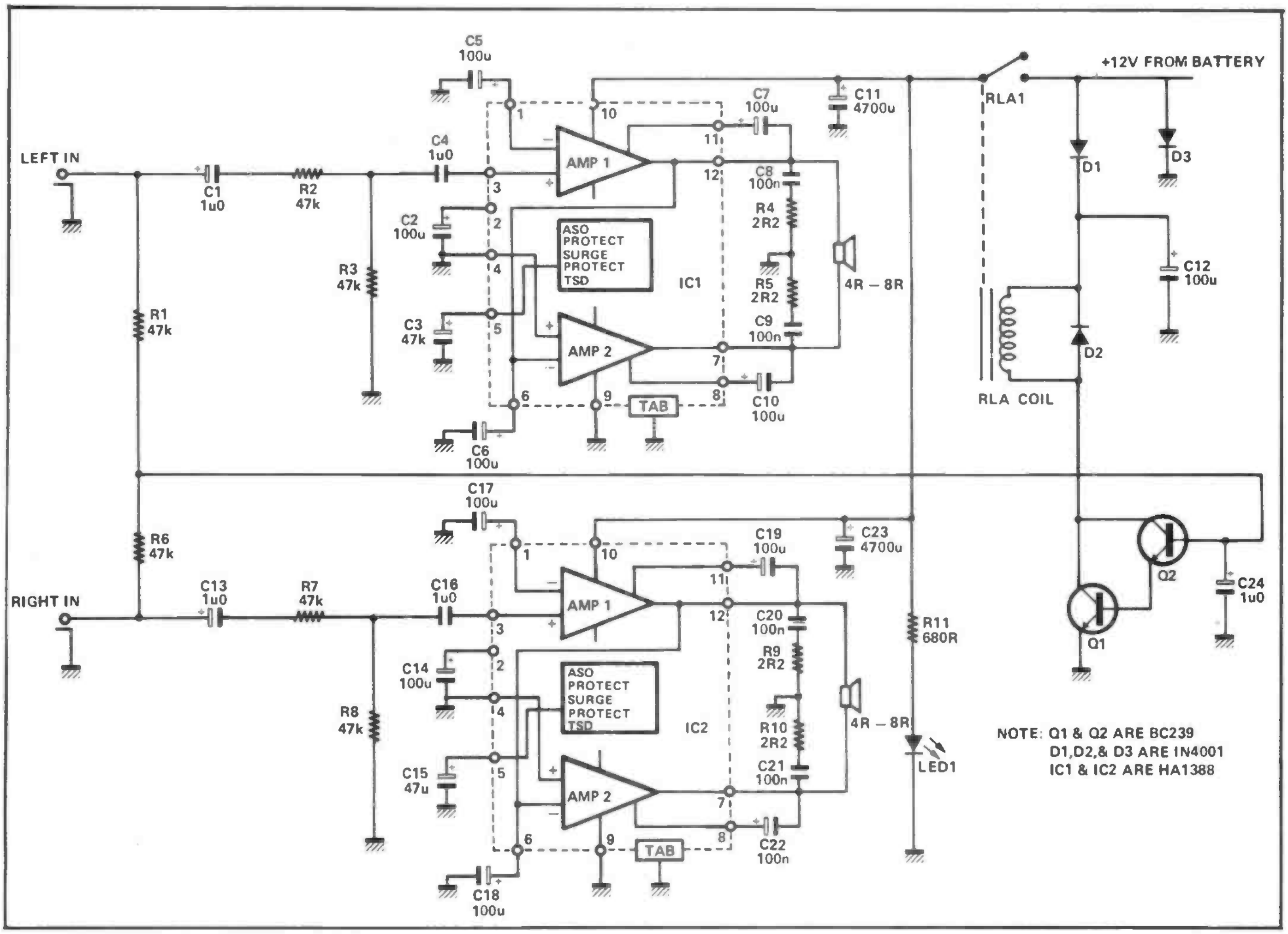


Figure 2. Circuit diagram

COMPONENTS LIST

Resistors (all¼W 5%)

R1,2,3,6,7,8	47k
R4,5,9,10	2R2
R11	680R

Capacitors

C1,13	1μ0 16V electrolytic
C2,5,6,14,17,18	100μ 6V3 electrolytic
C4,16	1μ0 monolithic
C3,15	47μ 6V3 electrolytic
C7,10,19,22	100μ 10V electrolytic
C8,9,20,21	100n polyester
C11,23	4700μ 16V electrolytic
C12	100μ 16V electrolytic
C24	1μ0 16V electrolytic

Semiconductors

IC1,2	HA1388
Q1,2	BC239
D1,2,3	1N4001
LED 1	Red LED

Miscellaneous

12V Relay
Speakers, PCB, Case, Sockets, etc.

CIRCUIT DESCRIPTION

The power booster consists of two power amplifier ICs, their associated components and A circuit that automatically applies power to the amplifier in the presense of an input signal.

The left-hand input signal is fed via C1 to the potential divider R2/R3. The potential divider is included to match the amplifier's sensitivity to that of the signal source it is to be used with. If necessary the sensitivity can be increased (reduce R2 in value) or decreased (increase R2).

The signal is coupled to IC1, left-hand power amp, via C4.

The HA1388 is an IC specifically designed for automotive use and features Automatic Safe area Operation (A SO), Thermal Shut Down (TSD) as well as comprehensive surge protection circuitry it has a relatively high external component count but does achieve unconditionally stable operation in a car's electrically hostile environment.

The capacitors C5 and C6 provide an AC signal path from the inverting terminals of the two internal 'bridge' amplifiers to ground while blocking DC. C2 provides ripple rejection, C3 determines the ASO while C7 and C10 are bootstrap capacitors. C8, C9, R4 and R5 form a zobel network that ensures stability at all frequencies.

Capacitor C11 decouples the amplifier's supply.

The operation of the right-hand channel's amplifier is identical.

AUTOMATIC ON/OFF CIRCUIT

A portion of the audio signal together with the superimposed DC voltage from each of the inputs is fed(Via either R1 or R6) to the Darlington pair Q1, Q2.

The DC content of the signal these transistor will turn on, energising RLA apply power, from the vehicle's battery, to the amplifier.

Removing the signal will, after a short delay due to the charge stored on C24, cause Q1 and Q2 to turn off, removing power from the circuit.

D2 is included to prevent the back EMF, generated as the field in RLA's coil collapses, causing damage to Q1 on Q2.

D3 is included as a 'brute force' protection against incorrect connection of the supply - connecting the supply in reverse will 'blow' the vehicle's fuse.

Your Reactions......	Circle No.
Excellent - will make one	64
Interesting - might make one	65
Seen Better	66
Comments	67

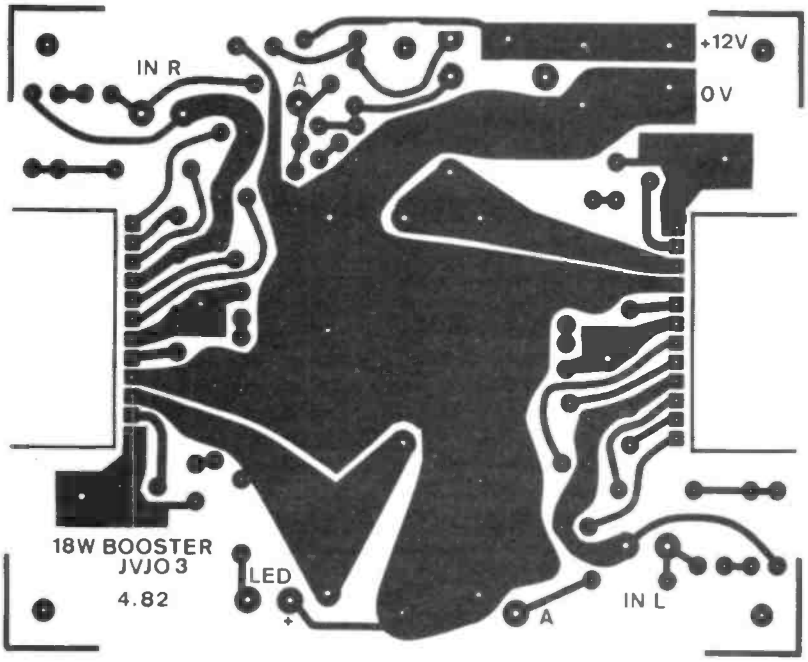


Figure 3. PCB foil pattern

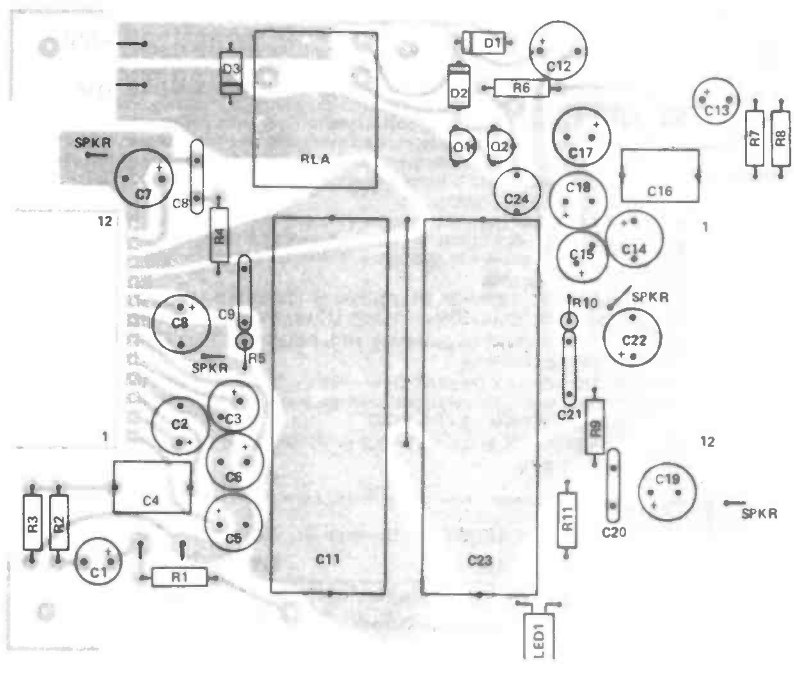


Figure 4. The power booster's overlay

■ R & EW

BE A SHARP BUSINESSMAN for only £278 +VAT

COMPUTER AND 4-COLOUR PRINTER

The sensational new PC-1500 Pocket Computer approaches the Personal Computer in ability. Add the revolutionary CE-150 Graphic Printer and a cassette recorder and you have a complete, battery powered, Business Computer System that travels in your briefcase!

SHARP CE-150
4-colour Graphic Printer
£130.39 + VAT;
Total £149.95

SHARP PC-1500
'Basic' Pocket Computer
£147.78 + VAT;
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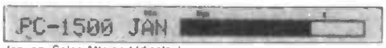
Price includes **SECURICOR 24 HOUR DELIVERY***.
Same day despatch, subject to availability.

BUSINESS APPLICATIONS

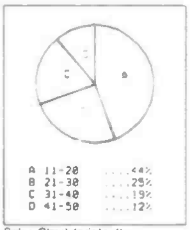


January Sales Attained (display)

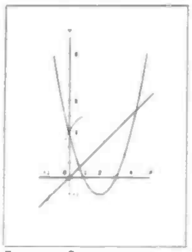
Quick and accurate data processing in daily business. Estimates, records and charts of sales, salaries, invoicing and all other data crucial to efficient business operations can be easily programmed, calculated and summoned.

ENGINEERING APPLICATIONS

Technical calculations in fields such as mathematics, statistics, measurements and mechanics are done superbly and easily. The calculator more than meets the requirements of engineers and scientists.



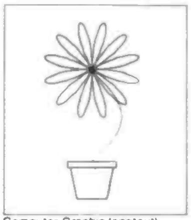
Sales Chart (printout)



Equational Graph (printout)

MANAGEMENT APPLICATIONS

Balance sheets, so crucial to management analysis, and profit calculations by break-even point analysis are instantly yours with the PC-1500. By using the integral clock, calendar and alarm functions, this computer can also be used as a schedule reminder.



Computer Graphic (printout)

HOBBY APPLICATIONS

Many popular computer games can be played, including Blackjack, utilising the random number function. Use the clock and alarm for speed games. The Computer Graphics will draw virtually any pattern.

Train (display)

BASIC LANGUAGE
The most simple computer language is used for programming ease. Additional BASIC terms provide variables including two-dimensional arrays, variable strings and many other advanced features.

LARGE MEMORY
16K bytes of ROM and 3.5K bytes of RAM, with 2.6K bytes in the user area. Adding the optional CE-151, 4K byte memory module, expands the RAM to 7.5K bytes. An 8K byte memory module will be available soon. The PC-1500 is battery powered and program and data memories are fully protected, even when switched off.

MINI-GRAPHIC DISPLAY
The 7 x 156 dot matrix allows almost any display, including game symbols. Line width is 26 characters and/or numbers.

HIGH SPEED DATA PROCESSING
The C-MOS 8-bit CPU enables swift data processing. Complicated technical or business calculations require far less time.

QWERTY TYPEWRITER KEYBOARD
The first in a pocket computer. Lower case letters are available. With the optional CE-150 colour graphic printer, the PC-1500 can serve as a small personal typewriter. Word Processor software will be available soon.

SIX SOFTWARE KEYS
These can serve as reservable keys, or as definable keys to define programs.

CE-150 4-COLOUR GRAPHIC PRINTER/CASSETTE INTERFACE
Automatic program, data and calculation printing. It prints virtually any drawing in either red, black, green, or blue. Characters are printed in nine different sizes and in lines ranging from 4 to 36 digits in length. You can control the printer completely and direct the printing either up, down, left, or right. As a **cassette interface** it will connect up to two cassette recorders, one for data and program storage, the other for their recall. The CE-150 has a built-in rechargeable battery and is supplied with a mains adaptor, type EA-150.

AVAILABLE SOON
* RS-232C interface. * Software board to serve as input keys in graphics, or pictures, previously drawn on a template. * ROM (MASK ROM) module also applicable. * A wide range of business software.

DIMENSIONS
PC-1500: 195Wx25.5Hx86Dmm (7-11/16x1x3-3/8") Wt 375g (0.83lb)
CE-150: 330Wx50Hx115Dmm (13x2x4 Inches). Wt 900g (1.98lbs).

Full 12 MONTHS guarantee, with EQUIPMENT LOAN SERVICE during downtime.

***SAME DAY DESPATCH** of orders – Systems by **SECURICOR 24** hour service, (to attended premises only) or by first class registered post. **AT NO EXTRA COST'**

SEND FOR FULL DETAILS to **TEMPUS**, the Portable Computer Specialists.

To: **Tempus**, FREEPOST, 38 Burleigh St, Cambridge CB1 1BR.

INFO.	ITEM	QTY	PRICE	TOTAL
	PC-1500 Pocket Computer		£169.95	
	CE-150 Four Colour Printer		£149.95	
	CE-151 4K Byte RAM Module		£ 49.95	
			Total inc VAT	

For information only tick appropriate box

I herewith enclose a cheque or Postal Orders value £ ________
or I wish to pay by Access B'card Visa.
My number is: ________
Name: ________
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R&EW8/82

TEMPUS

38 Burleigh Street, Cambridge CB1 1DG.
Tel: 0223 312866

167 for further details

R&EW Data Brief

LH 1605

LH1605 SWITCHING REGULATOR

The LH1605 is a hybrid switching regulator with high output current capability. It incorporates a temperature-compensated voltage reference, a duty cycle modulator with the oscillator frequency programmable, error amplifier, high current-high voltage output switch, and a power diode. The LH1605 can supply up to 5A of output current over a wide range of regulated output voltages.

Remote Sensing Connection

If the load is removed from the board, both the OUT SENSE and GND SENSE terminals should be connected via 'sense' leads to the OUT and GND terminals of the load. this minimizes the effect of voltage drop due to line resistance to assure full output voltage across the load.

The sensing lines should be shielded cables with the shield grounded at the regulator end to avoid noise pickup. The cable need not be heavy gauge wire as little current flows through it.

One caution should be exercised when the application has long leads. Voltage drop in the high current leads reduces the differential voltage between the input and output. To insure regulation, the minimum 5V input-to-output differential must be preserved.

Input Voltage Requirements

The board is designed to accept any DC voltage, requlated or unregulated, within the range of 10 to 25 volts. Almost any high output regulated DC power supply with the capability of over 3A output can be used. Beware that the high current switching can cause disturbance in the power supply, and be sure that the supply voltage does not drop below 10 volts. Some DC supplies will have difficulty in maintaining regulation; but as long as the board sees a minimum of 5 volt differential between its input and output, the switching regulator will perform normally.

Since the conversion efficiency of the switching regulator stays relatively constant within the normal input voltage range, and the ripple rejection is better than 60 dB, selection of the transformer and filter is far less critical than that required for linear regulators. Power line variations have little effect on conversion efficiency, therefore thermal characteristics are much more predictable.

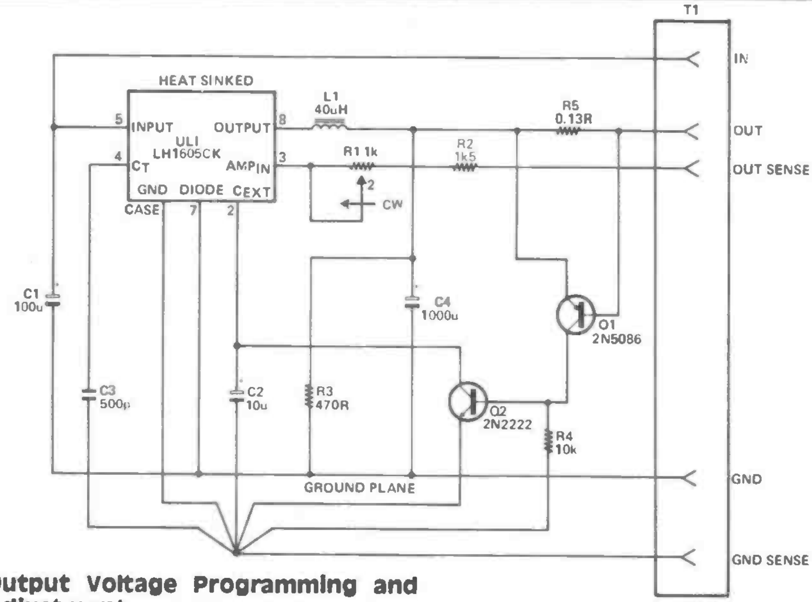


Figure 1: Circuit Diagram.

Output Voltage Programming and Adjustment

Although the LH1605 can operate within an output range of +15V to +30V, the output filter circuit for a switching regulator requires a design tailored to a specific set of operating conditions in order to optimize the inductor core size without risk of core saturation. If the output voltage or current is operated beyond the normal range, the inductor must be changed in order to preserve the expected performance.

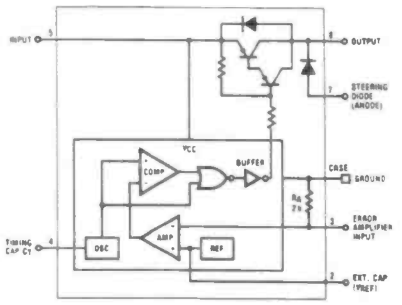
The board is designed for +5V output at 3A continuous current up to +70°C ambient temperature without the need for derating. The output voltage may be adjusted over a range of about +/-12% by adjusting potentiometer R1 on the PCB.

Since the total resistance of resistors R1 and R2 determines the output voltage, the regulator can be programmed to operate at other voltage levels by replacing the fixed resistor R2

As mentioned above, when an output parameter of the regulator is changed, be sure the inductor design is suitable in the new operating conditions.

Output Protection.

Although the LH1605 has no output protection against short circuits, external current limiting has been incorporated in the R&EW board. The limit threshold is set at approximately 4.5A. Take care not to operate the regulator near the limit for a sustained period of time as the power



Block Diagram

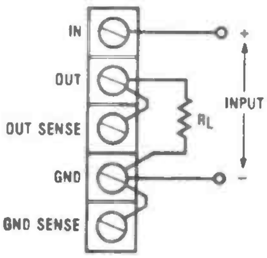


Figure 2: Board Connections for 'Normal Mode' Operation.

THE EVALUATION CIRCUIT'S SPECIFICATIONS

Input Voltage Range	+10V to +25V
Maximum Input Current V_{IN} = 10V, I_O = 3A	2.9A
Maximum Short-Circuit Input Current	4.0A
Output Voltage T_A = 25°C	+5.0V
Output Voltage Adjustment Range	4.38V to 5.62V (typ.)
Output Current Range	1A to 3A
Output Current Limit T_A = 25°C	4.5A (typ.)
Operating Frequency	50kHz
Line Regulation	10mV
Load Regulation	30mV
Output Ripple V_{IN} = 10V, I_O = 3A	50mV$_{p-p}$
Efficiency V_{IN} = 15V, I_O = 3A	72% (typ.)
Operating Temperature (no derating)	0°C to 70°C

ABSOLUTE MAXIMUM RATINGS

V_{IN}	Input Voltage	35V Max.
I_{OUT}	Output Current	6A
T_J	Operating Temperature	150°C
P_D	Internal Power Dissipation	20W
T_A	Operating Temperature Range	
	LH1605C	-25°C to +85°C
	LH1605	-55°C to +125°C
T_{STG}	Storage Temperature Range	-65°C to +150°C
V_R (V_{8-7})	Steering Diode Reverse Voltage	60V
I_D (I_{7-8})	Steering Diode Forward Current	6A

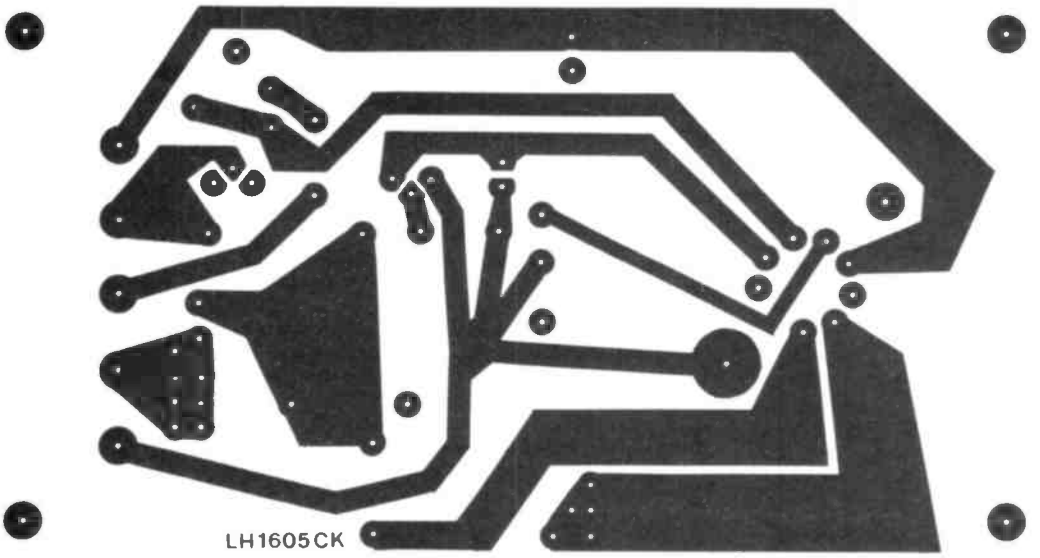


Figure 3: PCB Foil Pattern. Only one side shown, PCB available from R&EW Project Pack Service — See page 58.

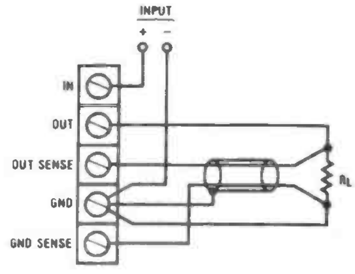


Figure 5: Remote Sensing Connections.

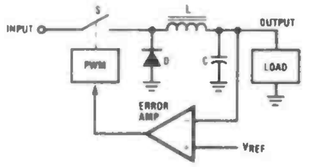


Figure 6: Step-down Switching Regulator Block Diagram.

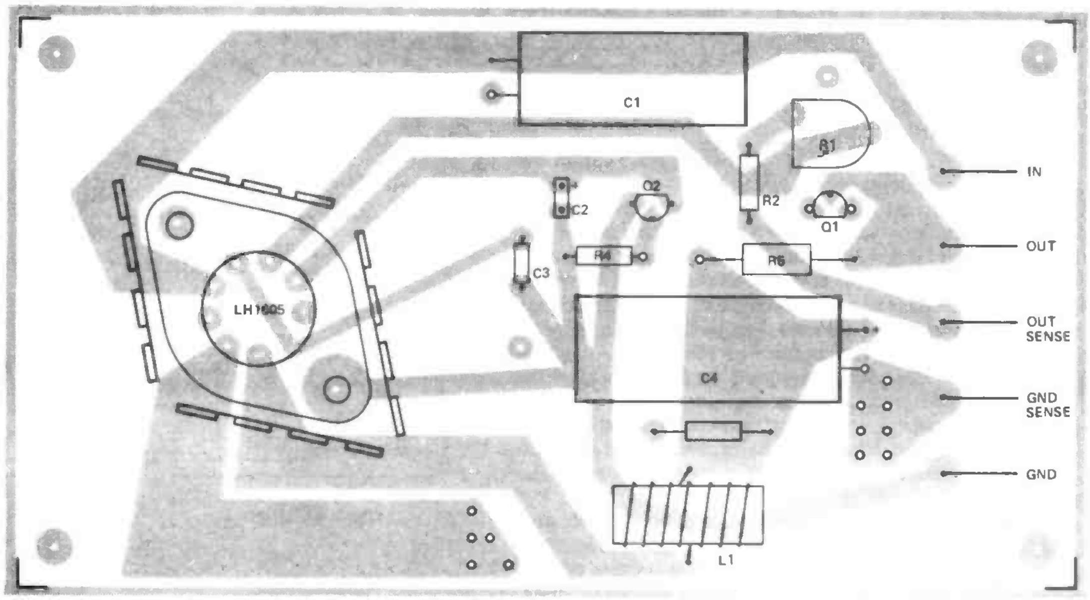


Figure 4: PCB Overlay.

● =SOLDERED ON BOTTOM
O =SOLDERED TOP AND BOTTOM

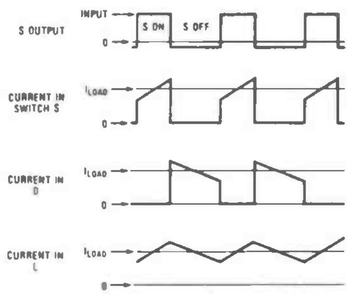


Figure 7: Waveforms associated with a step-down switching regulator design.

dissipation may cause the junction temperature to rise beyond a safe level. This is especially critical at high ambient termperatures.

The current limiting circuit consists of Q1, Q2, R4 and R5. Resistor R5 senses the output current. When the voltage across R5 reaches 0.6V, transistor Q1 begins to turn ON and drives transistor Q2 ON. Q2 collector tends to pull the reference voltage at pin 2 low, reducing the switching duty-cycle such that the total current is limited to the maximum set by the threshold.

Note that this current limit sensing technique is accurate only to within about +30% over the 0°C to 70°C ambient temperature range. Since the threshold temperature coefficient is approximately - 2mV/°C, the higher the ambient temperature, the lower the current limit threshold.

THEORY OF OPERATION

The switching regulator in the Evaluation Board is based on the step-down series-pass design. The block diagram is shown in *Fig. 6* The switch S turns ON and OFF at a fixed frequency, but the duration of the ON time is variable as a function of the load. When the switch S is closed, diode D is reverse biased, and current flows though the inductor L to the load and charges the capacitor C.

When switch S turns OFF, the inductor voltage rises in an attempt to sustain the current flow until the steering diode is forward biased. Once the diode turns on, the inductor voltage at the input side is clamped to a diode voltage below ground. The inductor current is allowed to flow around the loop formed by the diode, inductor, and capacitor/load. the energy stored in the inductor is then transferred to the capacitor and the load.

The error amplifier constantly compares the output voltage against the reference voltage Vref. The difference is amplified and is used to modulate the duty cycle (switch ON-time). The duty cycle increases as the error increases, and vice versa. As the output voltage rises to Vref, the duty cycle settles to a constant pulse width at equilibrium. At this point the net energy transferred across the switch just equals that consumed by the load. Output is regulated to a voltage Vref.

If the load increases, the output voltage tends to drop. The increased error signal is amplified and affects the pulse width modulator to increase the duty cycle, forcing the output voltage back to Vref at equilibrium. The same mechanism operates in reverse for the case where the load is decreased. Therefore, load regulation is maintained.

Similarly, if the input voltage increases, the inductor voltage also increases during switch ON-time, causing the inductor current to rise. Correspondingly, the output voltage tends to rise. Once again, the negative feedback works to reduce the duty cycle until the output voltage equals Vref. Line regulation is maintained. At the new equilibrium, the net energy transferred remains the same. Therefore, the total power consumption is relatively independent of input voltage change.

Figure 7 illustrates the waveform characteristics of this type of step-down switching regulator.

■ R & EW

WIDEBAND RF TRANSFORMERS

In this article, the first of an occasional series, Michael Graham looks at Monofilar types.

WIDEBAND RF TRANSFORMERS are finding increasing use in a variety of communications systems. Schottky diode mixers, combiners and, in particular, the 'broadband amplifier' have all contributed to the increasing applications for such wideband transformers.

SUCK IT AND SEE

The essence of most design techiniques involves a lot of trial and error, an approach that seems to be the one most commonly encountered amongst RF engineers. As often as not an engineer will select a core that looks as if it 'might do', winds the transformer and installs it in the circuit. If its performance is unsatisfactory a tedious process of adding or removing turns ensues with perhaps changes in wire gauge or core size. Eventually something which will do the job results but rarely will this be a truly optimum design.

IN A TWIST

The most common approach to the implementation of a wideband transformer is the twisted line transformer, wound on a high permeability ferrite core. Beware of confusing ferrite with dust iron when it comes to toriods for while dust iron is ideal for EMI suppression and for resonant applications by virtue of its inherent airgap effect, the broadband transformer relies on a high permeability material to achieve the tight overall magnetic circuit required for optimum coupling at low frequencies. At high frequencies the transmission line effect of the tightly twisted conductors predominates while the effect of the cores permeability decreases.

If the prospect of trying to estimate the impedance of twisted pairs of 32 SWG may leave you a shade less than enthusiastic however, then the wideband autotransformer may be a good place to start.

ONE WIRE WONDERS

Although apparently not widely recognised, it is not always necessary to employ multilayer windings in autotransformers. In low power applications, the core is often small enough to ensure adequate interturn winding 'intimacy' and a monofilar design can give excellent results. We'll look at some practical aspects of such designs later but first a look at some of the important parameters of RF transformers is in order.

SPECMANSHIP

One important measure of an RF transformers performance is its bandwidth, often graphically presented as a plot of the transformer's transmission loss vs frequency. *Fig. 1* shows a possible plot for a broadband transformer, the bandwidth being F2 - F1.

As with any bandwidth figure, the two frequencies between which the bandwidth is quoted are rather arbitrarily determined, and any meaningful specification must be accompanied by the corresponding transmission loss limitation.

The other important quality of a transformer that must also be specified are its reflection characteristics. This specification defines the quality of the transformer's impedance transformation over the frequency range of interest.

Figure 2. shows a model of a transformer in terms of its 'lumped' constants.

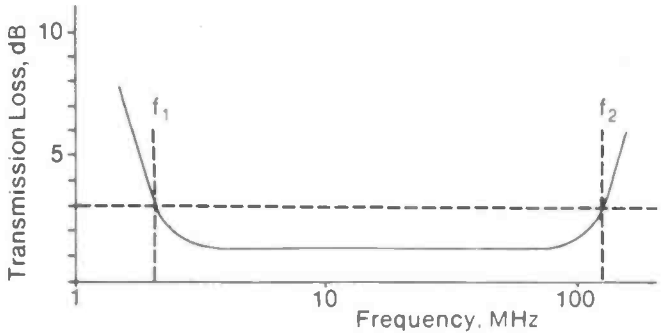


Figure 1: Typical transformer transmission loss vs. frequency.

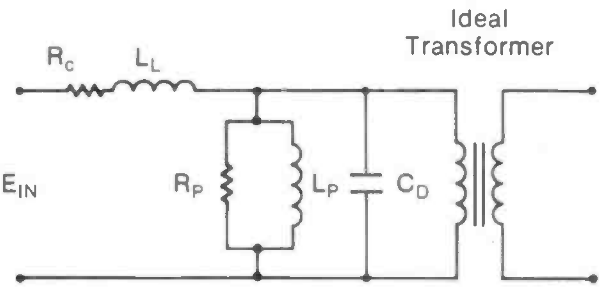


Figure 2: Transformer lumped element equivalent circuit.

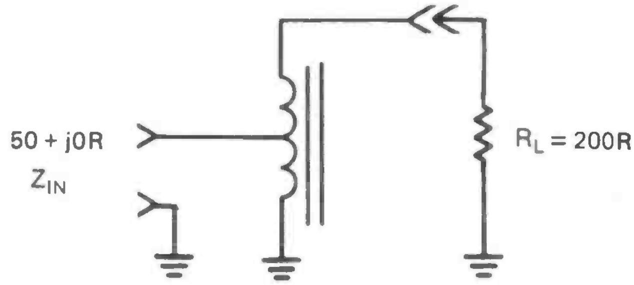


Figure 3: Ideal 1:4 autotransformer.

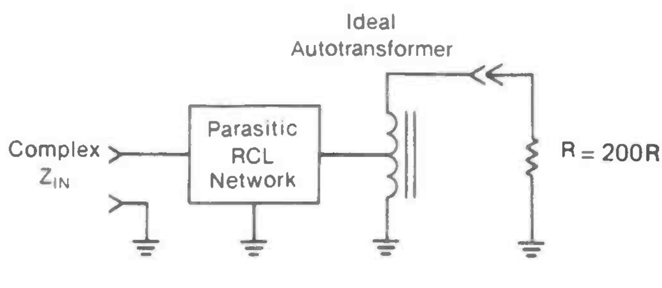


Figure 4: Simplified equivalent circuit of practical 1:4 autotransformer.

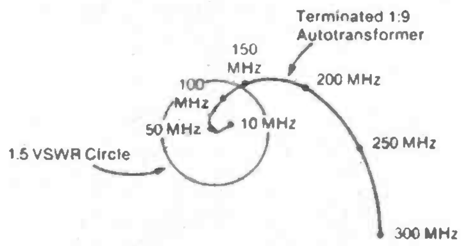


Figure 5: Smith Chart presentations.

From this it can be seen that the transformer's low frequency performance will be determined by Lp and, to a lesser extent, by Rp. High frequency performance will be determined by the Ll and Cd as, with increasing frequency the reactance of Ll will increase while that of Cd will fall.

Over the majority of the transformer's bandwidth, its insertion loss will be due to Rp and Rc with Rp being the dominating factor.

COMPLEX NUMBERS

The parasitic elements of *Fig. 2* do more than merely cause losses, as they willalso affect the value of the impedance reflected from the secondary to the primary.

Figure 3 show an ideal 1:4 autotransformer and, with its secondary terminated with a 200R load, the impedance measured at the primary terminals will be 50R.

Figure 4 shows the same 1:4 transformer but has the parasitic elements of *Fig. 2* lumped into a single network. With the 200R secondary load, the impedance seen at the primary will now no longer be a resistive 50R, but a complex impedance. the scaling factor of the transformer is no longer 4, but some complex factor $a+jb$. The object of the transformer designer is to get 'a' as close to 4 as possible and 'b as close to zero.

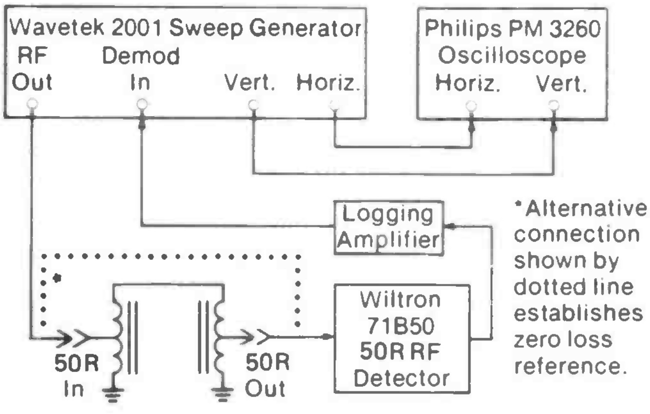


Figure 7: Swept transmission loss test set-up.

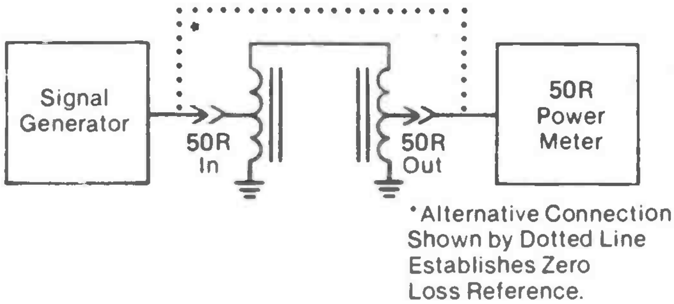


Figure 6: "Back-to-back" transmission loss test set-up.

NOTHING'S PERFECT

A practical transformer thus exhibits an insertion loss and variation in the impedance scaling factor. In order to specify the performance of a transformer some means of measuring the variations of these 'qualities' with frequency is needed.

Any analysis of complex impedances would not be complete without the ubiquitous Smith Chart and an autotransformer's reflection characteristics could be specified by measuring the complex impedance at various frequencies and plotting the results as in *Fig. 5* (pass the network analyser).

A more practical approach would be to assess the transformer's reflection profile from VSWR measurements at various frequencies. A practical autotransformer may have a VSWR of, say 1.5. This would define a locus of points on the Smith Chart as shown in *Fig 5*. The exact point on the VSWR circle that represents the complex impedance cannot be determined however, as this would require details of the phase angle of the voltage with respect to current. Back to the network analyser.

From transmission line theory we know that the voltage reflection coefficient ρ is given as

$$\rho = \frac{Z_r - Z_o}{Z_r + Z_o}$$

Where Zr = The autotransformer's input impedance

Zo = Reference impedance

As Zr is a complex quantity, ρ is likewise complex. Zo is assumed to be real.

The magnitude is given by

$$|\rho| = \frac{r-1}{r+1}$$

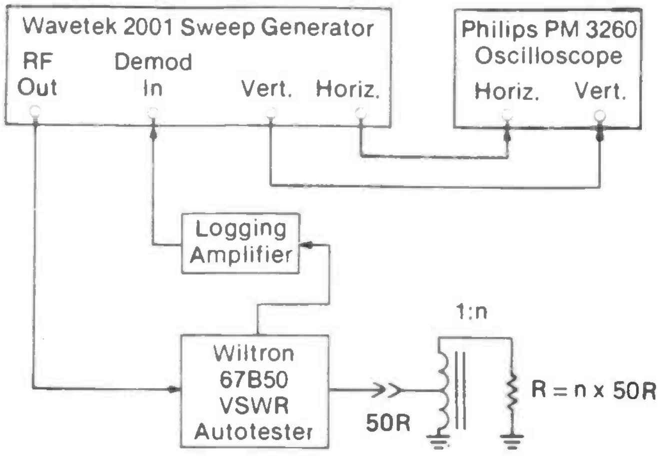


Figure 8: Swept VSWR test set-up.

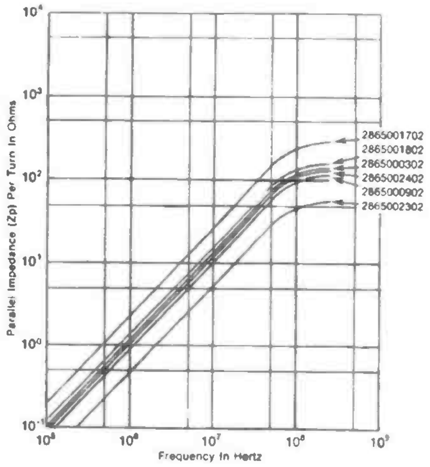


Figure 9: Parallel impedance per turn Vs frequency for Fair-Rite 65 material.

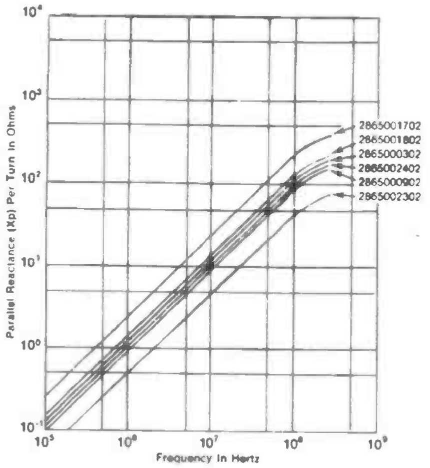


Figure 10: Parallel reactance per turn Vs frequency for Fair-Rite 65 material.

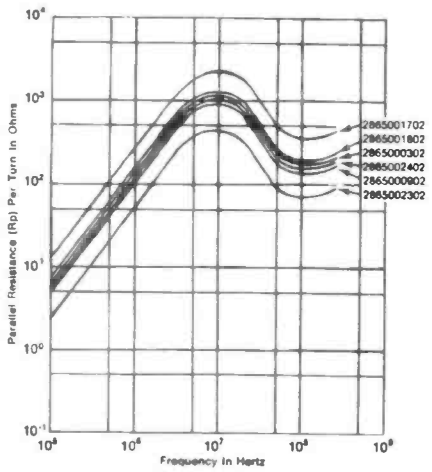


Figure 11: Parallel resistance per turn Vs frequency for Fair-Rite 65 material.

Where there's VSWR, there's return loss and this is given by

$$\text{return loss (dB)} = 20 \log_{10} \frac{1}{|\rho|}$$

Although measurements of VSWR, the voltage reflection coefficient and return loss do not provide any phase information, they do provide a convenient way of specifying reflection characteristics, and they can be measured with the sort of test equipment that is more accessible to engineers and enthusiasts.

MEASURING UP.

The most convenient way of measuring transmission quality is to place two identical autotransformers in a back-to-back configuration as shown in *Fig. 6* the equipment required is a signal generator and a 50R power meter. First the generator is connected directly to the power meter to determine the zero loss reference level *P1*.

The back-to-back transformers are then interposed between the generator and power meter and a second power level, *P2*, is noted. The insertion loss for each autotransformer is given by

$$\text{Insertion Loss} = \frac{P_2 - P_1}{2}$$

The back-to-back method may not be very 'pure' in theory, but in practice the results obtained with this technique show good agreement with other, more direct, means of insertion loss measurement.

Figure 7 shows a practical set-up for swept transmission loss measurements and providing all lead lengths are kept to a minimum, excellent results over a wide range of frequencies can be obtained.

TIME TO REFLECT

Reflection measurements are made by using a set-up similar to that shown in *Fig. 8*. As discussed earlier, these are based on VSWR measurments and the one unusual component shown in *Fig. 8* is the VSWR autotester, a device that produces a DC output voltage proportional to ϱ (shades of the **R&EW** 'Autobridge' published last month). The logging amplifier is included to display the return loss in dB as a function of frequency.

THEORY INTO PRACTICE

The type of core best suited to monofilar autotransformer designs is a two-hole ferrite balun core.

Nominal Z Ratio	"Primary" Turns	"Secondary" Turns
1 – 1.5	4	5
1 – 2	5	7
1 – 3	4	7
1 – 4	4	8
1 – 5	4	9
1 – 6.25	4	10
1 – 7.5	4	11
1 – 9	4	12
1 – 16	4	16

Note: "Primary" refers to number of turns from tap to ground. "Secondary" refers to number of turns on entire winding.

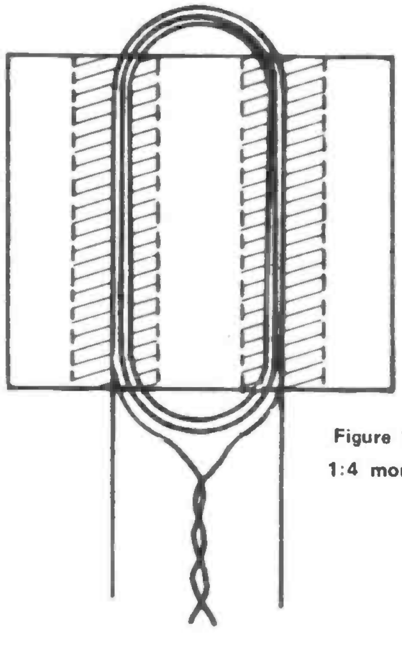


Figure 12: Cutaway drawing of 1:4 monofilar autotransformer.

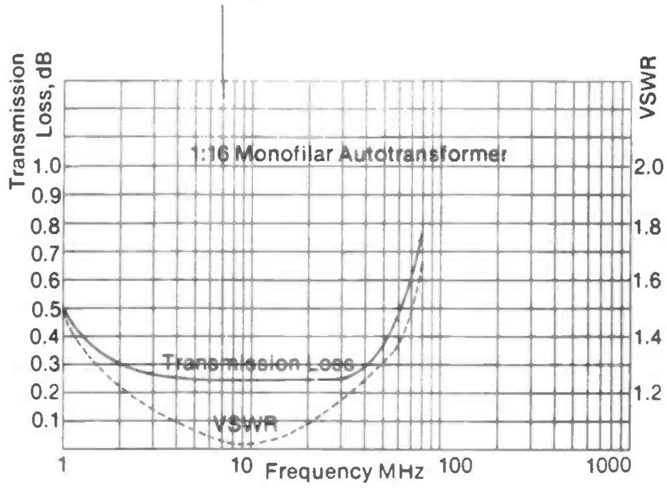


Figure 13: Transmission loss and VSWR.

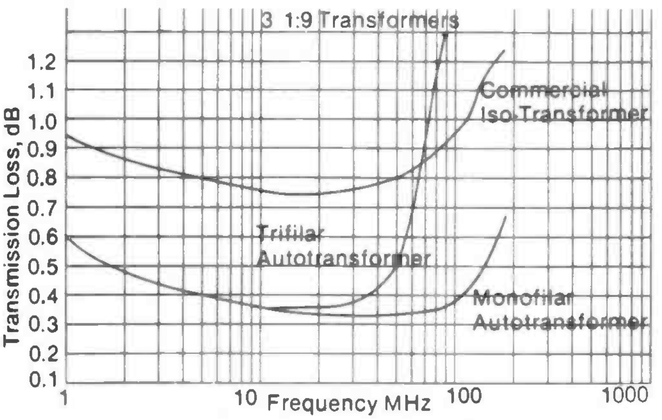


Figure 14: Transmission loss comparison.

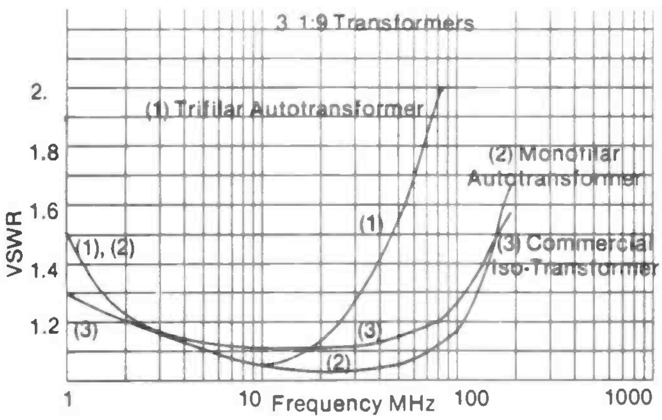


Figure 15: VSWR comparison.

In such designs, to obtain different impedance transformation ratios it is only necessary to select a turns ratio according to the formula:

$$Z_t = \left[\frac{N_s}{N_s}\right]^2$$

MATERIAL MATTERS

Referring back to *Fig. 2* we note that the important factors when selecting a particular material on which to wind an autotransformer are not the traditional initial permeability and loss factor figures as these are the result of measurements on a core expressed as though it were a resistor and inductor in series. The type of information required concerns the behaviour of the core when treated as a resistor and inductor in *series*.

The figure often referred to as the *material cutoff frequency* is also of little concern in wideband autotransformers. This figure is the point at which series permeability has dropped a signficant amount from its low frequency value. For wideband transformers the important quantity is the parallel inductive reactance (LP) which is, to a good approximation, the series permeability multiplied by frequency. Thus although permeability becomes less with increasing frequency, Lp either increases or remains constant and the material still forms a useful wideband transformer.

To select a material it is thus necessary to have information on the parallel components of the magnetic parameters such as parallel inductive reactance, Lp and parallel resistance, Rp, as a function of frequency. *Figs. 9* to *11* show such curves for Fairrite 65 material (Neosid F16, Philips 4C6).

THE SHAPE OF THINGS

It has been mentioned that the most suitable core for a monofilar autotransformer is the two hole balun core (*Fig. 12*). It would be useful to have a measure of any particular core's value as a wideband transformer. Such a number can be generated and is known as the core's Form factor. The lower this number, the wider the frequency range of the finished transformer.

The form factor is defined as

$$\text{FORM FACTOR} = \frac{lw\ le}{Ae}$$

lw = length of one turn of wire
le = effective magnetic path length
Ae = effective magnetic area

CLOSING TIME

A graph of a typical monofilar autotransformer's performance is shown in *Fig. 13* while *Figs. 14* and *15* compare the performance of three different forms of construction. It can be seen that the monofilar autotransformer offers superior performance to those employing standard toroids and multifilar windings.

The above has hopefully shown, that with the right information to hand, the design of an autotransformer need not owe anything to guess work. A systematic approach to the design should enable an optimum transformer design to be realised in a fraction of the time needed for a 'suck it and see exercise'. It's also a lot easier on the nerves.

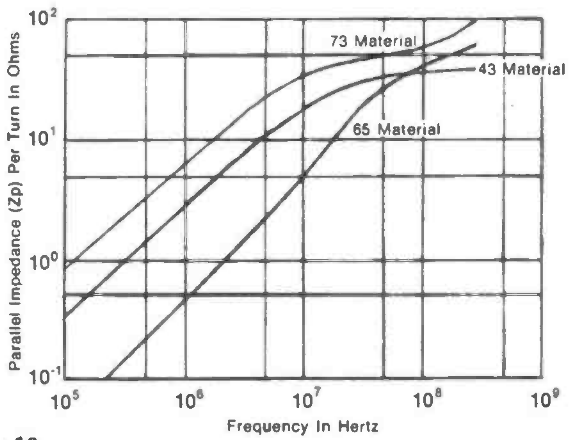
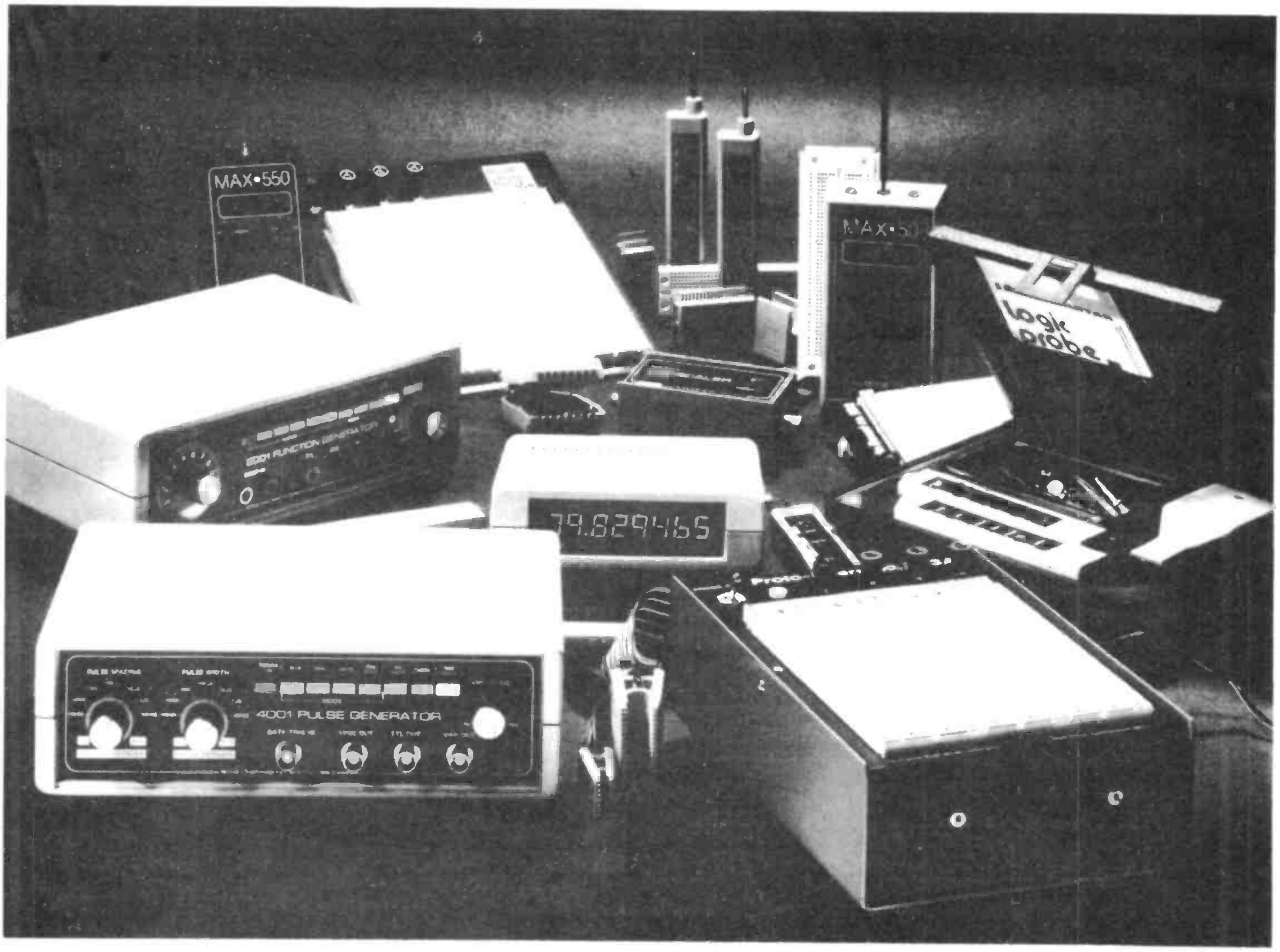


Figure 16
Parallel impedance per turn for a Balun Core in three materials.

■ R & EW

Your Reactions	Circle No.		Circle No.
Immediately Interesting	68	Not Interested in this Topic	70
Possible Application	69	Bad Feature/Space Waster	71


MAX•550
4001 PULSE GENERATOR
logic probe

CIRCUIT BLOCKS

Transistor/Diode Checker - design by J. C. Barker.

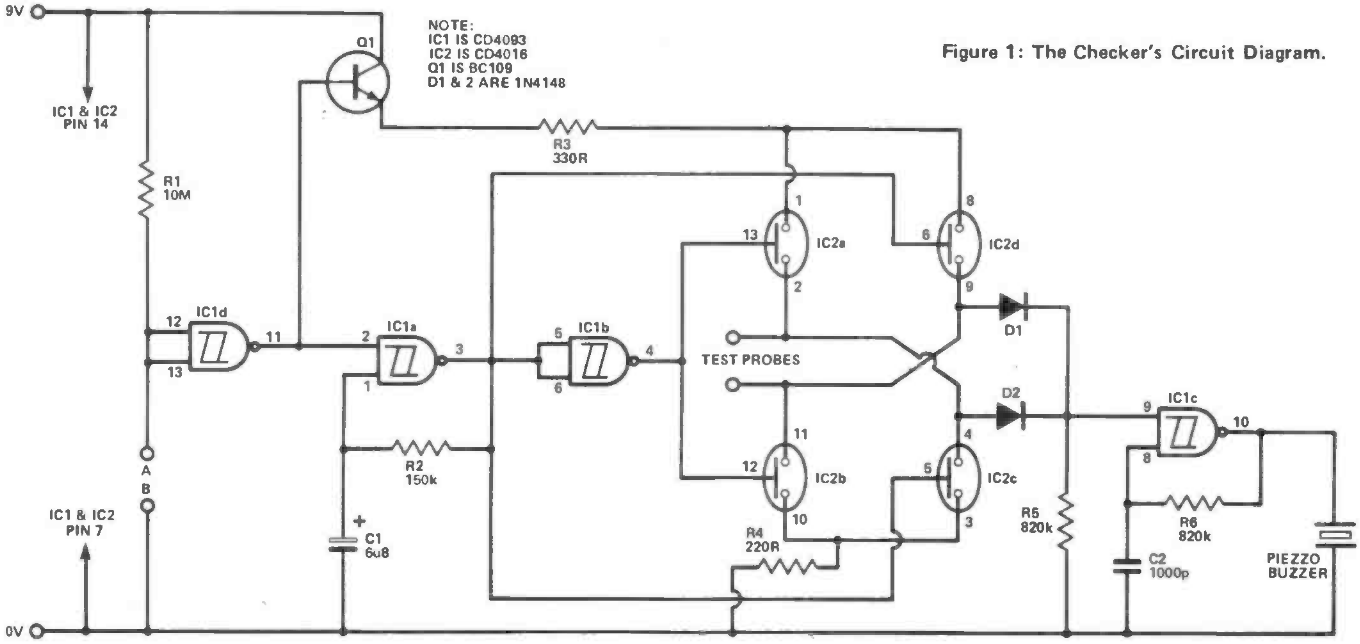


Figure 1: The Checker's Circuit Diagram.

THIS IN–CIRCUIT transistor /diode checker, to use modern parlance is very 'user friendly' and ergonomically designed. The facilities include:-

1)Automatic turn-on in use, and indication that it is working correctly.
2)Checks pn junctions without the necessity of constantly reversing the test leads or looking away from the circuit board to a meter reading.
3)Turns off when not in use.

Referring to *Fig. 1*; when not in use, IC1d output is low and neither IC1a nor IC1c oscillates. Q1 is turned off, and no current is supplied to the four electronic switches. In this mode the unit consumes negligible current.

When in use, points A&B are bridged by a finger, and IC1d's output goes high, which enables IC1a to oscillate slowly. Q1 is now turned on which supplies power to the four switches. IC1a and IC1b supply antiphase slow clock pulses to the switches, which turn on either S1&S2 or S3&S4 alternatively, thus constantly reversing the supply polarity to the test probes.

With nothing connected to the probes IC1c is enabled, which oscillates, sounding the piezo buzzer, indicating all is well. When the probes are short circuited the tone stops. If a pn junction is connected across the probes a pulsed tone is now heard, indicating a good component.

Construction of the unit is not critical and can be made up on PCB or vero board. The only point to note is the make up of one of the test probes.

Referring to *Fig. 2*, two insulated lengths of fine wire are laced to one of the test probe leads, and connected to points A&B in the main diagram. When the tester is in use, the two exposed wires are touched with a finger which turns the unit on.

■ R & EW

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

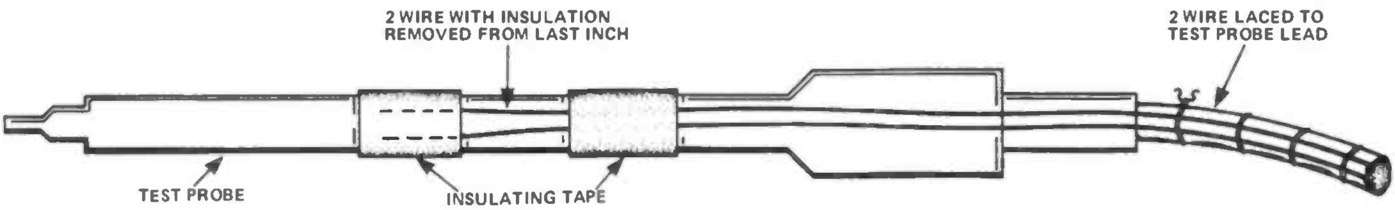
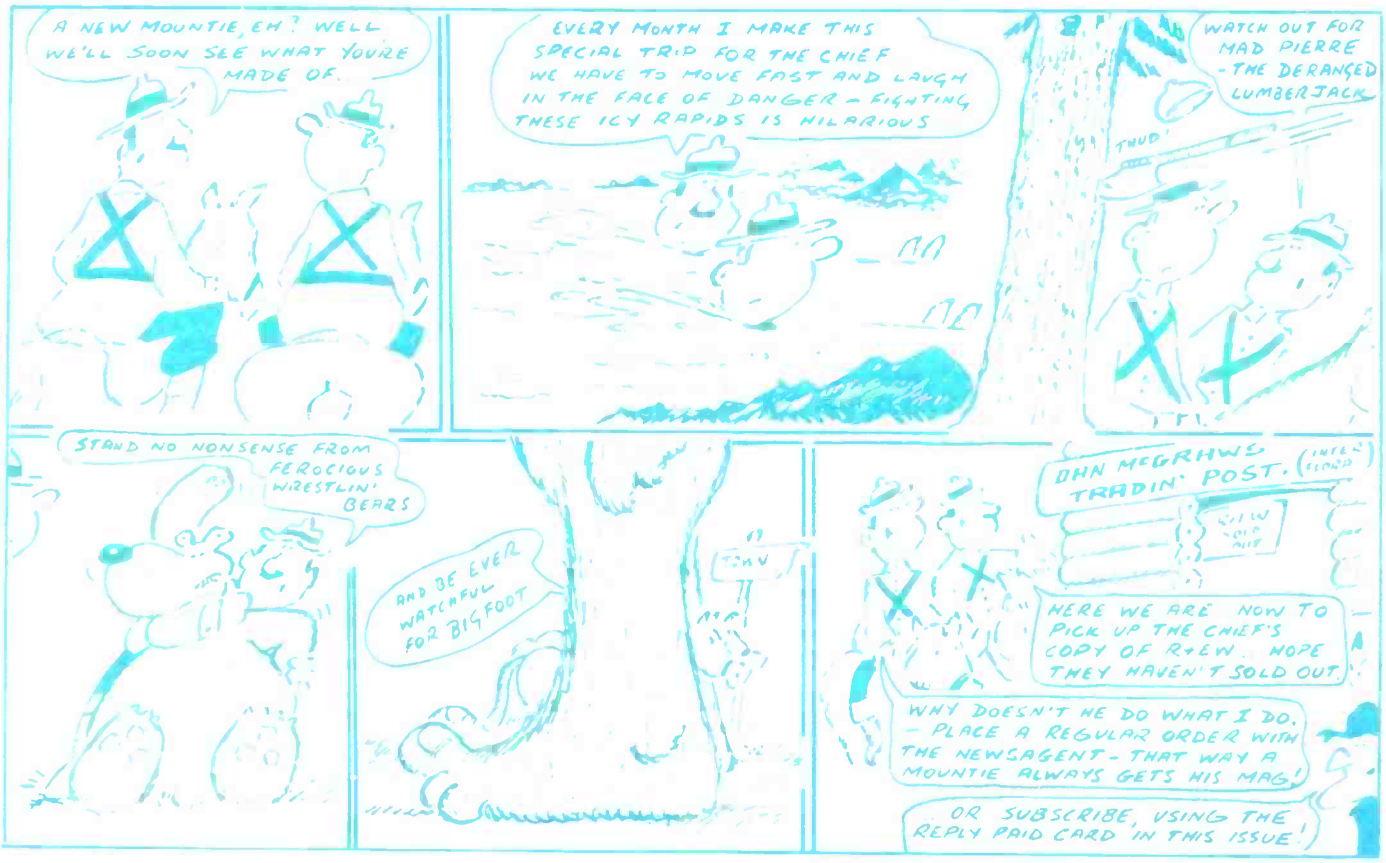


Figure 2: Details of Probe Construction.


A NEW MOUNTIE, EH? WELL WE'LL SOON SEE WHAT YOU'RE MADE OF.
EVERY MONTH I MAKE THIS SPECIAL TRIP FOR THE CHIEF WE HAVE TO MOVE FAST AND LAUGH IN THE FACE OF DANGER – FIGHTING THESE ICY RAPIDS IS HILARIOUS
WATCH OUT FOR MAD PIERRE – THE DERANGED LUMBERJACK
THUD!
STAND NO NONSENSE FROM FEROCIOUS WRESTLIN' BEARS
AND BE EVER WATCHFUL FOR BIGFOOT
TRADIN' POST.
HERE WE ARE NOW TO PICK UP THE CHIEF'S COPY OF R+EW. HOPE THEY HAVEN'T SOLD OUT.
WHY DOESN'T HE DO WHAT I DO. – PLACE A REGULAR ORDER WITH THE NEWSAGENT – THAT WAY A MOUNTIE ALWAYS GETS HIS MAG!
OR SUBSCRIBE, USING THE REPLY PAID CARD IN THIS ISSUE!

READERS LETTERS

Facts and opinions; Yours and Ours

Dominated again this month by our proposals for changes to the arrangements for licensing Amateur Radio Operators.

RAE: The HO answers...

Dear Sir,

We were interested to see your proposals for changes in the arrangements for licensing amateur radio operators. As to the RAE run by the City and Guilds Institute, the nature of the examination itself is, of course, a matter for the Institute. Under the International Radio Regulations we are required to satisfy ourselves as to the technical qualifications of any person operating an amateur radio station.

We require applicants for an amateur radio licence to pass the RAE as this clearly establishes an easily identifiable and acceptable standard for all applicants. Once this criterion has been satisfied, it is not clear what purpose would be served by making the examination more arduous. One possible consequence of doing so would be to increase the amount of unlicenced operation. Certainly we have no evidence to suggest that the standard presently required by the Institute was anything else than to ensure that successful candidates are suitable persons to pursue a course of self-training in radio communication while operating within the terms of their licences. It is also a requirement of the International Radio Regulations that any person operating an amateur station should have proved that he is capable of sending correctly by hand and receiving correctly by ear texts in Morse code. Administrations may waive this requirement in the case of stations which make use exclusively of frequencies above 30 MHz. Where bands are shared and more generally in the HF bands where signals can reach great distances, it is essential that an amateur interfering with another station should be able to read signals from that station so that he can know he is causing interference and can take remedial action. Despite the advent of equipment which is capable of sending and receiving Morse automatically, we do not consider that a compelling case has so far been advanced which suggests that by abandoning the Morse test we would not be risking serious difficulties. For this reason we do not at present propose to abandon the Morse test.

The fees for amateur licences were last increased in January 1981 to meet rising costs and to avoid a loss to public funds. Licensees are examined each year and adjustments are made as necessary to cover the cost of administering the licensing system. The period for which amateur licences are valid is a point which we are considering as part of the current review of the licensing structure being carried out by the Department.

P N McDonald
Home Office

Dear Sir,

On the subject of Morse for the Radio Amateur, might I suggest you add to your kit the possibility of a form of incentive licensing for the UK based on more power and more bands to more highly 'qualified' amateurs. The abilities required for technical examinations and for morse operation are clearly so different that two alternative, parallel paths to qualifications could be offered.

As a base point, nobody should be allowed on the air without sufficient technical knowledge to avoid causing a nuisance to other operators or causing TVI etc. From this stage, 'points' could be earned by passing technical exams or morse tests, or of course, both. More 'points' would earn more bands and/or more power allowance.

Any new scheme must follow on from the present arrangements, and this one will. Class A licensees will continue as at present, although conceivably an increase in power could be allowed for achieving 'points' in an advanced test. In practice, this would legalize the very high power run by some stations already rather than increase the power used on the bands; after all, who buys 1kW linears and cuts them back to 400W PEP.

Class B licensees should have the option to continue as now, or operate at low power on HF phone. CW should be allowed after passing a 5 wpm test 'Comprehensive Only' as in the US i.e. a standard good enough to ensure basically sound procedures, but easy enough for all (i.e. even me!). The points system would then apply up to the highest of about, say, 4 levels of competency, measured by technical knowledge or CW speed. This would enable the technically competent to attain the maximum benefits from the permit of amateur radio, but would not deny the value of CW.

It is deplorable that, while the standard required in the technical examination has declined in recent years, the CW requirement has maintained the relatively high level of 12 wpm. Other countries have either no test, or a basic 5 wpm test, often receiving only and requiring comprehension of the message but not a verbatim transcript.

Incentive licensing would dramatically improve the technical standard of the 'average' amateur and would ensure that the hobby remains an interesting mixture of possibilities for both the technical and the operators.

PHS
Northants

Never mind the width.....

Dear Sir,

I must admit I've never seen or read an electronics journal as good as yours ever before. It is by far the best electronics journal available on the bookshelves today. I have, however, one criticism to make. If you refer back to your March issue, on page seven it says, and I quote;

'Those extra pages are not provided simply on a 'one issue only' basis, but are intended to be a permanent feature of ALL future editions of the magazine.'

I was rather disappointd when, last week, I bought the May issue of R&EW and found that it had got thinner. 'What's this?', I thought, when I picked it up. 'It can't be **R&EW** can it?' Well you can imagine my surprise when I found out that you had gone back to your original 96 pages. I had to count each page, just to make sure I was not an April fool.

Well that's enough about the bad points of your nearly perfect magazine. Two of the features I particularly enjoy reading are the Data Brief and Circuit Blocks. These are very helpful when I am trying to design my own circuits, for a change.

While looking through your past editions I noticed that you have not covered much test equipment in your constructional projects. May I suggest a few. How about a digital multimeter, or maybe an oscilloscope. Anyway I'd just like to congratulate you on a fantastic magazine, despite its size, and wish you the best for the future.

KB
Nuneaton

R&EW:

Well, we're very sorry about the drop in pages, but we have had a few problems with production schedules that have effectively put us back an issue in terms of lead-time. Nevertheless, we hope that we have maintained the number of editorial pages at an acceptable level,' and will be reintroducing the fatter issue size in time for the autumn 'season'. Readers are beginning to help a great deal by submitting features that meet with requirements of style and content, and we look forward to receiving many more.

Dear Sir,

Having taken your magazine since it first started, and been pleased with the contents, I have had nc real complaints... until now.

Although it is not the sole reason I buy the magazine, I always turn to SW News from Frank A Baldwin, being a Short Wave listener, and always find some useful information. However, the format has been changed this month (May 1982) to try to provide a more balanced view of all radio activities.

Firstly, I don't like the idea of the SW News and tips being shortened, as very few tips means it is hardly performing its function.

Secondly, if a more balanced view of the radio spectrum is aimed at, devote more space so a proper job may be done of it. Little bits and bobs are of no use to anybody and I certainly do not find a column on what CB fanatics decide to call themselves in the slightest bit interesting. I realise space is at a premium, in a magazine but 1.5 pages is not enough to do justice to such a wide subject as you are attempting.

I hope the column is not how it will continue in future issues but just a temporary thing, and will return to plain old short wave news.

One more thing, I note several letters asking for features for future issues. How about another to add to the list, inside 'Frank Baldwins Shack'. I would be very interested to know what equipment he uses, and some general background as to how he goes about DXing, etc.

SS
Market Harborough

Dear Sir,

Having read your review of the SMC OSCAR 1 CB rig, I am taking up your invitation to write to you 'if I know better'.

The main board, PTBM134AOX, is used in at least two other rigs to my certain knowledge, namely the YORK JCB863 (SULKIN) and the BINATONE 5-STAR. These two rigs, along wih the SMC, appear to be very similar, with minor differences concerned with the front panel arrangement. I note that the OSCAR rig differs from the other two rigs in having a 5-pin DIN microphone plug/socket, normally considered to be inferior by the CB cognoscenti, as the plug is likely to part company with the rig at awkward moments.

I, too, was surprised by the Delta-tune circuit arrangement when I first studied the circuit diagram, but haven't noticed any undue problems attributable to this implementation.

JM
Wokingham

R&EW:

Thanks to all those who responded to this feature. We have learned of some 25 'look alike' rigs based around the Cybernet chassis, and conclude there must be a few more still. This neatly highlights the oft stated fact that there are basically 5 chassis in the entire CB industry!

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This new two stage 144MHz solid-state linear amplifier has been introduced as a result of the large number of low power transceivers currently available. When used in conjunction with such transceivers this unit will provide an output of 100 watts.
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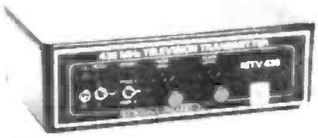

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- TWO CHANNEL USING PLUG-IN CRYSTALS

This high performance ATV transmitter consists of a two channel exciter, video modulator and a two stage 20 watt linear amplifier. The unit will accept both colour and monochrome signals, and a sync pulse clamp is incorporated to ensure maximum output. An internal pin diode aerial c/o switch allows connection of the aerial to a suitable receive converter when in the receive mode. (MMC435/600 – £27.90). Full transmit/receive switching is included together with an internal waveform test generator which will assist the user in adjusting the gain and black level controls.

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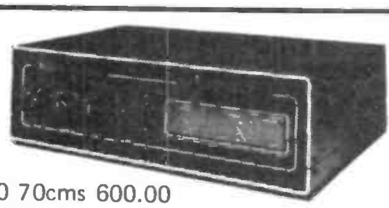

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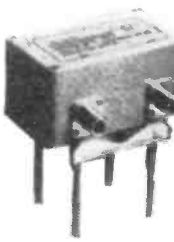

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COMPUTING NEWS

This month Gary Evans has news of Sony's entry to the micromarket place and of a gathering of the Commodore Clan.

THE GIANTS OF the Japanese electronic industry are starting to enter the micro computer battle field with a vengeance. We've seen the Sharp and Casio machines over here, the States have additional representives of (far)eastern promise including a Hitachi machine and the recently released Sony SMC- 70.

SONY'S STORY

The SMC-70 is a business orientated machine and, although the model is too new to have been assesed by any impartial parties, there seems no reason to doubt Sony's claim that the machine has been designed to the high engineering standards associated with other Sony products. Expertise from all wings of the Sony empire has been applied to the computer, in particular the video interface capability of the SMC-70 seems to owe much to Sony's long experience with TV systems.

The system has been designed to make effective use of industrial video disc systems and, if our interpretation of the Press Release is correct, will allow computer generated displays and video frames to be superimposed on the same screen - a unique and powerful feature that would enable impressive graphic displays to be produced.

The SMC-70 incorporates its own 12" monitor, either black and white or a colour system using a Trinitron tube.

The machine is Z80 based and Sony have licensed the CP/M operating system ensuring that there will be no lack of software for the machine.

A number of plug-in units based on a design that Sony claim eliminates the problems of inserting exposed circuit-boards into a computer, problems that ZX81 owners know all about. Plug-in modules include a 16 bit processor, RS-232 interface, IEEE card, battery back up unit any additional memory to complement the basic models 64K.

The computer incorporates Sony's 3.5' micro floppy drive, recently licensed by Hewlett Packard for use in some of its computer equipment - a good recomendation indeed. The machine is small in size, 366mm wide x 90mm high x 444mm, and light at 10.5 pounds.

The SMC-70 firmware includes a Rom diagnostic routine that checks the machines functions after power up. The system can also be instructed to 'fetch' its first instruction after switch on from either the ROM, the disc or an external ROM pack.

The system thus doubles as a powerful business computer, an area in which it faces much competition, and as a powerful aid to the production of video software, in which role it has the field to itself.

The basic system includes the computer, the built in SMC - 7012 dual micro floppy disk unit, the SMI-7020 dot matrix printer and the CPD-120 Hi-resolution monitor. Price is to be about $3,800.

The colour system replaces the CPD-120 black and white monitor with the Trinitron KX-1211 colour TV and will cost $4,300.

The systems are due to become generally available during September, as yet there is no news of a date for their arrival in this country.

FRANTIC FAIR

The Commodore Computing Fair is an event that has grown in size with each year that it has been staged. This year the event virtually took over the Cunard Hotel, Hammersmith at the beginning of June.

The formula of the show has remained the same, the formula being to gather all the diverse dealers and software houses dealing in things Commodore under one roof and flinging the doors open to the public. Its a recipe that works and some 15000 were expected at this year's show.

There were many new products at the show, pride of place going to the new machines from Commodore themselves (previewed in July's **R&EW**). We don't have space to go into the various products but can't resist mentioning one item from the Commodore Applications catalogue.

A software package named'Supercow' conjures up a vivid mental image - perhaps a simulation of a Joan Collins film role. It is however, rather disappointingly, a management and record-keeping program for Dairy Farmers. Takes the fun out of life doesn't it.

PANIC STATIONS

The Commodore computer gathering also saw a minor outbreak of panic when it seemed that the VIC series' arch rival, the Sinclair Spectrum, had weaved its way into the show. We don't know whether the hand of Clive Sinclair was behind things, although the whole thing has that certain style. Any road up, according to an indiscreetly overheard conversation over the security contingent's radios, it appeared that one stand had done a deal with Sinclair - just what the deal was is a mystery - but it would have meant a Sinclair Spectrum at the show. The Commodore heavies were quick to move in and amid talk of closing stands down (wonder what sort of contract the exhibitors had to sign?). The Spectrum threat was removed.

That was not the only fly in the ointment however, the issue of Your Computer magazine on sale during the show featured a flexi- disc with ZX81 software in a prominent position on its front cover.

Shades of paranoia apparent in some Commodore people - whatever happened to the spirit of competition.

■ R&EW

Your Reactions..........	Circle No.
Immediately Interesting	78
Possible application	79
Not interested in this topic	80
Bad feature/space waster	81

COMING NEXT MONTH IN R&EW

PROJECTS, DATABRIEFS, REVIEWS, FEATURES, NEWS, COMMENT - IT'S ALL IN THE SEPTEMBER ISSUE OF R&EW.

AIRBAND RECEIVER

A SYNTHESIZED 720 CHANNEL DESIGN

The VHF airband occupies frequencies from 118MHz to 136MHz with 25kHz spacing. Transmission is AM with double sideband and carrier — very old fashioned but almost impossible to change now that it's enshrined as an international standard.

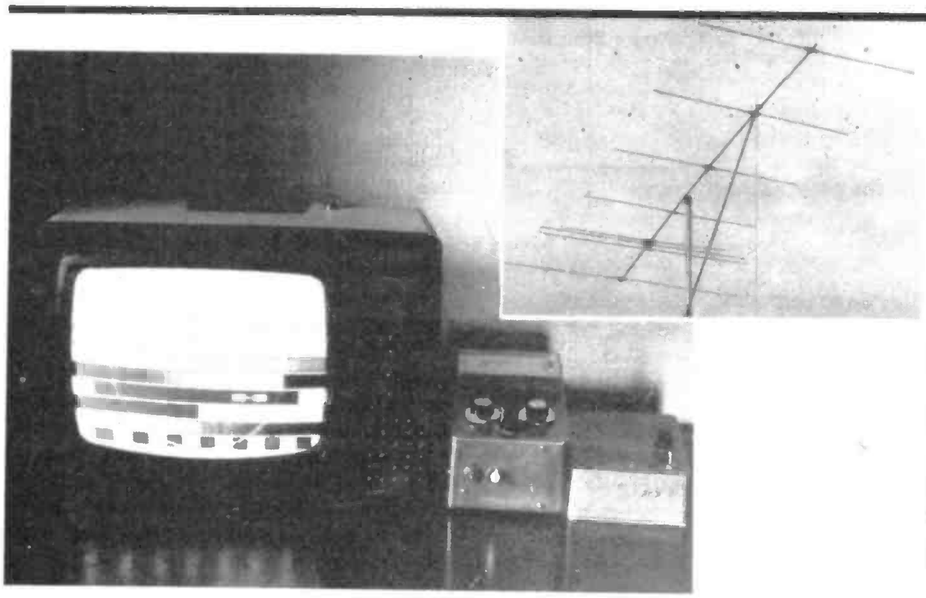
Our 11 IC design features four PCBs, one carries the RF front end, the synthesizer and frequency selector logic occupy another two and the IF and audio stages the fourth board.

4/6/10m PREAMPS

Tuned preamplifiers designed to complement the multiband up-converter published in this issue.

Small in size they exhibit a useful performance making them useful in systems where extra gain and selectivity is required.

R&EW — First with the news



DX-TV SETTING STARTED

Since Keith Hamer and Garry Smith began their regular DX-TV column we've had numerous enquiries from readers who wish to know more about the equipment needed for long distance TV reception.

All is explained next month when DX-TV receiving systems are examined in detail - from the aerial to the IF frequency conversion unit that provides an output suitable for a standard UK TV set.

MINI-DRILL CONTROLLER

The first of two practical implementations of the SMVF motor controller that Ray Marston introduces in this month's data file.

The design provides fully-variable speed control with self adjusting speed regulation making previously published designs based on 'variable DC voltage' or 'fixed frame pulse-width' principles look rather 'old-hat'.

ARTICLES DESCRIBED HERE ARE SCHEDULED, HOWEVER THE FINAL CONTENT MAY VARY TO SOME EXTENT.

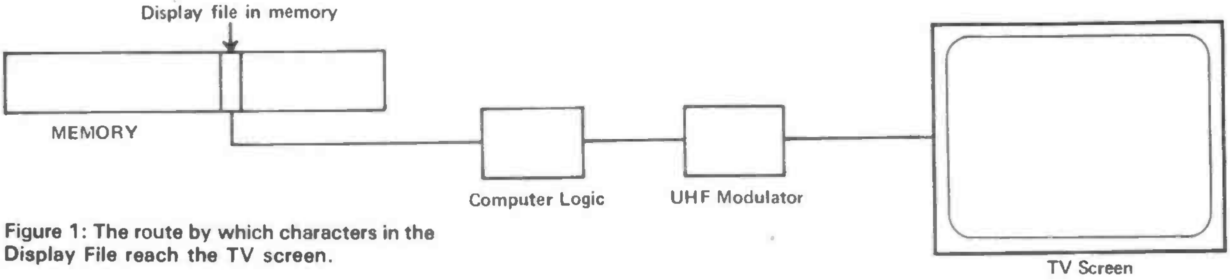


Figure 1: The route by which characters in the Display File reach the TV screen.

UNDERSTANDING THE ZX81 DISPLAY FILE

Allen Pardoe explains the ZX81's display file with the aid of some example programs.

The display file of the ZX81 is the part of the memory that contains the necessary information to tell the computer what to print on the TV screen. As the ZX81 goes about the business of computing, it keeps going to the display file, picking up information, and sending messages to the television; when and how it does this is governed by the hardware of the ZX81 (*Fig. 1*).

An unusual feature of the ZX81 display file is that it can move about in the memory map of the computer; it is not in a fixed memory area, starting at a particular address. The computer needs to know where this display file starts, and so it stores the address of the first part of the display file in an area of memory known as 'system variables'. The information on this part of the memory is to be found on pages 177 to 179 of the Sinclair handbook, and is outlined in *Fig. 2*. The particular address we are interested in is called D-FILE and is stored in two addresses in the systems variables, 16396 and 16397. To find the address in memory where the display file begins, the calculation:- peek 16396 + 256* peek 16397 is carried out. This gives the memory address where the display file starts in memory. The area of memory immediately before this stores the Basic programme you are using – so if you add more to the programme, then the address of the start of the display file must move up the memory to allow the programme into its proper area - (*Fig. 3*).

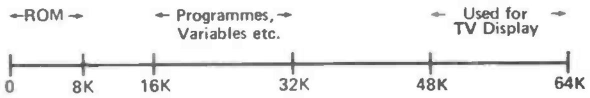


Figure 2(a): The organisation of memory.

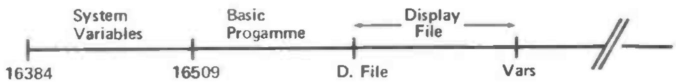


Figure 2(b): The position of the Display File within the ZX81's memory.

Figure 3(a): A small programme

Figure 3(b): Adding to a user programme causes the Display File to move up the memory map.

THE TWO TYPES OF DISPLAY FILE

The ZX81 has two types of display file, depending on the amount of memory available. In both cases the first address (D- FILE) contains the number 118.

1 IF THE MEMORY IS LESS THAN 3.25K

In this case the display file for an empty screen usually consists of only 25 bytes, each the code of NEWLINE (118); if the computer prints anything onto the screen (and so puts into the display file information on what is printed), then each line expands to hold the information, but is still terminated by the number 118 to tell the computer a newline is needed. The display file then gets bigger, depending on how much is to be printed on the screen.

IF THE MEMORY IS GREATER THAN 3.25K

The computer sets up a full sized display file, which consists of 24 lines, each of 32 spaces with a 33rd character in each line which tells the computer to go to a newline. If we again look at an empty screen, there are for each line 32 empty spaces (all 0) with a 33rd number for newline (118). If the computer starts to print anything onto the screen, then it must store that information in the display file, and so stores the correct codes for what is to be printed in the file. A typical empty line as stored in the display file is shown in *Fig. 4a.* together with a row showing a line of graphic symbols in *Fig. 4b*

00000000000000000000000000000000 118

Figure 4(a): An empty line stored in the

88888888888888888888888888888888 118

Figure 4(b): A line of graphics as stored in the Display File.

A bit of arithmetic will show that the display file in this second situation, with the memory greater than 3.25K, is 24 * 33 = 792 addresses, and so 792 bytes of memory are usually reserved for this purpose.

USING THE DISPLAY FILE

It is a simple matter to find out the position in memory of the start of the display file. Type in:-

PRINT PEEK 16396 + 256*PEEK16397
followed by NEWLINE

The result printed in the top left hand corner of the screen is the start address of the display file - with no Basic programme in the computer this should be 16509. You can show that the display file is mainly empty spaces (code 0) with a clear screen by typing in:-

PRINT PEEK 16510 (or any number up to 16509 + 792 = 17301)
followed by NEWLINE

In most cases the result is 0, showing an empty space in that position of the display file. However, you can also put a number into an address in the display file, and so get the computer to print a character on the screen instead of an empty space. With an empty screen, type in:-

POKE 16510,128
followed by NEWLINE

In this case a black square will appear in the top lefthand corner of the screen. This is the same result that is produced by the instructions:-

PRINT "■" (with an empty screen)
or PRINT AT 0,0; "■"
or PRINT AT 0,0;CHR$ 128
in each case followed by NEWLINE

In all these cases the net result is the same, and is obtained by the number 128 being put into the first address of the display file.

This idea can be expanded to print anything at all onto the screen, by putting the correct numbers into the correct positions in the display file. One way of thinking of this is shown in *Fig. 5*. Consider the display file as a set of 792 boxes, arranged 24 boxes high by 33 boxes across. The last box in each horizontal row is closed off for your purposes (it contains the number 118), and if you try to put a number other than 118 into it, the computer gets confused and all sorts of funny things may happen.

To put the numbers into the boxes you can use various processes. This is shown by the four programmes that follow; they vary from short Basic programmes that operate slowly, through a longer Basic programme that operates much more quickly, to the fast operation of a machine code programme.

Programme	No. of Lines	Length	Time Taken
1	24	494	9
2	21	476	4½
3	58	1137	2
4	2	203	Very Quick
		Bytes	Seconds

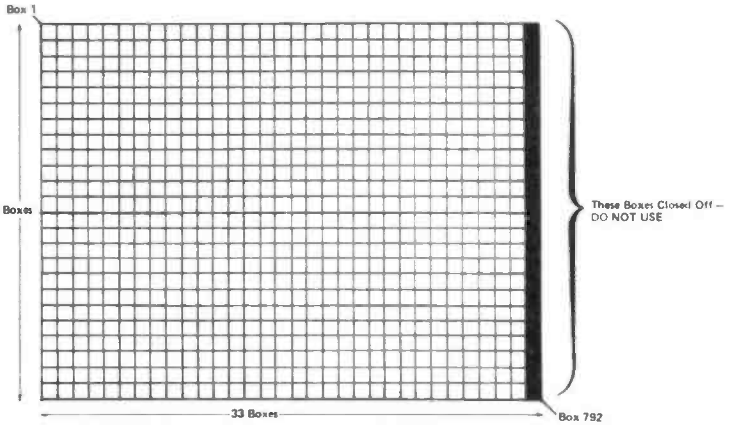


Figure 5: The organisation of the ZX81's display.

Programmes 1 and 2 are straightforward Basic ones; programme 3 simulates the processes operated by the machine code programme 4 - but by using BASIC to poke the numbers into the display file.

To load in the machine code, a loader programme is supplied. Type in:-

5 REM followed by 150 zeros
then press NEWLINE

Type in the loader programme when this is done, then press RUN and NEWLINE. The prompt (= inverse L) appears at the bottom of the screen. Type in each number in turn, followed by NEWLINE, and the computer prints up the address and the number entered. When the last number has been entered, type in a number greater than 255 at the next prompt to stop loading. LISTing should give the programm shown. Delete the loading programme by typing in number 10 to 80 in steps of ten, each time followed by NEWLINE. If you want to check the programme, a suitable programme is also supplied. Finally add:-

20 RAND USR 16514
followed by NEWLINE

PROGRAMME 1

```
  5 REM HELLO 1
 10 LET YO=18
 20 FOR Y=YO TO YO+9
 30 FOR X=0 TO 1
 40 PLOT 7+X,Y
 50 PLOT 13+X,Y
 60 PLOT 17+X,Y
 70 PLOT 27+X,Y
 80 PLOT 37+X,Y
 90 PLOT 47+X,Y
100 PLOT 53+X,Y
110 NEXT X
120 NEXT Y
130 FOR N=1 TO 5
140 FOR X=0 TO 1
150 PLOT 7+N,22+X
160 PLOT 17+N,22+X
170 PLOT 17+N,18+X
180 PLOT 17+N,26+X
190 PLOT 27+N,18+X
200 PLOT 37+N,18+X
210 PLOT 47+N,18+X
220 PLOT 47+N,26+X
230 NEXT X
240 NEXT N
250 STOP
```

PROGRAMME 2

```
305 REM HELLO 2
310 LET A=128
320 FOR N=1 TO 5
330 LET B=N+7
340 PRINT AT B,4;CHR$ A
350 PRINT AT B,7;CHR$ A
360 PRINT AT B,9;CHR$ A
370 PRINT AT B,14;CHR$ A
380 PRINT AT B,19;CHR$ A
390 PRINT AT B,24;CHR$ A
400 PRINT AT B,27;CHR$ A
410 NEXT N
420 FOR N=0 TO 3
430 PRINT AT 10,4+N;CHR$ A
440 PRINT AT 8,9+N;CHR$ A
450 PRINT AT 10,9+N;CHR$ A
460 PRINT AT 12,9+N;CHR$ A
470 PRINT AT 12,14+N;CHR$ A
480 PRINT AT 12,19+N;CHR$ A
490 PRINT AT 12,24+N;CHR$ A
500 PRINT AT 8,24+N;CHR$ A
510 NEXT N
520 STOP
```

PROGRAMME 3

```
 605 REM HELLO 3
 610 LET D=PEEK 16396+256*PEEK 1
6397
 620 LET A=128
 630 POKE D+269,A
 640 POKE D+272,A
 650 POKE D+274,A
 660 POKE D+275,A
 670 POKE D+276,A
 680 POKE D+277,A
 690 POKE D+279,A
 700 POKE D+284,A
 710 POKE D+289,A
 720 POKE D+290,A
 730 POKE D+291,A
 740 POKE D+292,A
 750 POKE D+302,A
 760 POKE D+305,A
 770 POKE D+307,A
 780 POKE D+312,A
 790 POKE D+317,A
 800 POKE D+322,A
 810 POKE D+325,A
 820 POKE D+335,A
 830 POKE D+336,A
 840 POKE D+337,A
 850 POKE D+338,A
 860 POKE D+340,A
 870 POKE D+341,A
 880 POKE D+342,A
 890 POKE D+343,A
 900 POKE D+345,A
 910 POKE D+350,A
 920 POKE D+355,A
 930 POKE D+358,A
 940 POKE D+368,A
 950 POKE D+371,A
 960 POKE D+373,A
 970 POKE D+378,A
 980 POKE D+383,A
 990 POKE D+388,A
1000 POKE D+391,A
1010 POKE D+401,A
1020 POKE D+404,A
1030 POKE D+406,A
1040 POKE D+407,A
1050 POKE D+408,A
1060 POKE D+409,A
1070 POKE D+411,A
1080 POKE D+412,A
1090 POKE D+413,A
1100 POKE D+414,A
1110 POKE D+416,A
1120 POKE D+417,A
1130 POKE D+418,A
1140 POKE D+419,A
1150 POKE D+421,A
1160 POKE D+422,A
1170 POKE D+423,A
1180 POKE D+424,A
```

CHECK PROGRAMME

```
  5 REM )■RNDE■RND FAST FOR GOS
UB ?£RND7??? FOR Y■? LPRINT F■
■ GOSUB PITAB ■RNDTAN S :■)■ <■ =
■ +■ -■ /■ 1■ 6■ 7■ 8■ 9■ J■ M■ O■ T■ Y■ ?■ ?■ ?
■ ?■ ?■ ?■ ?■ ?■ ?■ ?■ ?■ ?■ ?■ ?■ ?■ ?■
 379 ■■■■■■■■■■■■■■■■
■■■■■■■■000000000000000000
00000000000000
 20 FOR N=16514 TO 16660
 30 PRINT N;" ";PEEK N
 40 NEXT N
```

ALTERNATIVE CHECK PROGRAMME

```
10 PRINT AT 21,0;
20 FOR N=16514 TO 16664
30 SCROLL
40 PRINT N;" ";PEEK N
50 IF PEEK N=201 THEN STOP
60 NEXT N
```

THE MESSAGE

HELLO

The programme can now be run.

The machine code programme loads the number 128 into each 'box' of the display file where it is needed. Try changing the pattern by giving the instruction:

POKE 16533, x

where x is a number from 1 to 255 followed by NEWLINE

The character set on pages 181 to 187 of the manual should help you to decide what to expect.

The programme uses lines 16514 to 16546 to put the number in the 'box' of the display file. Lines 16547 and 16548 say how many boxes are used, and lines 16549 on are organised as pairs of numbers that give the box number (1 to 792) to be added to D-FILE.

The advantage of the machine code programme, apart from its short length and speed, is thsat the message or display can be moved quickly about the screen, with just a few changes in the machine code programme - but that's another story!

GOOD READING: Sinclair manual pages 171-174; 177-179; 181-187

■ R & EW

LOADER PROGRAMME

```
10 PRINT AT 21,0;
20 FOR N=16514 TO 16664
30 SCROLL
40 INPUT A
50 IF A>255 THEN STOP
60 PRINT N;" ";A
70 POKE N,A
80 NEXT N
```

PROGRAMME 4

```
  5 REM )RNDERND FAST FOR GOS
UB ?£RND7??? FOR Y? LPRINT F
 GOSUB PITAB RNDTAN S :?)( =
 + - / 1 5 7 8 9 J M O T Y ? ? ?
 ? ? ? ? ? ? ? ? ? ? ? ? ?
 379
0000000000000000000
0000000000000000
 20 RAND USR 16514
```

```
16514 17      16563 29      16612 1
16515 164     16564 1       16613 116
16516 64      16565 34      16614 1
16517 42      16566 1       16615 118
16518 163     16567 35      16616 1
16519 64      16568 1       16617 123
16520 229     16569 36      16618 1
16521 235     16570 1       16619 128
16522 237     16571 37      16620 1
16523 91      16572 1       16621 133
16524 12      16573 47      16622 1
16525 64      16574 1       16623 136
16526 35      16575 50      16624 1
16527 78      16576 1       16625 146
16528 35      16577 52      16626 1
16529 70      16578 1       16627 149
16530 235     16579 57      16628 1
16531 9       16580 1       16629 151
16532 62      16581 62      16630 1
16533 128     16582 1       16631 152
16534 119     16583 67      16632 1
16535 225     16584 1       16633 153
16536 43      16585 70      16634 1
16537 1       16586 1       16635 154
16538 0       16587 80      16636 1
16539 0       16588 1       16637 156
16540 167     16589 81      16638 1
16541 237     16590 1       16639 157
16542 66      16591 82      16640 1
16543 194     16592 1       16641 158
16544 136     16593 83      16642 1
16545 64      16594 1       16643 159
16546 201     16595 85      16644 1
16547 56      16596 1       16645 161
16548 0       16597 86      16646 1
16549 14      16598 1       16647 162
16550 1       16599 87      16648 1
16551 17      16600 1       16649 163
16552 1       16601 88      16650 1
16553 19      16602 1       16651 164
16554 1       16603 90      16652 1
16555 20      16604 1       16653 166
16556 1       16605 95      16654 1
16557 21      16606 1       16655 167
16558 1       16607 100     16656 1
16559 22      16608 1       16657 168
16560 1       16609 103     16658 1
16561 24      16610 1       16659 169
16562 1       16611 113     16660 1
```

Your Reactions	Circle No.		Circle No.
Immediately Interesting	82	Not Interested in this Topic	84
Possible Application	83	Bad Feature/Space Waster	85

THE GSC

ALTHOUGH A SEEMINGLY mundane piece of equipment, a function generator is something that every bench, if not home, should have. The GSC 2001 offers an acceptable performance and provides the usual range of waveforms, sine, square and triange, a DC offset facility and variable outputs at maximum levels of 5V and 50mV into a 600R load as well as a TTL compatible output.

OVERVIEW

The front panel layout is functional and although the unit has a distinctly 'plastic' feel about it, the construction looked sturdy enough to endure a rigorous life at the mercy of the heavy handed.

The selection of frequency is by means of five interlocking pushbutton switches while waveform selection is via a further three interlocked switches. Push on, push off switches at either end of the bank are responsible for power on/off and the selection of the DC offset facility. A calibrated knob, the scale being printed on the knob's perspex skit, provides a satisfactory method of quick and accurate selection of a precise frequency within the decade selected by the switch bank.

A dual concentric control provides control of both amplitude and of the DC offset. The amplitude control is not calibrated and setting up an accurate output voltage level would have to be accomplished with the aid of a 'scope. This lack of any decent output attenuator is a common failing in signal generators of the 2001's class and an extra amount of 'engineering' in this area, with a scale and perhaps a click-stop pot would go a long way to improving the 2001's appeal.

The hi-lo output levels are available at separate, Banana, type sockets as is the TTL output. A provision of a switch to select the two output levels would have obviated the need to swap wires around when making measurements although in practice this should not be that inconvenient. BNC output sockets would also have imparted a more professional look to the 2001.

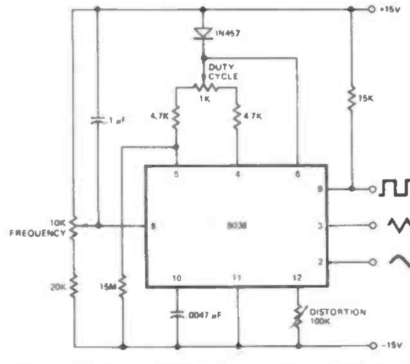
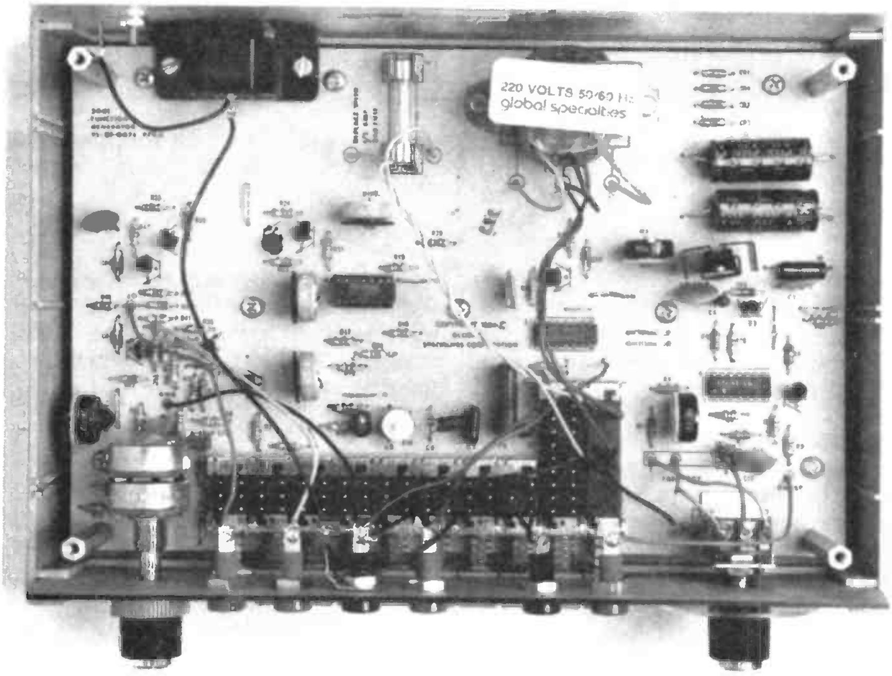


Figure 1: Basic 8038 circuit The 2001 design supplies The necessary output buffering And input conditioning circuitry

2001 FUNCTION GENERATOR

A sweepable function generator with a 1Hz to 100kHz range. Michael Graham assesses the model.



SPECIFICATIONS

Frequency Range:	1Hz to 100kHz in 5 decade ranges, push-button selectable; calibrated ±5% of setting at 10Hz, 100Hz, 1kHz, 10kHz.
Waveforms:	
Sine:	Less than 2% THD.
Triangle:	Linearity better than 1%
Square:	Rise and fall times under 100nsec (600R, 20p) for ± 2% time symmetry.
TTL Square:	Rise and fall times under 25nsec.
Sweep Range:	100:1 max., 10:1 linear range; 0 to ±10V. Sweep input impedance 30k.
Outputs:	
Hi:	0.1 - 10 Vp-p into 600R.
Lo:	1 - 100mV open circuit, 5 - 50mV into 600R; 40dB amplitude control ±0.5dB flat.
TTL Square:	drives 10TTL loads.
DC Offset:	switch selectable; ±5V into an open circuit; max offset (AC + DC before clipping) ±10V at Hi output and ±1V at Lo into open circuit, ±5V at Hi and ±5V at Lo into 600R load.

CIRCUIT DESCRIPTION

The 2001 adopts the modern approach to function generator design being based on the Intersil 8038 waveform generator IC. This does most of the donkey work with the rest of the circuitry concerning itself with input/output buffering and with the provision of the power supply rails.

The frequency vernier forms a potential divider across the ± 12V rails and has its high and low points set by two preset pots. Its output is buffered by a unity gain inverting op-amp stage. This output is then summed with the sweep input by a second op-amp and fed to the voltage control pin of the 8038.

The output of the 8038 is buffered by a two transistor amplifier stage before being passed to the amplitude pot. Some 'squaring up' of the square wave output is provided, this output also being taken, via a level shifting transistor, to four paralleled TTL NAND gates (7400).

The main amplifier follows standard Hi-Fi practice comprising a differential amplifier driving a complementary push-pull output pair overall gain of this stage is 11.

The power supply provides unregulated ± 17V rails for the output stage, the +12V rail is set by a three terminal regulator while the − 12V rail is derived from an inverting op-amp stage that has the +12V line as its input.

The +5V logic line is produced by a potential divider across the +12V line feeding an op-amp and transistor.

The remaining two sockets are responsible for accepting the sweep input voltage.

A CASE IN POINT

The rear panel of the instrument is blank with the exception of the IEC mains input socket. The provision of such a socket is a far better approach than, what one might call, a dedicated mains lead.

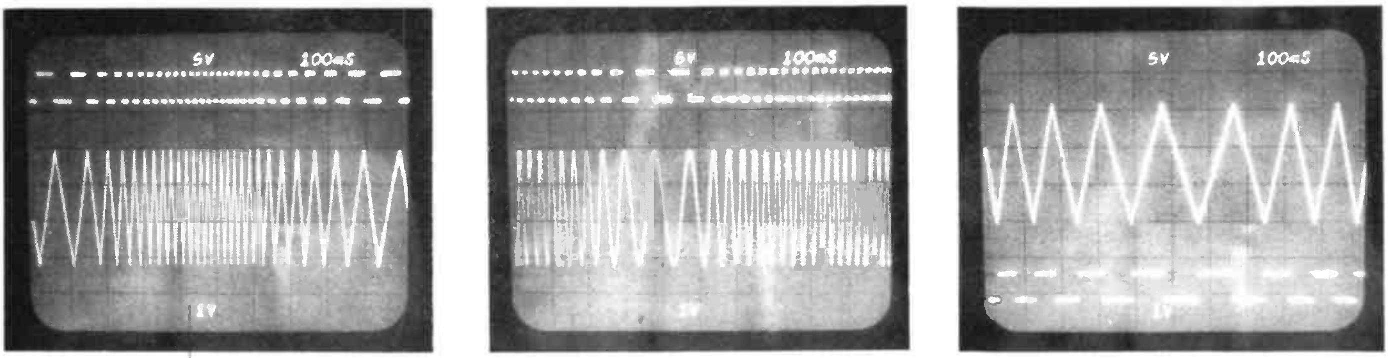
One criticism of the case is that the ventilation holes on the top and bottom do not have a grille behind them. Not too serious on the underside, but pieces of wire etc., could easily fall through the slots in the top of the case when they would land on the track side of the PCB and possibly cause damage to the circuit.

ILLUSTRATED INSTRUCTIONS

The instruction book provided with the 2001 is a comprehensive 20 pager that covers the units initial testing, indicates the

▶

GSC 2001 FUNCTION GENERATOR



Some photographs of the 2001 in action.

calibration procedures associated with the circuit and provides a full circuit diagram.

The manual also devotes several pages to the various uses to which the generator can be put. A particulary useful section this with tables showing the relationship between dBm, volts and power, speaker powers (8R and 4R) with associated output voltage (RMS), a guide to 'square-wave testing' amplifiers and of the RIAA frequency vs . gain characterisitc - a handy reference section all in all.

ON THE BENCH

In use the 2001 performed adequately and to spec. in all areas. The accompanying photographs show its performance and confirm the acceptable standard of the model.

The 2001 is a well built, functional unit that should provide reasonable performance. In its price range it stands up well and, except for the few minor points mentioned above, it was an excellent unit. At these price levels, the 2001 is around £100, its very much swings and roundabouts and while the failings of the 2001 may be absent from its competitors the 2001's strenghts will be other generator's weaknesses.

■ R & EW

Your Reactions..........	Circle No.
Immediately Interesting	36
Possible application	37
Not interested in this topic	38
Bad feature/space waster	39

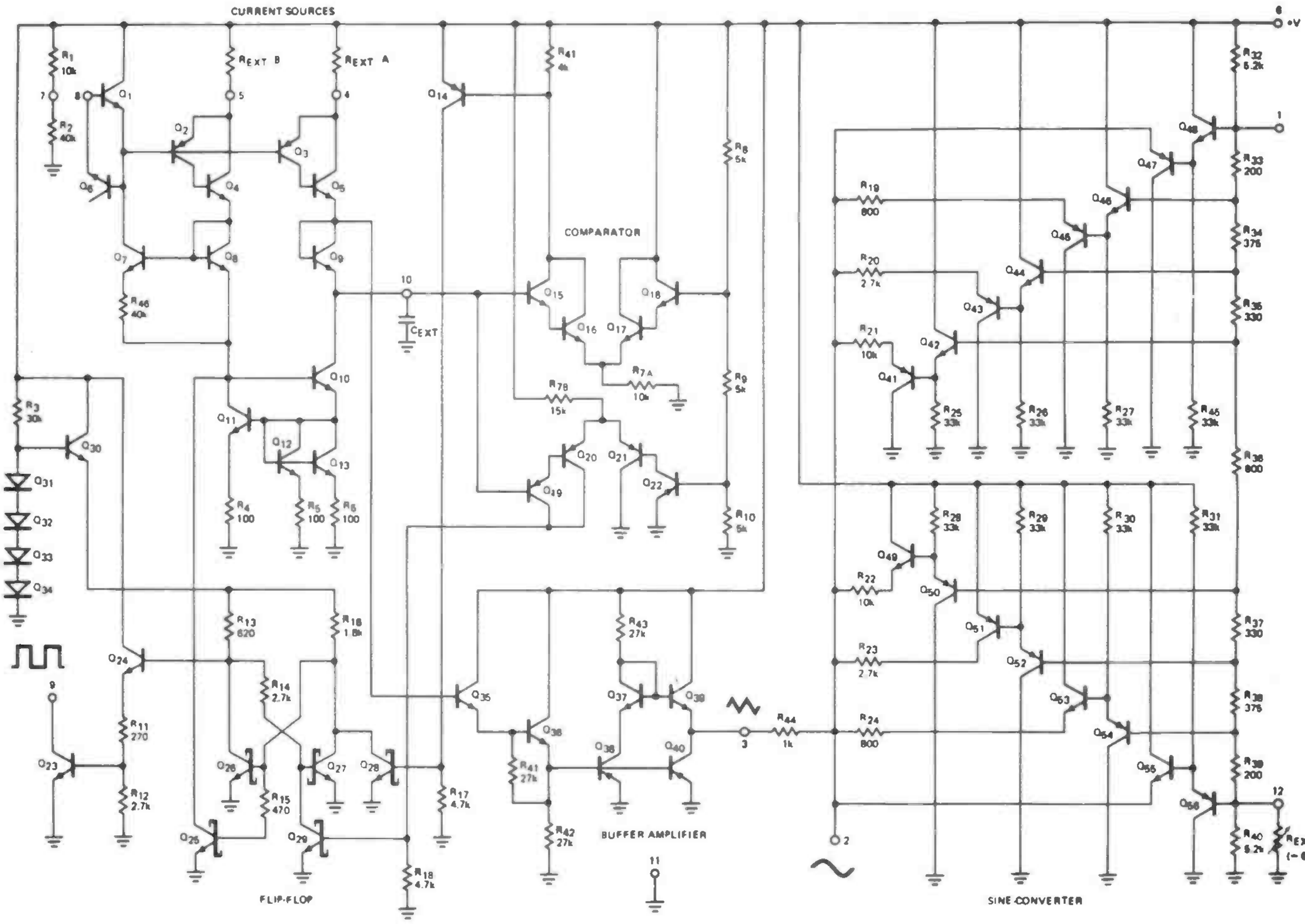


Figure 2 Internal schematic of the 8038, the IC that generates the basic waveforms of the 2001.

A GaAs FET PRE-AMPLIFIER FOR 1.3GHz

Note:
The NE72089 Ga As fet is available from Castle Microwave Ltd.,
2, Clarence Road, Windsor SL4 5AD
Tel: (07535) 56891.

Design by Roger Ray

A low noise GaAs fet amplifier built on a fibre glass PCB.

THIS PRE-AMPLIFIER DESIGN makes use of a GaAs mesfet the NE720 manufactured by NEC. This device costs under £20 and therefore brings into reach of the Amateur the possibility of constructing very low noise microwave amplifiers. GaAs fets are very sensitive to supply transients especially the gate which is only 1 micron thick in the case of the NE720. So to reduce the chance of expensive failure the design of a 'safe' bias supply is included in the article.

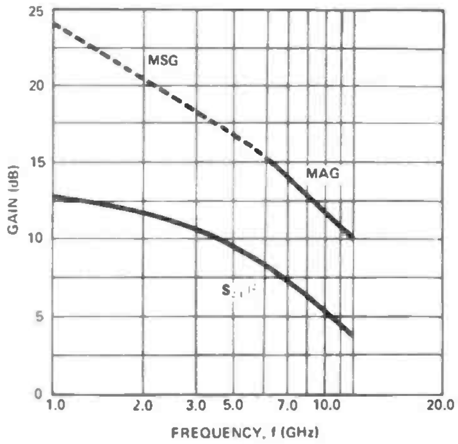


Figure 1a: Typical gain vs. frequency for the NE72089 at V_{DS} = 4V and I_{DS} = 30mA.

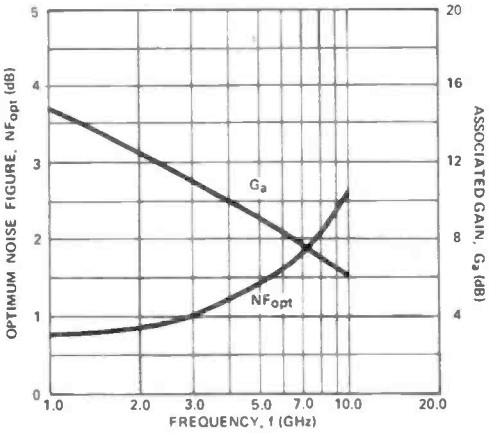


Figure 1b: Typical noise figure and associated gain vs. frequency for the NE72089 at V_{DS} = 3V and I_{DS} = 10mA.

NOISE FIGURE

From the 'Typical Noise Figure' graph (*Fig. 1*) it can be seen that the optimum noise figure at 1.3GHz is 0.8dB for the NE72089. The noise parameters for the NE21889 (*Fig2*) which appears to be a selected version of the NE72089 were used to determine the required source impedance. The required equivalent parallel source impedance at 1.3GHz is about 340R (314 + j136)R, using interpolation between the figures given for 1.0 and 1.5GHz. (Microwave noise and impedance matching will be the subject of a future article).

The noise figure of the prototype 1.3GHz pre-amplifier was measured using an Ailtech automatic noise measuring system (thanks John). The figure measured was 1.35dB which did not take account of extra losses in the cables used. This is about 0.5dB worse than that claimed on the manufacturers data sheet, the difference is likely to be due to losses in the input circuit caused by using standard fibre glass pcb.

A scaled up version of the layout will be built on PTFE board and measured as soon as time permits.

At this stage it is worth looking at the system noise figure which would result from using this pre-amplifier in front of a typical 23cm converter. As an example the figures are used from the **R&EW** 23cm converter (*Ref. 5*). The noise figures quoted for this converter was a measurement of double sideband noise. Taking due account of image noise the system calculations are as follows:

Total noise factor

$$Ftot = F1 + \frac{F2-1}{G1} + \frac{F3-1}{G1xG2} + \ldots\ldots$$

Where F is the noise factor expressed numerically and G is the gain expressed numercially (Not dB's).

Noise figure of the RF amplifier used in [5] is 2.5dB (1.78). As there is no image rejection after this amplifier image noise worsens this by 3dB to 5.5dB (3.56), Gain is 9dB (8).

Mixer loss = -8.5dB (0.14)
Mixer noise = 11.5dB (14.2)

Assuming an IF noise figure of 2dB (1.6) Noise figure of the 23cm converter system without pre-amplifier is as follows:

$$3.56 + \frac{14.2-1}{8} + \frac{1.6-1}{8x0.14}$$

$$3.56 + 1.65 + 0.54 = 5.75$$

System noise figure = 7.6dB

Noise figure calculations for the GaAs fet pre-amplifier, image filter and converter are as follows.

Noise figure of pre-amp 1.35dB (1.36)
Gain of pre-amp 14.0dB (25.1)
Loss through filter 2dB (0.63)

$$1.36 + \frac{3.56-1}{25.1x0.63} + \frac{14.2-1}{15.8x8} + \frac{1.6-1}{15.8x8x0.14}$$

$$1.36 + 0.16 + 0.104 + 0.034 = 1.658$$

System noise figure 2.2dB.

NOISE PARAMETERS FOR NE21889 (NE72089) VDS 3V ID 10MA

FREQ (GHz)	NF opt	GA opt	Γo opt	ψ deg.
1.0	0.4	16.0	0.69	33
1.5	0.4	16.9	0.82	46
2.0	0.5	14.9	0.44	56
2.5	0.7	13.7	0.46	57
3.0	0.48	14.3	0.59	73
3.5	0.7	14.4	0.62	86
4.0	1.14	13.3	0.67	104
4.5	1.49	12.6	0.63	119
5.0	1.4	11.9	0.47	126
5.5	1.4	11.4	0.55	139
6.0	1.5	11.1	0.52	147
6.5	1.7	10.9	0.43	159
7.0	1.7	10.7	0.44	173
7.5	1.9	10.5	0.50	–172

Figure 2.

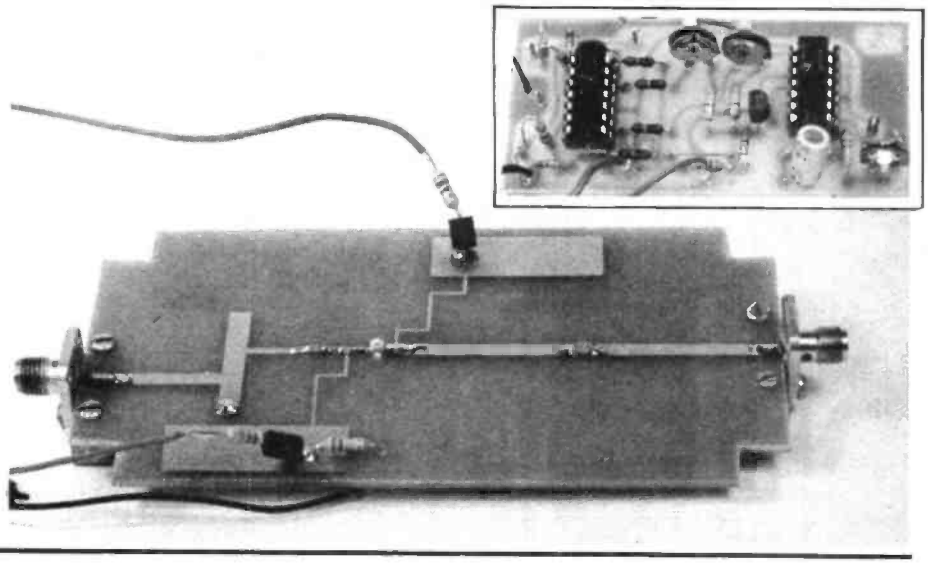
A number of conclusions can be drawn from these noise figure calculations.

1 Noise figure of the pre-amplifier and its gain to mask subsequent noise contributions, is the predominant figure in the calculations.

2 Image filtering is required between pre-amplifier and mixer.

3 The noise figure of the IF amplifier following a mixer with conversion loss should be as low as possible.

4 Feeder loss in front of the pre-amplifier adds directly to its noise figure and therefore overall system noise figure.



Ga As Fet Preamplifier with Power Supply (inset).

CIRCUIT DESCRIPTION

23CM GaAs FET PREAMPLIFIER

Circuit element for the RF pre-amplifier are formed as strip lines on the printed circuit board. Inductor L1 is a shortened quarter wave line resonated by a tuning screw (C1) to 1.3 GHz. the input is tapped onto the line near the grounded end via a short length of 50R track. The position of the tap for the gate is determined by the required source impedance of Q1 for minimum noise figure.

L2 on L4 are quarter-wave 100R lines acting as bias chokes, L2 being shortened to cancel some of the gate input capacity. L3 and L5 are 20R quarter-wave lines which act as short circuits at 1.3 GHz as well as appearing as capacitors to higher frequences. The output of Q1 is unmatched so 50R track connects the drain to the output connector. Bias voltage (V_{GS}) is supplied through R1 and a ferrite bead choke to L3, R3 is included to keep the gate tied to ground when the supplies are disconnected for protection. Drain supply (V_{DS}) is applied in a similar manner to the gate bias, through resistor R2.

GaAs FET POWER SUPPLY

IC1a forms an integrator with its feedback capacitor C1. When the +/- 15 volt supply is turned on IC1a ramps on allowing Vds and -Vgs also to ramp on. VR1 controls the drain supply voltage (Vds). IC16 and Q1 form a constant voltage regulator, allowing Vds to be adjusted between 2.8 and 3.2 volts. Constant drain current is maintained by comparator ICa. VR2 allows the drain current to be adjusted between 8 and 20mA, by supplying the required negative bias to the gate (-Vgs). The circuitry around IC2b is identical to that around IC2a, it allows the drain current to be set independently for a second device by VR3. Supply voltage is however referenced to the drain voltage on the first device (Vds 1).

Zener diode D1 forms a negative supply referenced to the voltage at the emitter of Q1, while D2 and D3 act as protection devices limiting gate voltage to a maximum negative voltage of - 3.1volts.

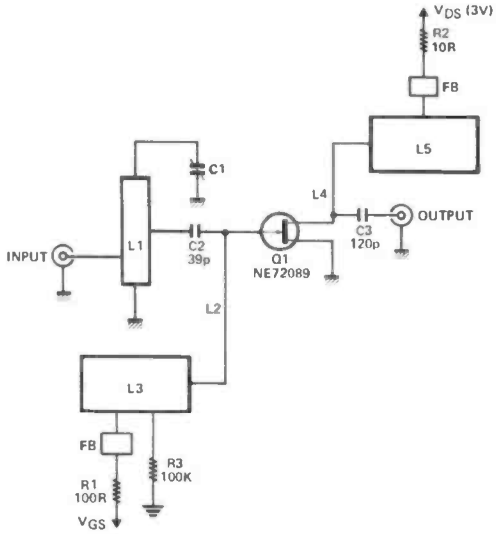


Figure 4: Pre-amplifier Circuit Diagram.

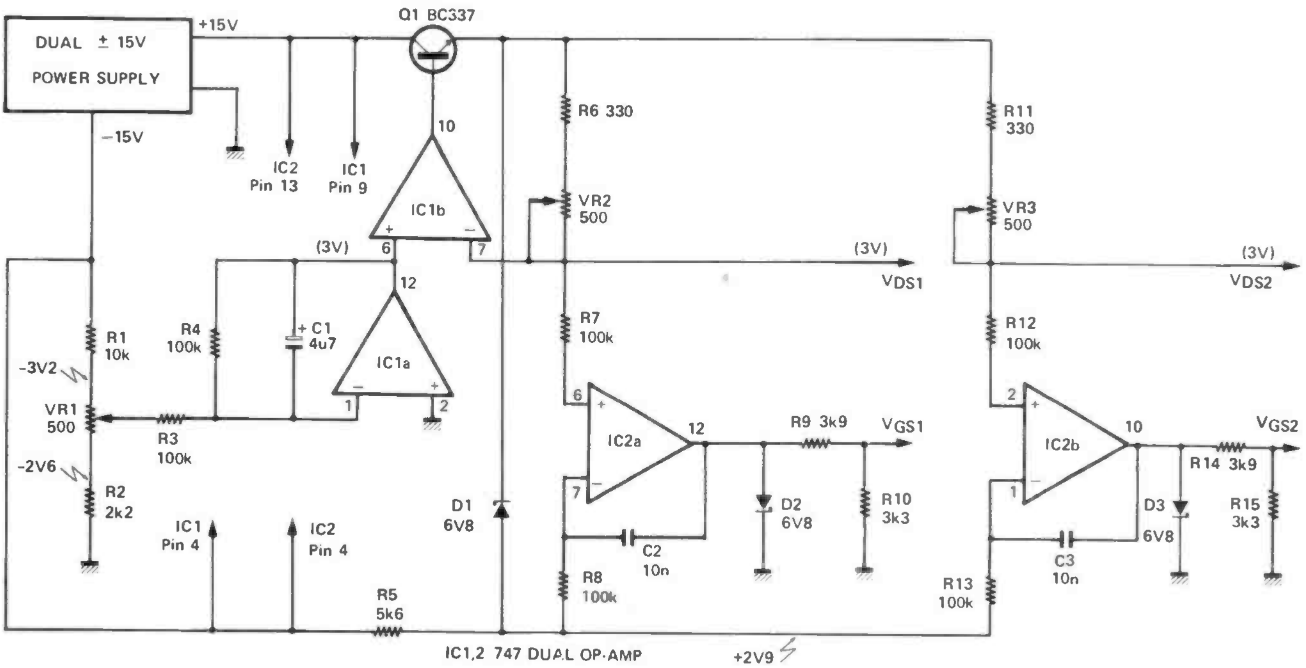


Figure 3: Power Supply Circuit Diagram.

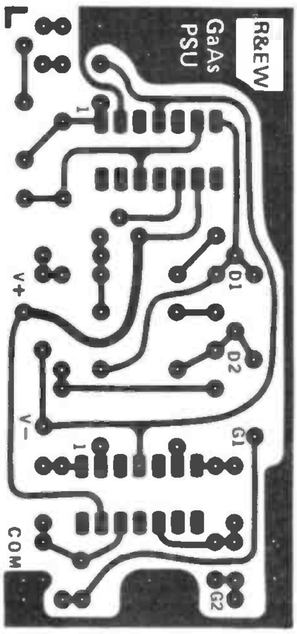


Figure 5: Power Supply PCB Foil Pattern.

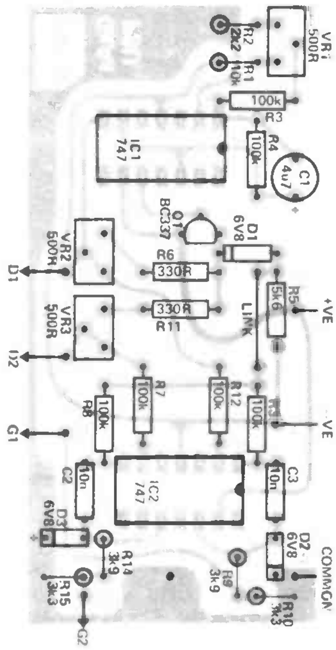


Figure 6: Power Supply Component Overlay.

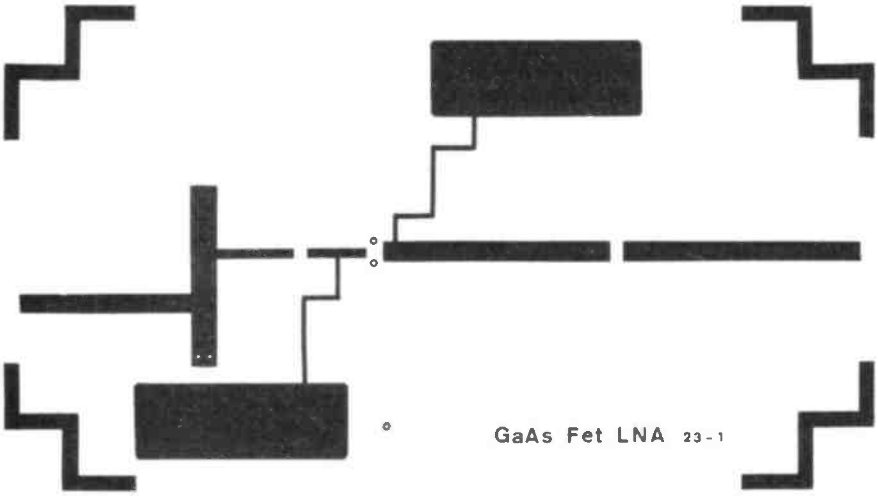


Figure 7: Pre-amplifier PCB Foil Pattern.

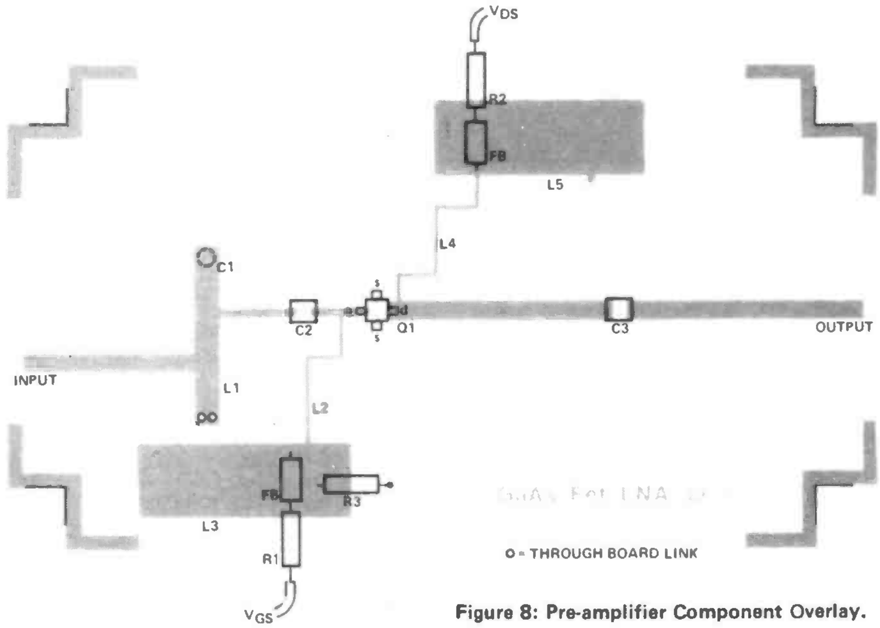


Figure 8: Pre-amplifier Component Overlay.

CONSTRUCTION

The power supply board is constructed as shown in the overlay *(Fig 6)* on single sided PCB. When built, it is a good idea to test the operation of the board by using it to bias a cheap ordinary FET. Operation is such that this sort of dynamic test is required to properly check the operation of the bias supply. VR1 is used to set the drain supply, nominally 3VO. VR2 adjusts the drain current for device 1 by varying gate bias, with a conventional fet the range will be somewhat restricted, but should be of the right order (10-20mA). Repeat the test with the fet in the position of the second device and check that VR3 varies its drain current.

The pre-amplifier is built on 1.6mm thick double-sided glass fibre pcb. Etch the top of the board as shown in *Fig 7* leaving the underside unetched as a continuous earth plane. The holes are drilled using a 1.1mm drill, the two positions marked ○ are thro' board links made with 1mm diameter wire and soldered top and bottom. Chip capacitors C2 and C3 are now positioned and soldered using the minimum amount of heat to make an effective joint. Resistor R3 is soldered in position between L3 and the earth plane. Construction of the board is now complete with the exception of the GaAs fet Q1.

Precautions need to be taken to avoid static damage to the GaAs fet. The NE72089 appears to be fairly robust as GaAs fets go, although its better to be safe than sorry. Firstly, prepare a work surface consisting of a sheet of aluminium or copper clad pcb. Make sure the assembler is at the same potential as the work surface by wrapping a length of bare wire around the assembler's wrist and connecting it to the work surface. Place the fet's protective package on the work surface and shake out the device. Form the source leads so that they will fit through the two holes in the board, taking care not to touch the gate (lead with 45° cut). Insert the GaAs fet into the circuit board with the gate towards the input. With the device firmly against the board bend the source leads flat against the back of the board. Use either a battery soldering iron or a mains one unplugged but earthed to the work surface. Solder the source leads first and then the drain followed by the gate. the completed board can now be fitted into the die cast box. At the input and output connectors use copper foil to make a good earth connection between the ground plane and the connector earth. Capacitor C1 is formed by drilling and tapping a 2BA or similar size screw in the lid of the box so that it is positioned above the input line L1 at the point marked by a dotted circle on the overlay.

The amplifier is now ready for testing, connect up the bias supply and switch on. Monitor the drain current and adjust the bias supply for a drain current of 10mA. If all is well peak the tuning screw C1 for maximum gain. If noise measuring facilities are available the drain current (ID) can be adjusted to produce a minimum noise figure.

INSTALLATION

To make use of the low noise figure provided by the pre- amplifier, image filtering should be provided after the pre- amplifier if not already integral in the converter used. Suitable filters are described in references 3 and 4 which give insertion losses close to 1dB. Printed circuit filters on fibre glass board are too broad and lossy to be suitable for this application. For reasons already mentioned low loss cable should be used between aerial and input together with low loss connectors such as SMA or TNC. Batteries can be used as an alternative to the bias supply described. A battery holder intended for 4 dry cells can provide the required positive and negative supply, the centre tap being earthed. In this case the bias should be taken through a 47K potentiometer to allow adjustment of drain current.

For optimum results with the R&EW23cm converter (*Ref. 4*), capacitors with thick leads should be used for C1,2,4,5,7 and 10 in that converter. If available chip capacitors can be used to give around a 1dB increase in gain. The optimum value for R4 when used on a 10 volt supply is 220R, any sign of instability in the RF amplifier can be cured by decoupling R1(680R) with a 100n monolithic capacitor. One final warning about handling GaAs fets, do not try measuring between leads with a multimeter the voltage spike introduced can be destructive!

COMPONENTS LIST PRE–AMP

Resistors (¼W 5%)

R1	100R
R2	10R
R3	100K
Capacitors	
C1	See text
C2	39p chip capacitor
C3	120p chip capacitor
Semiconductors	
Q1	NE72089 (NEC)
Miscellaneous	
FX1115 ferrite bead (2)	
PCB	
Die-cast box	
Connectors	

GaAs FET POWER SUPPLY

Resistors (¼W 5%)

R1	10k
R2	2k2
R3,4,7,8,12,13	100k
R5	5k6
R6,11	330R
R9,14	3k9
R10,15	3k3
VR1,2,3	500R preset
Capacitors	
C1	4u7 16V electrolytic
C2,3	10n ceramic
Semiconductors	
Q1	BC337
IC1,2	UA747
D1,2,3	6V8 zener
Miscellaneous	
PCB	

References

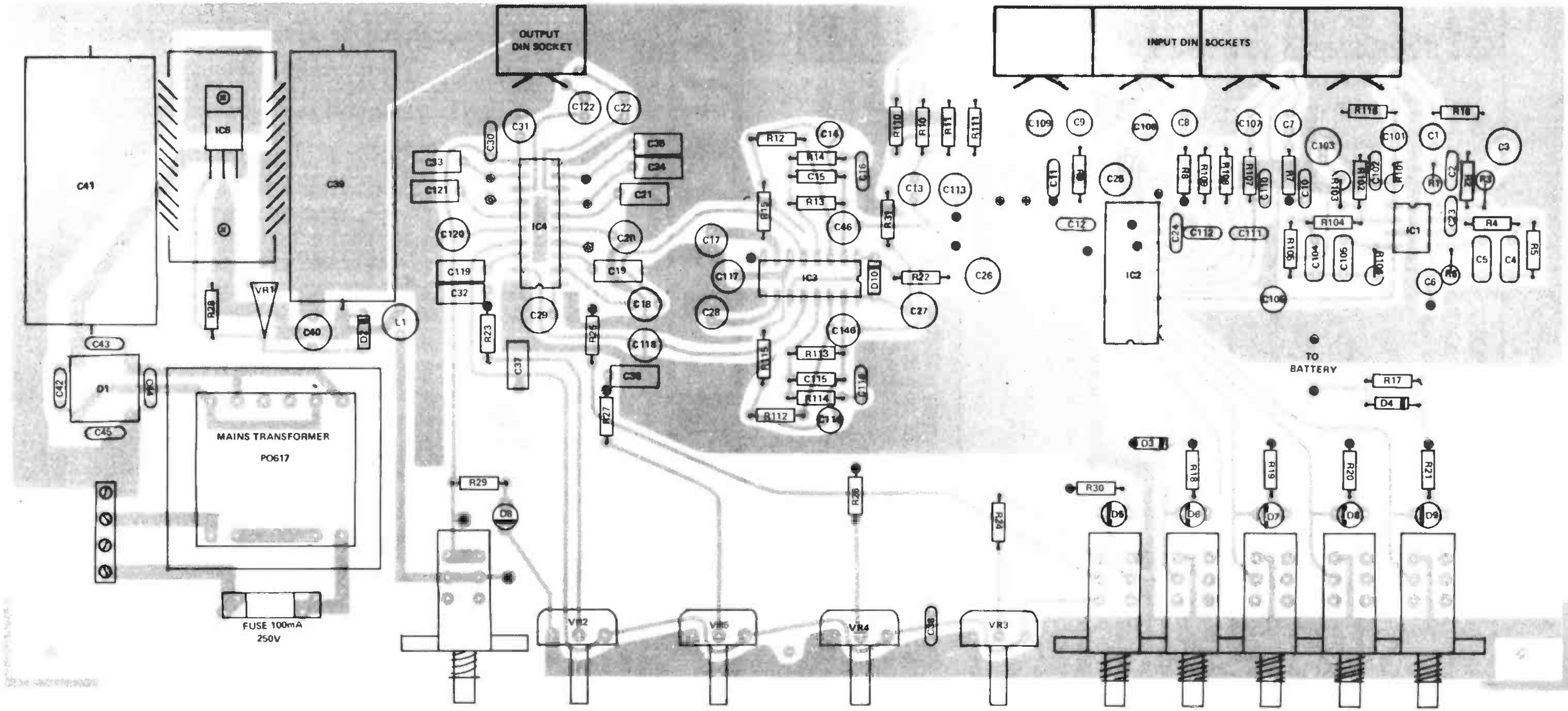
1. NE218, NE720 Transistor Data; Nippon Electric Co. Ltd. 1981
2. AN80901, AN80902 Application Notes; Nippon Electric Co. Ltd. 1980
3. Suckling C., Microwaves, Radio Communication; June/July 1980.
4. Volhardt , Narrowband Filters for the 24cm,13cm and 9cm Bands; VHF Communications 1/78.
5. Ray R., 23cm/2m/10m Converter; R&EW March 1982.

■ R & EW

Your Reactions......	Circle No.
Excellent - will make one	32
Interesting - might make one	33
Seen Better	34
Comments	35

DC PREAMPLIFIER Part 2

A design that offers the possibility of remote control.



PARTS LIST

Resistors (all 0.25W 5%)

R1, R101	470R
R2, R102	100k
R3, R103	270R
R4, R104	2k2
R5, R105	12k
R6, R106	270k
R7,8,9,18,19,20, 21, 29,30,107, 108, 109	1k
R10,11,16,23, 24, 25,26,27,110,111 116	47k
R12,13,31,112,113	27k
R14,22,114	680R
R15115	3k3
R17	8k2
R28	220R
VR1	5k Preset
VR2,3,4,5	100k linear

Capacitors

C1, 101	1u 35V
C2,102	100p ceramic
C3,26,27,103	100u 16V
C4,104	3n3 Mylar
C5,105	1n Mylar
C6,106	10u 35V
C7,8,9,13,14,18, 20,25,107,108,109, 113,114,118,120	10u 16V
C10,11,12,110, 111,112	68p ceramic
C15,115	47p ceramic
C16,116	150p ceramic
C1728,29,117	47u 16V
C19,119	10n polycarbon
C21,121	330n polycarbon
C22,122	4u7 16V
C23,24,30,38, 42,43,44,45	100n ceramic
C31,	100u ceramic
C32,33,34,35,36 37	220n polycarbon
C39	4700u 16V electrolytic
C40	10u 25V
C41	4700u 35V

Semiconductors

D1	Bridge Rect W005
D2,3	IN4001
D4,10	IN4148
D5,6,7,8,9,11	5mm Red LED
IC1	NE542
IC2	TK10321
IC3	KB4438
IC4	LM1035[
IC5	LM317K

Switches

SW1,2,3,4	2pMO
SW5 ,6	2p Latching

Miscellaneous

5 x 5 pin DIN PC mount, fuse 100mA and holder; mains transformer; P 0617

VIDEO NEWS

National Panasonic's latest recorder, the NV-7800, offers stereo sound.

Peter Luke, our video man, has been looking into Big Screen, Stereo Video this month. He also has the latest on the 'clash of the formats'.

IN AN EXTRAORDINARY volte face that is likely to put the market penetration of the Video 2000 system simply years behind, ITT have decided to market VHS format machines under their brand name. Until recently only V2000 machines bore the ITT logo, the company having reached a marketing agreement with Philips some time ago.

According to an ITT spokesperson after 'initial teething troubles' the company were 'pleased with the Video 2000's performance' but that 'in order to offer to customer a wider choice' VHS machines were to be added to their range. Philips were said to 'understand' ITT's position.

It is doubtful whether the men of Eindhoven are as polite about the ITT move in private.

The Video 2000 format has indeed had its share of technical bugs during its early days and has not 'taken off' quite as fast as the Philips/Grundig boys might have hoped but there can be no doubt that Philips will cling to the system until death do they part. Remember Philips and the DNL vs. Dolby saga. Philips invented the compact cassette and developed the DNL noise reduction system. Along came Ray Dolby with, in everyone but Philips' eyes, a far superior system. Soon all 'Hi-Fi' cassette recorders, bar Philips, had Dolby. A 'head-in-the-sand' attitude was maintained by Philips for many years until grudgingly they paid Ray his royalty and added Dolby to their recorders, in addition to DNL of course.

In view of this sort of behaviour from Philips in the past it seems certain they'll stick to V2000 and will not look too kindly on any defectors in the camp.

The ITT (once Philips or Hitachi depending on format) range now comprises a basic VHS machine (£500), a feature laden VHS model (£670) with the V2000 model weighing in at an intermediate (£540).

The budget machine is designated the Telerecorder (quaint isn't it?) 3913 and for its price offers a fair sprinkling of features. Search, still frame and audio dub are offered the main concession to the low price being the absence of remote control although a wired unit is available as an optional extra. The timer too is rather limited, being of a one event, 10 day specification.

The 'all singing' VHS machine has just about everything that is anything. The front loading machine, in addition to all the 'trick' video functions comes complete with stereo sound and Dolby.

The timer has an eight event, 14 day capability and the machine, Telerecorder 3943, has a IR remote controlunit supplied as standard.

The timer has an eight event, 14 day capability and the machine, Telerecorder 3943, has a IR remote control unit supplied as standard.

The V2000 format machine is designated VR580 (whatever happened to Telerecorder?) and offers the eight hour flip-over cassette of the Philips format. Dynamic Track Following gives good performance with no noise bars evident on 'trick' video speeds. The timer is a five event, 15 day design - quite adequate for most needs.

Another new model for ITT is the Telerecorder TRP 3833. This forms the basis of a portable VHS system, a teletuner TT3833 completing a home set up for off-air recording while accesories like the colourscope 3084 camera, PB 3833 battery pack and CTC 3833 carry cart provide a 'movie making' system.

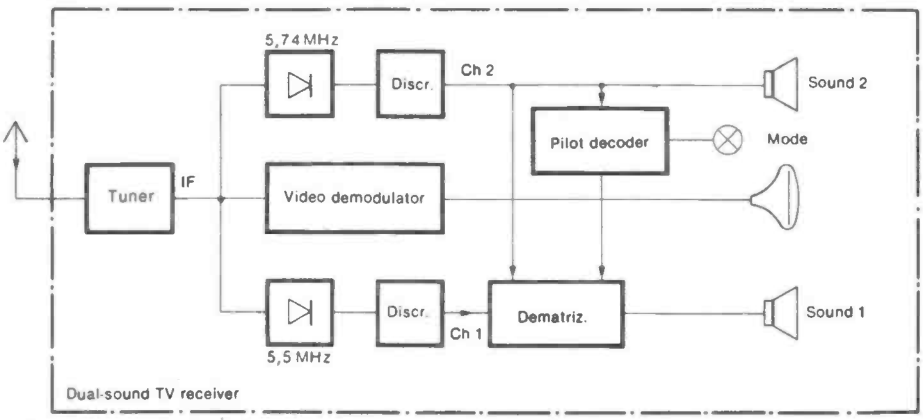
£600 will get you the recorder and tuner, the camera costs about £550.

A good range of video products from ITT who are now in the unique position of flying their corporate flag on two different, although we can no longer say competing, systems.

Is there any truth in the rumour that an ITT 7 Beta recorder is on the cards?

HEARING DOUBLE

The Hitachi/ITT stereo recorder is soon to be joined by another VHS stereo machine,



Block diagram of a typical stereo TV receiver using the dual carrier approach adopted in Germany.

the Panasonic NV-7800.

We are told that a number of duplicating houses have been using Panasonic industrial copying machines for some time and that this software has just been waiting for the hardware, in the shape of the NV-7800, to turn up. Re-organise the Hi-Fi to place one speaker either side of the TV and this development should go some way to making sit-in cinema more of an occasion. We hope to have more to say about the NV-7800 soon for it is an interesting machine not only in its stereo capability but in its use of Dolby B and C noise reduction and a special tape transport system that offers variable slow motion from 1/4 to 1/30 of normal speed.

The only depressing note is that price is yet to be fixed but it will almost certainly hover around the £700 mark.

GERMANY CALLING

The launch of stereo video recorders is bound to stimulate interest in stereo televisions and the prospects for stereo transmissions from the BBC and IBA.

Already we have seen a couple of Pseudo stereo TVs (from Grundig and Tanberg) these sets incorporating comb filters to process off-air sound signals to give an impression of width. In Germany - from where the above sets hail - stereo TV is a reality. As the PAL system adopted in this country was developed by the Germans, as look at their system may give us a taste of things to come.

The system adopted in Germany uses a dual carrier with the two sound channels being frequency modulated onto carriers 5.5MHz above vision (the German 'mono' standard) and 5.742MHz above vision (the second channel).

The dual carrier approach was adopted rather than a pulse-code- modulation system on grounds of cost while multiplex techniques (as VHF stereo radio) were rejected as one of the uses for stereo TV is seen as dual language transmission - clearly not possible with a multiplex method.

The diagram (Fig 1) shows the basic outline of a TV set with stereo capability and it can be seen that, in addition to the conventional sound channel, an additional intercarrier demodulator is required. Operation of the demodulators is controlled by a demodulated pilot signal that is amplitude modulated onto the second channel.

Editorial budgets have not permitted a trip to Germany to assess the system in operation and one wonders whether program makers working to tight TV production schedules will be able to make much creative use of stereo in anything other than 'music' shows.

If anybody out there has seen (heard) the German stereo system in operation perhap's you'd write and let us know about it.

PROJECTION BOX

Its been a busy month for ITT, for not only have they added VHS machines to their video recorder range but they've also launched a projection TV system.

ITT's Cinevision 200 projection TV system give excellent picture quality.

The Cinevision 200 consists of a projector box and a 124 x 166cm silvered parabolic screen. The projector uses the Kloss Video Corporation's Novabeam projection tube, a tube which incorporates the mirror objective and cathode ray tube in a single sealed unit - thus avoiding deterioration in picture quality due to dust collection and mechanical movement.

The chassis is based on a standard ITT design making the projector as easy to operate as a colour TV.

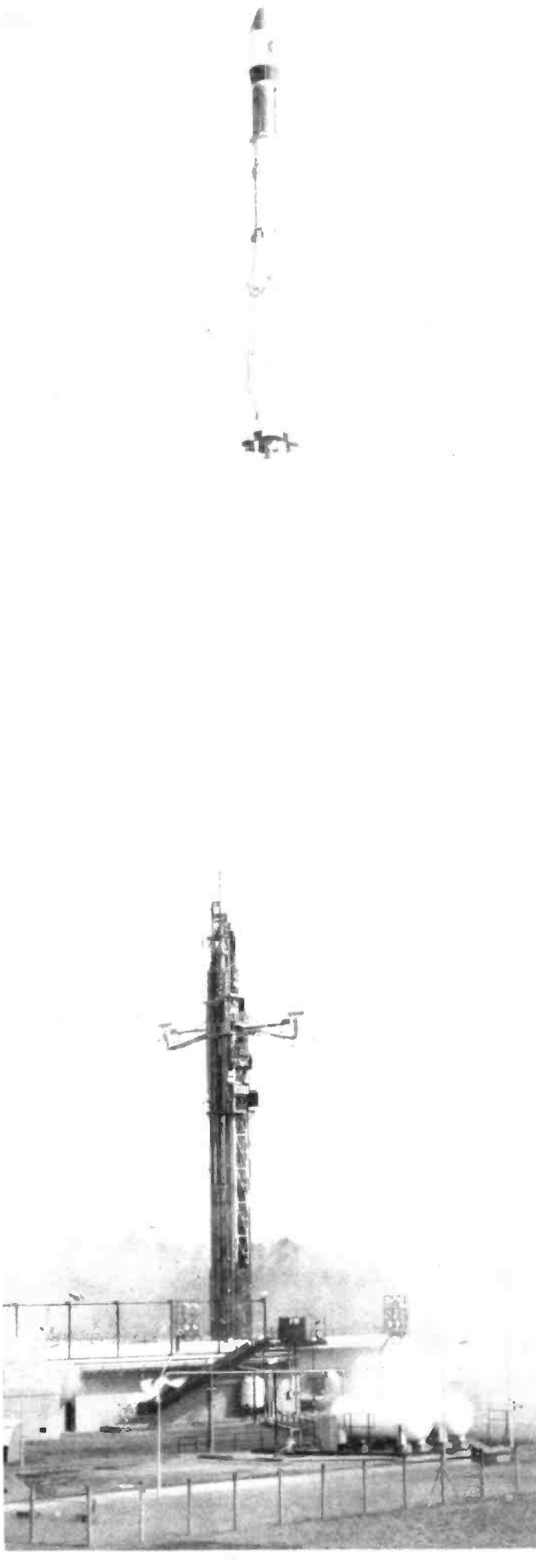
The screen display shown in the accompanying photograph does not do the system justice, the results obtained at the launch being excellent. The picture produced was bright and sharp without any deterioration in quality towards the edges.

The system will sell for about £3,500 which may seem expensive when compared to some of the £1,000 projection systems around at present. Most of these lower cost projectors however consist of a standard TV chassis with over run CRT and a lens. The performance they offer is rather 'mickey-mouse' in general and certainly not in the league of the ITT machine.

■ R & EW

Your Reactions..........	Circle No.
Immediately Interesting	60
Possible application	61
Not interested in this topic	62
Bad feature/space waster	63

The range of video recorders offered by ITT now includes both V- 2000 and VHS format machines.



METEOSAT

A GEOSTATIONARY WEATHER SATELLITE

Geostationary weather satellites open up a new field to the Radio Amateur. Terry Weatherley describes the Meteosat Spacecraft and its associated ground system before going on to describe his own receiving station.

METEOSAT IS THE EUROPEAN contribution to a system of five geostationary satellites positioned over the equator at intervals of about 70°B. The system is, in turn, a contribution to the Global Atmospheric Research Programme and to the World Weather Watch of the World Meteorological Organisation.

The successful launch of Ariane on the 19th June, 1981 placed in orbit the European Space Agency's Meteorological Satellite METEOSAT 2. This was a relacement satellite for Meteosat 1 launched on 23rd November, 1977.

Meteosat's station is the point $0^{\circ}.0'$ above the Gulf of Guinea. The ground station used for data acquisition, telemetry and tracking, is situated 50km south-east of Darmstadt in the Federal Republic of Germany. This is linked to the control centre and ground computer system by land line. Both centres are located in Darmstadt itself. The main receiving dish is 15m in diameter and can be steered either manually or under program control, but normally it is self steering since it is able to lock onto and track spacecraft telemetry signals.

At present the ground computer is a SIEMENS R30 with 512K core and two 66M discs. It is intended to change the main computer system and software should be complete by mid '82. Until that time a full dissemination service is not available.

The principal payload of the satellite is the multispectral radiometer, which provides both visible and infra red images of the earth's disc as seen from geostationary orbit. The imaging instrument is a Ritchey-Chretien reflecting telescope to which is attached a system of mirrors that reflect the radiation onto the appropriate detectors. Rotation of the satellite is such that the spin axis is nominally north south, while the telescope is stepped vertically from south to north and rotated through an angle of 1.25×10^{-4}.

There are two identical adjacent visible light channels in the 0.4 to 1.1um spectral band. A thermal infra red channel (10.5 - 12.5um) and a water vapour channel (5.7 - 7.1um).

Each infra red image is composed of 2500 lines and 2500 pixels giving a spatial resolution of 5km. The resolution in the visible channels is twice this if both channels are operated.

Communications between the spacecraft and the ground are in three frequency bands:- S band, used to transmit the raw image to the ground, to relay processed data to users, and for ranging and housekeeping transmissions; UHF, used to receive data transmitted by the remote data collection platforms; VHF, used for telemetry telecommand and ranging during the launch phase, as well as S band back-up. The frequency used by Meteosat 2 for the transmission of raw data is 1686.833 MHz.

While in orbit the attitude of the spacecraft is controlled by four earth sensors. Two sensors scan the earth's disc and provide pulses at the earth/space, space/earth transitions. Two sun-slit sensors give one pulse on each revolution of the satellite. Two on board accelerometers give information on the satellite nutation. This data is transmitted to the ground with each image data line and thus

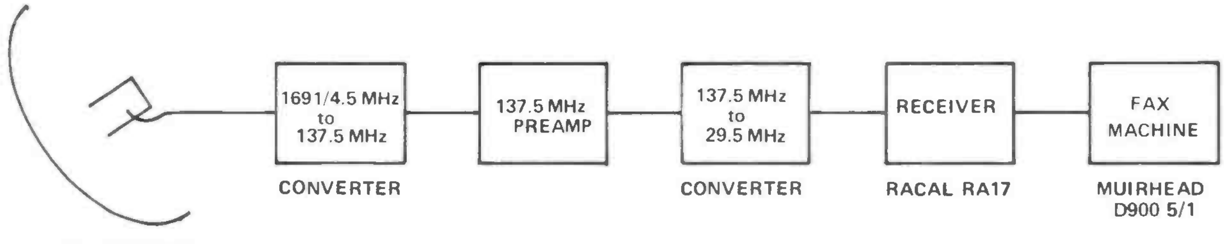


Figure 3: Block Diagram of a Meteosat receiving station.

gives constant information about spacecraft attitude. The same data is used internally to activate the image sampling during each earth scan and for directing the spacecraft antennas.

The satellite is powered by silicon cells on the main body of the spacecraft. The maximum power available from the solar cells is 280 watts dropping to about 200 watts after three years of life. The main voltage bus is regulated around 28 volts and the excess power is used to charge 16 series nicads with a capacity of 70A hours. This back-up power is available to the satellite during periods when the sun is eclipsed by the earth. There are two eclipse seasons from 1st March to 15th April and 1st September to 15th October. The eclipse can last for up to two hours from approx. 2300 hours to 0100 UT.

There is a period of data loss when the sun, spacecraft and Darmstadt are in direct line. These are 3rd March at 12h 04m and again on the 9th October.

The raw data received at Darmstadt is in line by line format in the original order as sampled by the sensors. Each line is thus comprised of 2560 32-bit words each of which contains visible, infra red and possibly water vapour data, corresponding to the sampling period of the radiometer. Because sensors are located in positions in the focal plane of the instrument the data values from the three channels do not correspond to one earth location.

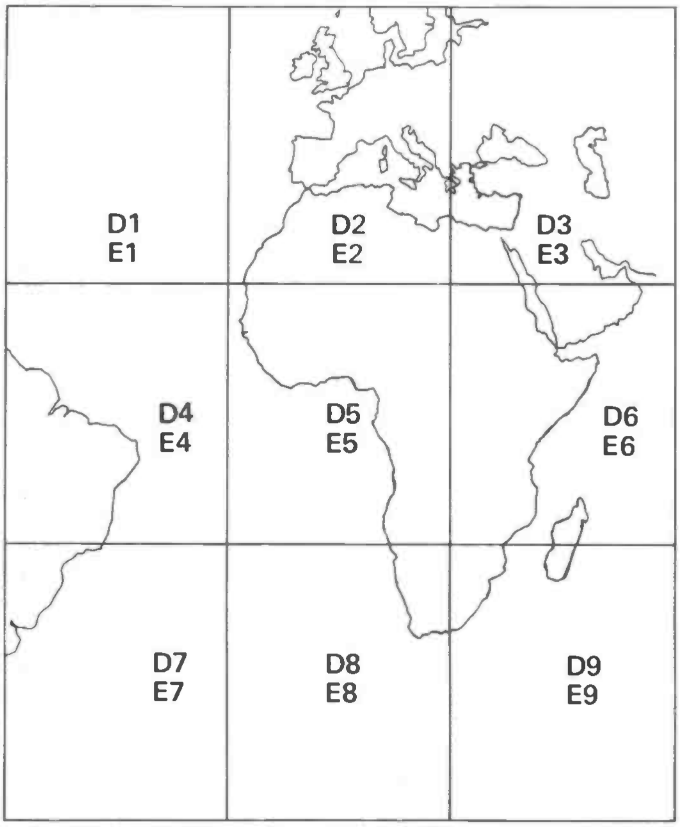


Figure 1: Area covered by D Format.

The data is computer processed, enhanced checked and corrected for distortion to produce a high resolution image prior to being retransmitted for dissemination by the spacecraft to user stations.

The transmissions being considered in this article are the WEFAX transmissions, which are compatible with the transmissions from the polar orbiting weather satellites. Each picture consists of 800 lines transmitted at a rate of 4 lines per second, pulse standard stop and start signals. The total time to transmit one picture is 3 minutes 43 seconds.

Pictures are transmitted according to a prearranged timetable and the area covered by the picture determined by a code letter. *Figs. 1* and *2* show the areas covered by the C and D formats. It is usual for the visible light pictures to be on a C format while infra red and water vapour pictures are a D format. Once every 3 hours during daytime however, a set of visible light pictures on D format covering the whole hemisphere are transmitted. These are coded C-D. the schedule is such that user stations can expect to receive C1, C2 and C3 pictures half-hourly throughout the day. The present schedule also transmits whole earth pictures (CTPT) at 9am (see photo) 12 noon and 3pm.

A test card, grey scale and admin. messages are also transmitted regularly. Experimental pictures are sent from time to time and Meteosat 1 retransmitted pictures from the GOES satellites showing North and South America. Darmstadt will also respond to user requests.

Having discussed the spacecraft and the associated ground system the author's receiving station is described in detail together with some of the results obtained. A block diagram of the receiving set-up is shown in *Fig 3*.

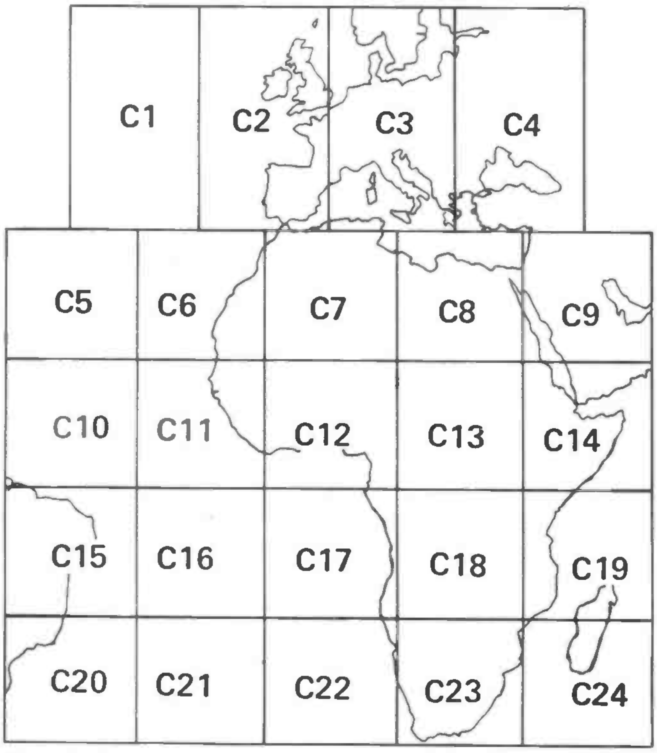
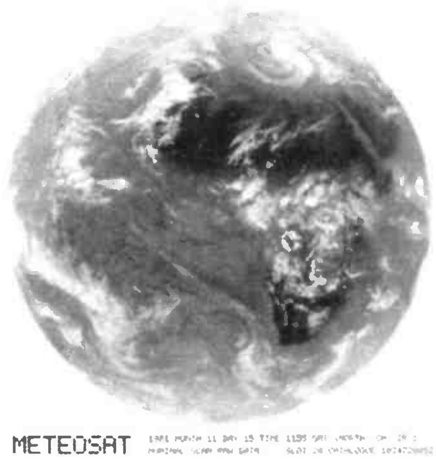
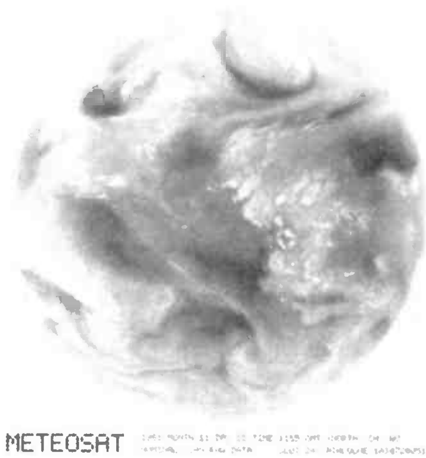


Figure 2: Area covered by C Format.





The signal from the satellite is received using a 1.2 metre parabolic dish and it's associated tubular radiator. This probably represents the smallest practical dish size. Inside the tubular radiator is a monopole cut for the operating frequencies 1691 MHz and 1694.5 MHz.

The dish is based on the design published in VHF Communications (reference 1). The dish is fabricated from twelve segments with a round disc forming the centre. The segments are cut from 1mm aluminium and are drilled so that the parabolic shape results when the segments are rivetted together. The instructions in the reference are quite clear and the dish was fabricated without problem. Dimensions are also given to allow the tubular radiator to be made. An article in *73 magazine* (reference 2) suggested that a catering size coffee or bean can could be used and these give satisfactory results.

The focal length of the dish is 50cms, giving an F/D ratio of 0.42. the 10dB beamwidth being 130^{o}. At this long focus the curvature is so low that the deviation from the ideal parabola has little adverse effect.

Unlike most amateur antennas, height is not necessary , all that is required is for the antenna to have a clear view of the sky to the south. The dish is mounted on an A frame on the ground outside the author's shack. A solid dish has considerable wind resistance and in practice it is wise to dismantle it in windy weather.

High quality coax is needed to feed the signal from the dish to the converter, UR67 will do so long as the run is short. The first converter converts the 1691/1694.5 signal to an IF of 137.5 MHz. This IF is chosen since it falls within the 136-138 MHz satellite band. Most stations are already equipped to receive on this band so the converter simply goes in from existing equipment. Homebrewing a converter at this frequency is possible, but Microwave Modules produce an excellent unit which has the following characteristics:-

Input frequencies 1691 MHz & 1694.5 MHz switched
Noise figure 4.8dB maximum
Gain 25dB

The gain is such that no preamp is necessary between the dish and the converter to obtain usable pictures. It is this unit which brings such a project in the price range of the amateur, and this might be the opportunity to thank Mr. Richard Porter of Microwave Modules for his continuing interest and encouragement.

The output from the converter is at 137.5 MHz and this is pre-amplified through two further Microwave Modules' units, the 144 MHz pre-amp which has been peaked at 137.5 MHz and the 137

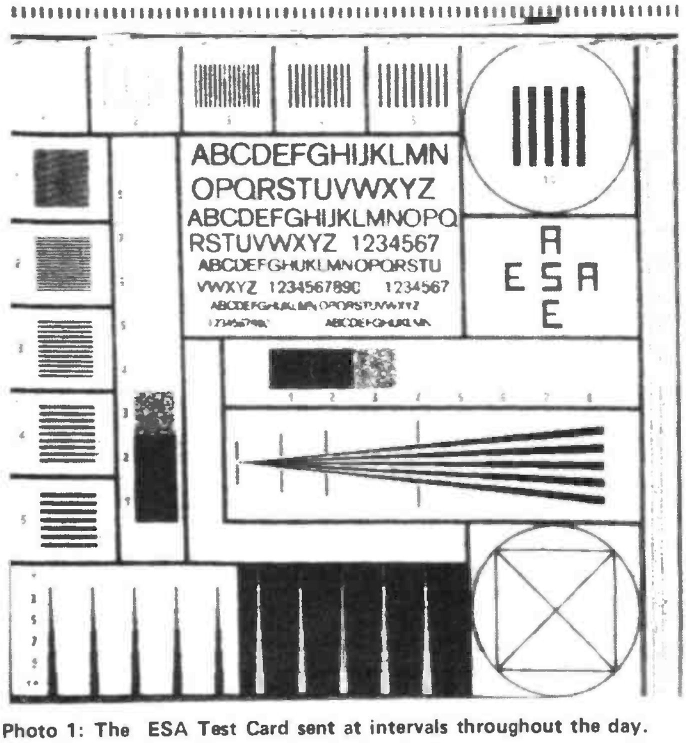


Photo 1: The ESA Test Card sent at intervals throughout the day.

Photo 2: Depressions south-east of South Africa.

MHz to 29 MHz converter, before being fed to the receiver. The last two units were of the existing set-up for the polar orbiting satellites.

The receiver is a Racal RA17 and although this is an excellent, albeit bulky, stable, receiver it is not ideal for the purpose, since it does not have an FM discriminator. There is an output from the IF at 100 kHz and an external unit was built, but it did not give as good a result as was obtained by slope detecting the FM on the widest position of the IF control (8kHz). There is an odd bonus with slope detecting, different positions on the 'slope' give a degree of contrast control.

The audio from the receiver is fed into the Muirhead D900 S/1 fax unit. While the picture writing unit is quite compact and gives a picture about nine inches square, there are two nineteen inch rack mounted units associated with it. This model was built to receive pictures from early weather satellites which transmitted them at 240 lines per minute. Later satellites changed the line rate first to 48 lines per min. and then to the rate in use today, 120 lines per min., making the machine obsolete. The index of co-operation (IOC) of the D900 is 264.

The standards adopted for WEFAX transmissions are very similar to those of the D900, being 240 lines per min., and an IOC of 267, so the once obsolete D900 can be used successfully.

Some signal processing is carried out within the unit and a picture is drawn on electro-sensitive paper. The advantage of this method is that results are available in real time, without further processing, and the paper is relatively cheap. The disadvantage, as is clear from the photos, is a certain loss of contrast. With careful tuning etc., however, acceptable results can be obtained.

The photographs show what can be achieved with the system described.

Photo 1 shows the ESA test card which is sent at intervals during the day. It is a good test of system resolution and grey scale (or in this case, lack of it). The lines displayed down the right hand

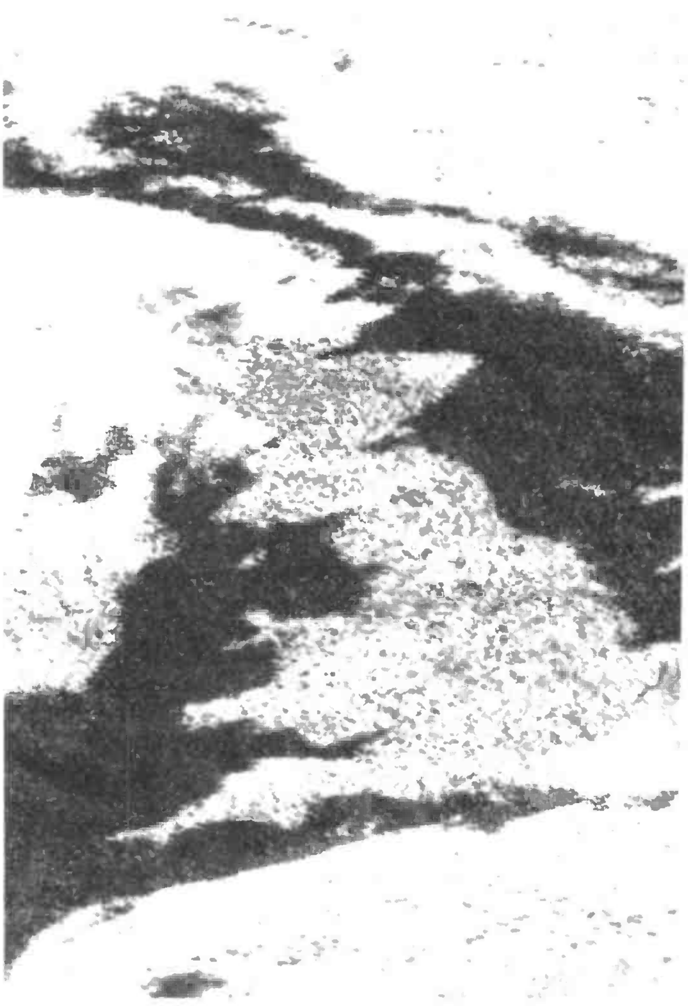


Photo 3: The UK, free of cloud cover for a change.

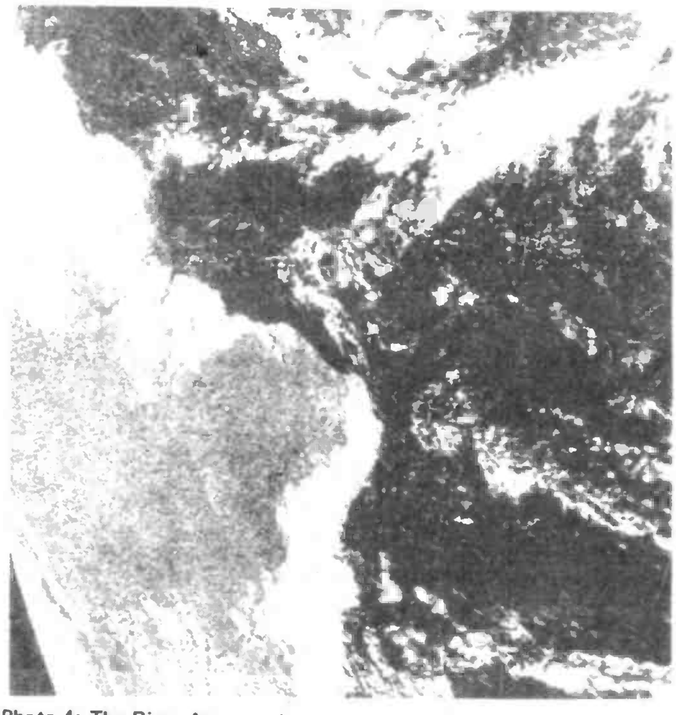


Photo 4: The River Amazon shows up quite well in this picture of north-east South America.

Photo 5: The first infra-red picture of the whole globe.

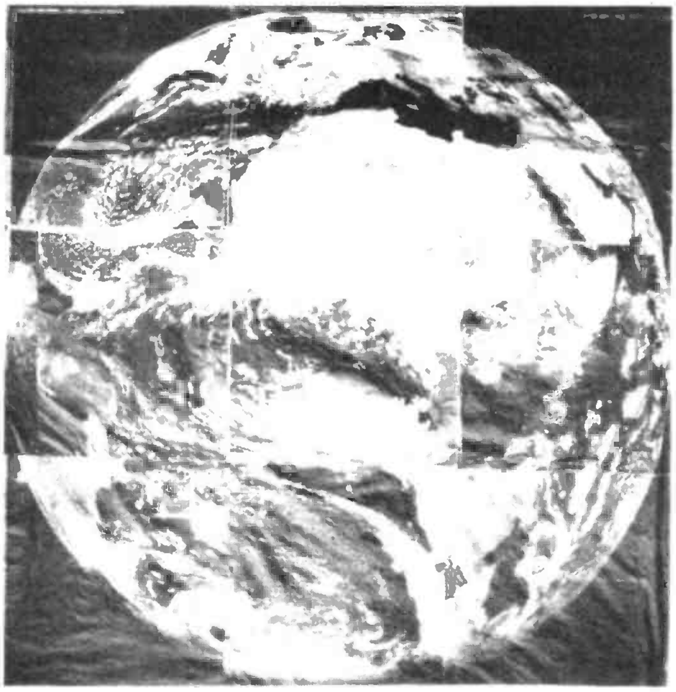
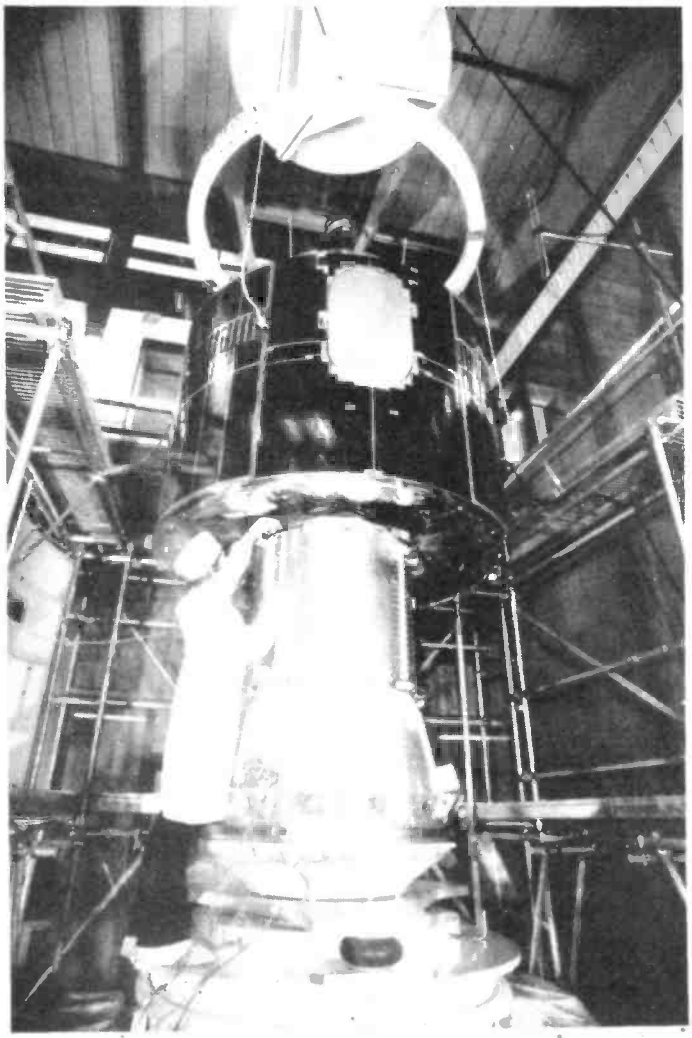


Photo 6: The whole earth built up from nine separate pictures.



edge are the line sync pulses. The dotted line at the top is the start pulse, the black bar the sync pulse and the dashes show where the picture edge has been slipped to the correct position.

Photo 2 shows a couple of impressive depressions south-east of South Africa. This is a visible light picture taken on 31st July, 1981. Space, of course, appears black.

Photo 3 shows the UK, fairly free of cloud cover. This is an enlargement from a 'CO2' picture taken during August, 1981.

Photo 4 shows the north eastern portion of South America. The River Amazon shows up quite well for some of it's length.

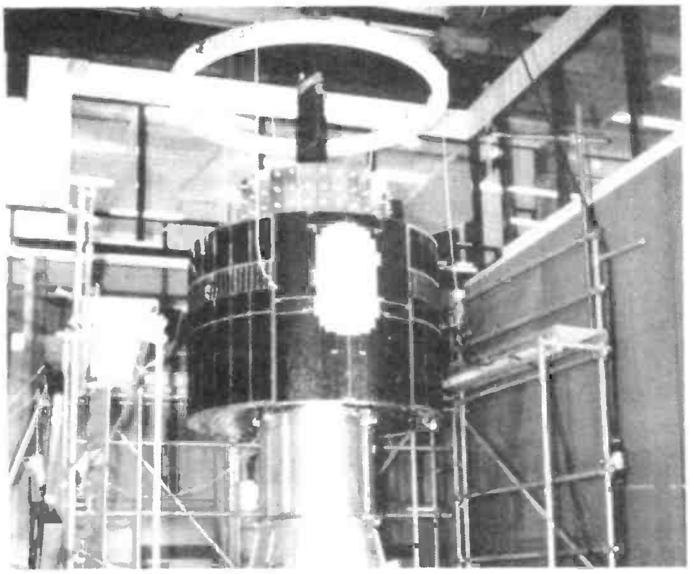
Photo 5 is included because it is the first infra red image of the whole globe transmitted via Meteosat 2. In this picture space appears white (cold); this caused momentary concern since all previous pictures received to that point were whole earth in visible light.

Photo 6 shows a whole earth view built up from nine separate pictures transmitted on the 31st July, at various times during the day. A set of nine pictures, giving whole earth coverage, are transmitted over a three hour period. The original is 27 inches in diameter and looks well on the shack wall.

Information regarding the Meteosat System is freely available from:-

MDMD/ESOC,
Robert-Bosch-Strasse 5,
6100 Darmstadt,
West Germany.

The geostationary weather satellites open up a new field to the radio amateur but one quite in keeping with the 'self- training' aspect of the hobby. The techniques and frequencies used encourage experiment. The pictures themselves are always interesting and sometimes quite beautiful. Why not try it? ■ R & EW



ADDITIONAL SOURCES OF INFORMATION

European Space Agency:-
Introduction to the Meteosat System
Meteosat Wefax transmissions
ESA Journal - various issues

REFERENCES

1) VHF Communications - Vol 11 Autumn 3/1979
2) 73 Magazine 'Be a weather Genius' - November 1978

Your Reactions

	Circle No.		Circle No.
Immediately Interesting	44	Not Interested in this Topic	46
Possible Application	45	Bad Feature/Space Waster	47

WIND SPEED AND DIRECTION INDICATOR

Remote display of wind speed (0-30m/S) and direction (eight point resolution) with an accuracy of +/-2.5% is offered by this unit.

THE ABILITY TO MONITOR wind speed and direction is useful, if not essential, in many different situations. Sporting activities, everything from sailing to athletics meetings, can benefit from such information and in addition many schools and colleges, as well as individuals, take an interest in monitoring the weather. The wind speed and direction indicator, together with a min/max thermometer and rainfall gauge, will provide a 'weather station' that will allow basic meteorological data to be accumulated.

The **R&EW** wind monitor provides an effective eight point resolution of wind direction on four front panel LEDS, the intermediate compass points (NE, NW etc.,) being indicated when two adjacent LEDs, are illuminated.

Wind speed is indicated on a meter featuring a log scale. Thus the most commonly encountered wind speeds, in the range 0-10 m/S, occupy half the meter's scale, the higher speeds (10-30 m/s) being compressed to occupy the other half.

The unit is designed to be powered from a number of sources - four AA cells, a 12V car battery or from a 5/8V AC source. These different power supplies are catered for by minor modifications to the main PCB.

The two remote sensors have been designed to provide rugged units capable of standing up to the rigors of outdoor life and should provide years of trouble free service. Both sensors consist of a plastic cylinder and 'vane' together with a reed switch assembly constructed from two circular PCBs.

Both sensors are based on a rotating magnet assembly, mounted on a central shaft, and a reed switch 'cage'. The speed indicator features one reed magnet while the direction vane incorporates four reeds as well as a diode matrix.

Before final assembly of the sensors, reed switch operation can be confirmed by rotating the magnets and listening for the 'click' as the reeds operate. In the case of the direction sensor one of the four reeds should be closed at all times, and as the shaft is rotated to an intermediate compass point (NE say) two reeds should be closed. Some adjustment of the magnet's positions may be necessary to achieve this.

The design offers an overall accuracy of +/-2.5% and is easy to calibrate, this being a matter of adjusting a preset to give a full scale reading on the meter while a 50 Hz AC signal is applied to speed sensor input.

BUILDING IT UP

The electronics of the wind indicator is straightforward to construct and, if the overlay is carefully followed, should present no problems.

The majority of components are fitted in the 'traditional' fashion to the topside of the PCB, the exception being the LEDs. These are mounted to the underside of the board with a space of 3mm between their lower face and the PCB.

Mechanical assembly of the sensors is a similarly straightforward operation covered fully in the construction notes supplied with the kit of parts.

PUTTING THE WIND UP

When assembly of the unit is complete, operation of the direction indicator can be simply confirmed by a temporary connection of the sensor whereupon one, or possibly two, LEDs should light and rotation of the vane should produce a rotating LED display in the same sense.

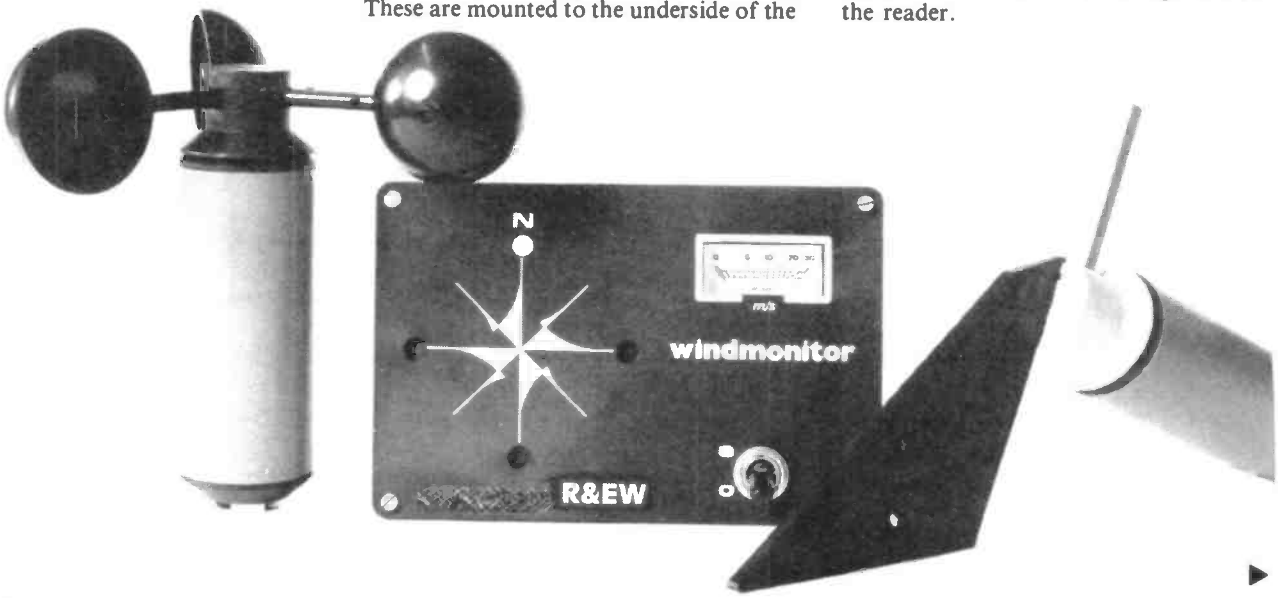
To calibrate the speed indication circuit A low voltage (5V) AC source should be connected to points E and H of the PCB. The variable resistor should then be adjusted to give an FSD reading on the meter.

IN USE

The two sensors should be mounted on a flat surface at least 50cm apart and, obviously, in a position where they are not sheltered by any buildings, trees etc.

The cables should be secured by means of cable clips and taken to the main unit at which time final confirmation of correct operation can be made.

The signals from the sensors, after processing by the unit's electronics, are in a form that should be suitable for feeding to a computer system. This would allow automatic logging of data and would extend the scope of this project. We'll leave such experiments up to the imagination of the reader.



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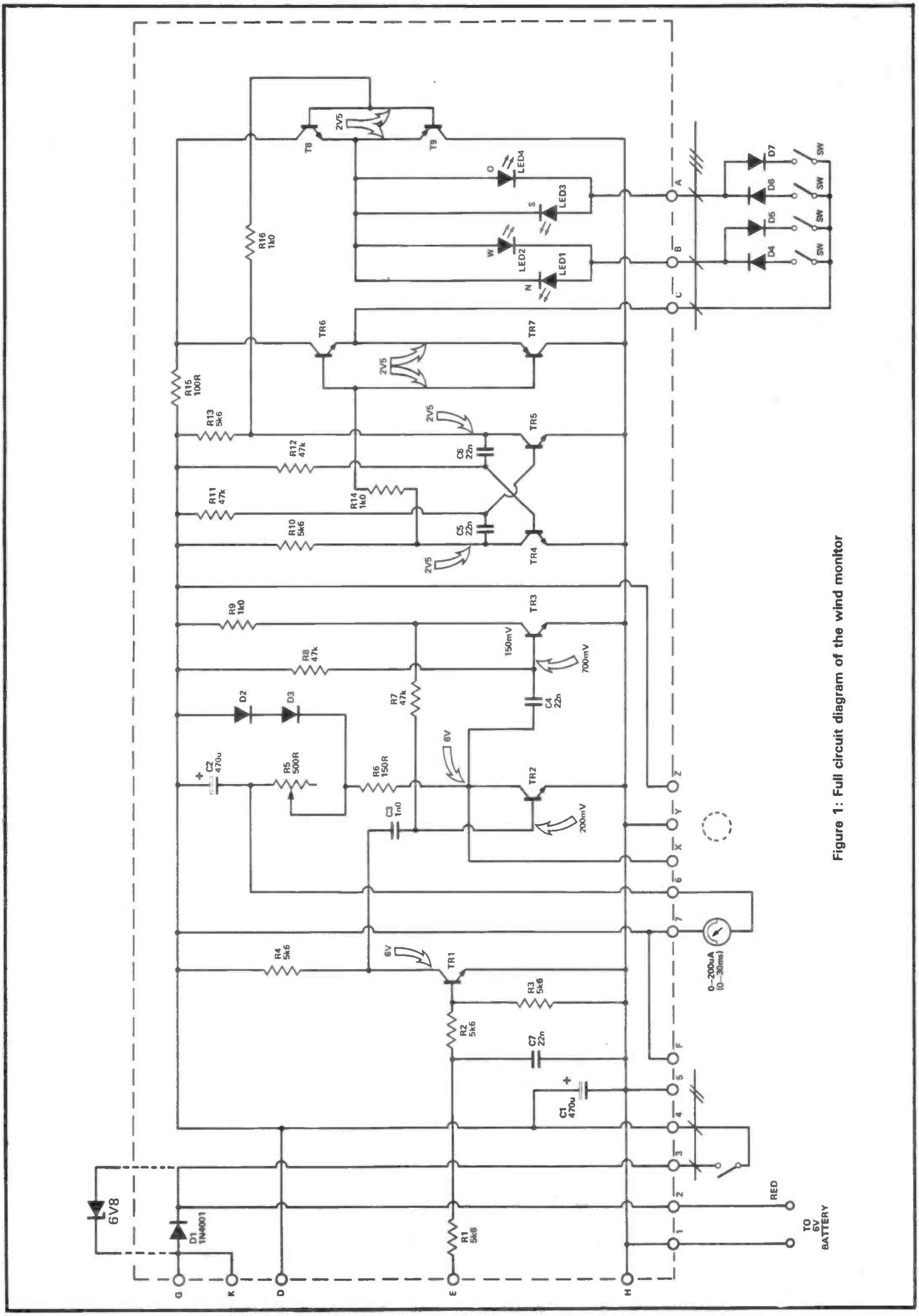


Figure 1: Full circuit diagram of the wind monitor

CIRCUIT DESCRIPTION

The circuit consists of two separate sections concerned with processing the information from the remote sensors into a form suitable for display on a meter (windspeed) or LEDs (wind direction).

WINDSPEED

In essence the wind speed indicator circuitry is a D/A convertor that forms the 'digital' on-off pulses from the reed switch in the sensor into an analogue voltage suitable for driving the meter.

Figure 2 shows that the heart of the circuit is a monostable multivibrator.

The switch represents the sensor's reed which 'closes' for a short period, twice during each rotation of the anemometer's head.

Momentarily closing this switch causes T2 to turn off - it is normally held on by the resistor in its base lead. As T2 turns off its collector voltage rises. This voltage in turn switches T1 on thus causing T1's collector voltage to fall. The falling voltage at T1's collector is coupled to T2 via a capacitor and maintains T2 in its off state.

The circuit will remain in this condition T2 off, T1 on for a period of time determined by the value of the capacitor coupling T1 and T2 and by that of the resistor in T2's base circuit. After this time the transistors will return to their stable state (T1 off, T2 on).

The constant duration pulses appearing at T1's collector are integrated by the circuit of *Fig. 3*. The variable resistor provides a means of calibrating the circuit while D2 and D3 prevent damage to the meter's movement in the event of an excessive voltage being applied to the circuit.

In the final circuit of *Fig. 1*, T2 and T3 form the multivibrator but instead of the sensor switch being connected directly to the monostable a buffer stage around T1 is included. As this is an inverting stage, the sensor switch is now connected between T1's base and the positive rail.

The components in T1's base provide a degree of filtering for the 'digital' signal and also serve to condition the sine wave 50Hz calibration sign al.

Although of a fairly 'basic' nature the circuit is capable of producing results with an accuracy of +/-2.5%.

WIND DIRECTION

The direction indicator circuitry achieves an effective eight point resolution via a three wire link by means of a diode matrix and an on board oscillator.

Figure 4 shows the fundamental circuit of the diode matrix. An AC voltage (square wave) forms the supply to the circuit in which, for simplicity, just two of the four sensor switches are shown. Assume that SS1 corresponds to North and SS2 to East and that the vane is pointing North.

SS1 will be closed and on positive half cycles D1 and LED 1 will conduct, illuminating the 'North' LED. LED 2 will be reverse-biased and will thus be unlit. On negative half cycles, D1 is reverse-biased and both LEDs will be unlit.

In a NE position SS1 and SS2 will be closed, in this case LED 1 will light up as before on positive half cycles while during negative cycles D2 will pass current illuminating the forward-biased LED 2.

In the East position of the vane only SS2 will be closed passing current to the LEDs only during negative cycles when only LED 2 will light, LED 1 being reverse-biased.

The full four LED circuit is shown in *Fig. 1* and a similar analysis of this circuit will confirm the eight point resolution capability of the circuit.

Figure 5. shows the circuit of the square wave generator and reveals an astable multivibrator driving two, complementary 'push-pull' output stages driven by 'opposite phase' outputs of the astable.

In the final circuit of *Fig. 1* the oscillator is formed by T4 and T5 while T6 and T7, T8 and T9 form the output stages. D4-D7 form the diode matrix that is remotely mounted in the sensor head.

POWER SUPPLY

The circuit may be powered from a number of different sources. Dry cells giving a 6V supply can be directly connected to the rails while diode D1 will rectify and C1 smooth the output of a 5/8V transformer allowing AC operation.

The circuit may also be powered from a 12V car battery in which case a 6V8 zener should be included in the power line.

Current consumption is approximately 20mA.

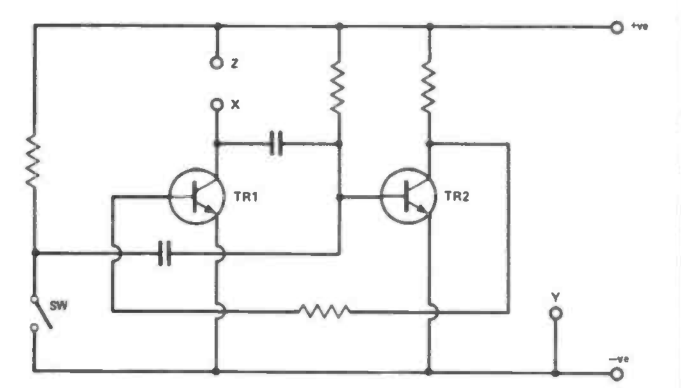


Figure 2: The basic building block of the speed indicator circuit is a monostable multivibrator.

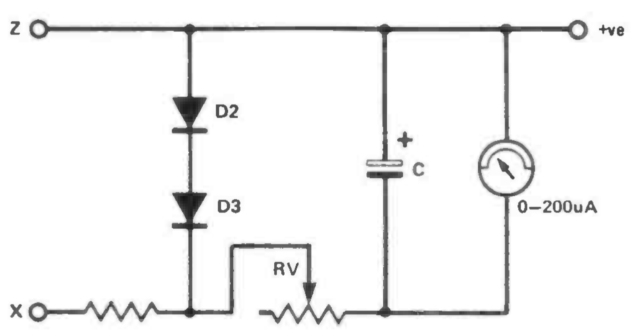


Figure 3: The constant duration pulses from the multivibrator are integrated by this circuit.

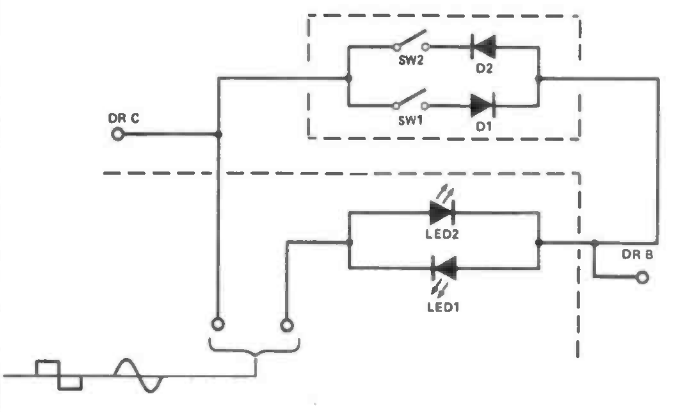


Figure 4: The 'heart' of the direction indicator circuit.

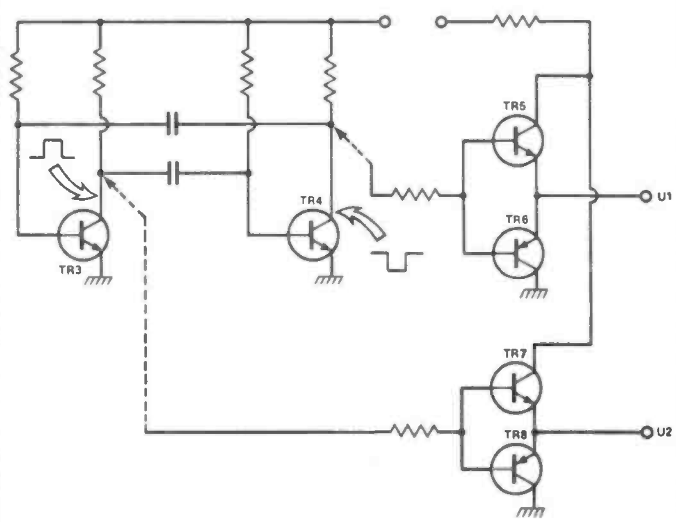
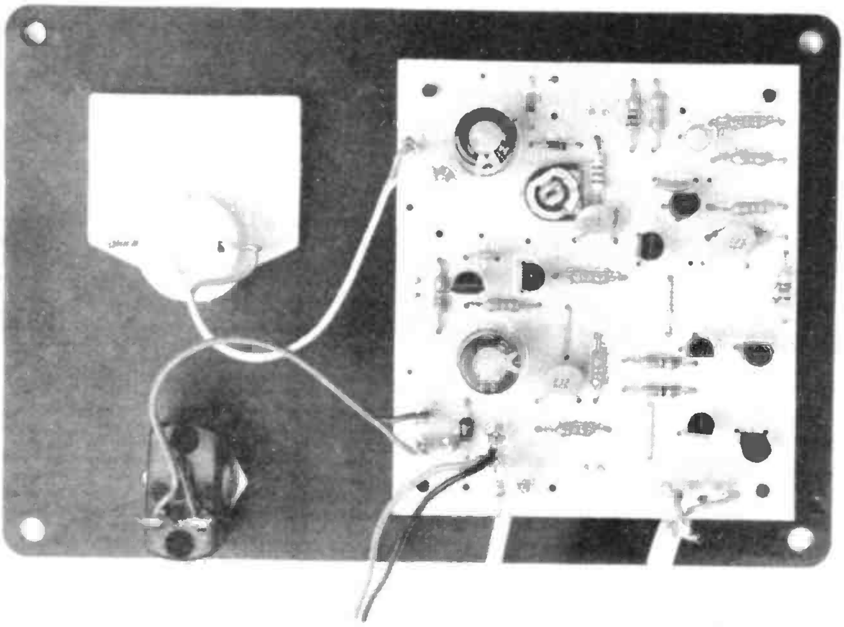


Figure 5: The circuit to produce the AC drive to the direction indicator circuit is an astable multivibrator.

WIND SPEED AND DIRECTION INDICATOR



The clean, uncluttered, layout of the finished project.

SEE PAGE 62 FOR DETAILS OF OUR £1000 COMPETITION LINKED TO THIS PROJECT!

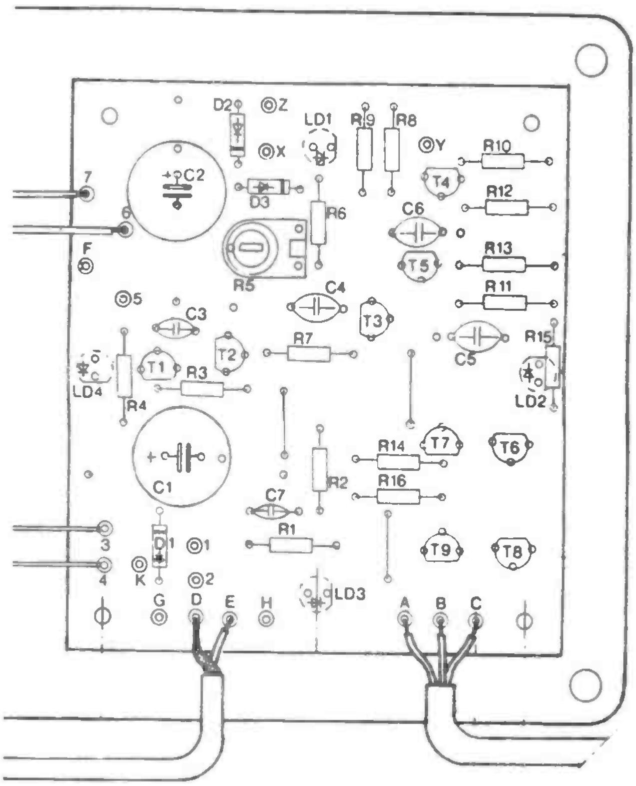
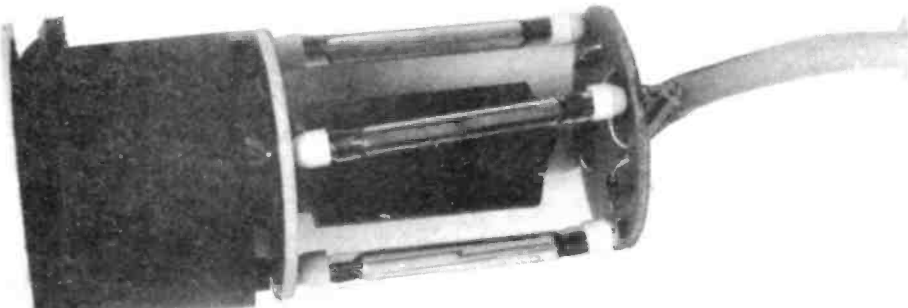


Figure 6: The overlay of the Windspeed and Direction Indicator's PCB.



Detail of the direction sensor. Four reed magnets form a 'cage' and are activated by magnets on a central shaft

PARTS LIST

Resistors

R1,2,3,4,10,13	5k6
R6	150R
R7,8,11,12	47k
R9,14,16	1k0
R15	100R

Potentiometer

R5	500R

Capacitors

C1,2	470u
C3	1n0
C4,5,6,7	22n

Semiconductors

T1,2,3,4,5,6,8	BC547
T7,9	BC557
D1	IN4001
D2,3,4,5,6,7	1N4148
LED1,2,3,4	5mm Red LED

Meter

M1	200uA FSD

Miscellaneous

Windspeed and direction sensor assemblies, cable, switch, front panel, PCB, PCB connectors, etc.

■ R & EW

Your Reactions......	Circle No.
Excellent - will make one	56
Interesting - might make one	57
Seen Better	58
Comments	59

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186 for further details

●●●●●●●●●●●●●●

WE HAVE BEEN GETTING some flak for our preoccupation with 2m equipment at **R&EW**; it just happens that there has been a lot of interesting gear introduced in the past year for this band due to its enormous popularity, amounting to the use of the band as the 'thinking Man's' CB.

It is also worth noting that several rigs introduced in the first instance as 2m equipment, have appeared later with 70cm coverage - and one or two with 6m facilities, but we wouldn't know about that - would we? So, here we go again, and let's hope we can all learn a little from the undeniably excellence of this circuit design. As it happens, the IC290 also happens to find yet another way to mute the MC3357, and provide mute facilities for SSB into the bargain.

●●●●●●●●●●●●●●

ICOM's IC290:

R&EW looks into another Icom transceiver and concludes that there are few better sets around

THE HIGHLIGHTS.....

We have come to expect the receivers in Icom equipment to perform virtually to the limits of the physical science. And once again, we haven't been disappointed. There won't be too much action for the **R&EW** 2m preamplifier in this set. All the usual functions are present: FM, SSB and CW, 100Hz synthesiser steps, scanning etc. The facilities are pretty much similar to the FT290, although the available output power is rather higher at 10W.

The RF output stage employs a power module rather than a discrete transistor strip. We are generally fairly nervous of such things, although it must be said that we havn't managed to do anything untoward to our review set. We must confess a degree of jealousy where such things are concerned, since we haven't been able to locate a source of supply that is prepared to:

a) Give a sample or two, and

b) approach the cost of the discrete alternative.

No doubt Icom have more clout in the right quarters!

The use of squelch on SSB is an unusual but by no means pointless facility. Perhaps more sets are destined to appear with this facility now that the IC290 has set the trend.

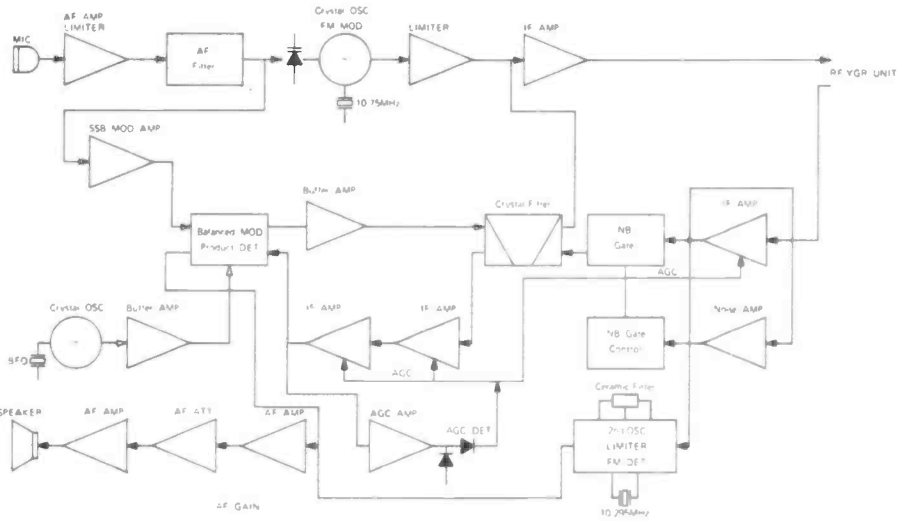


Figure 1: Block Diagram of the IC290.

TEST RESULTS	
Sensitivity (FM)	0.16uV
(for 12dB Sinad) (SSB)	0.09uV
Adjacent Channel Rejection (FM)	67dB
(SSB)	60dB
Blocking Rejection $\pm$2 to 10MHz	100dB
IMD Rejection	78dB
Spurious Response Rejection	90dB
Image (123.5MHz)	95dB
IF (10.75MHz)	92dB
Transmitter Spurious	
Harmonic	−79dB Relative to carrier
Other	−64dB Relative to carrier
IMD	−33dB at 10W

The operation of the transceiver was checked, and found to be satisfactory over a temperature range of −20°C to +55°C.

AROUND THE CIRCUIT

The block diagram on page 43 of the manual is of more use as a key to the main circuit diagram than an 'at a glance' guide to the operation of the IC290. However, Icom have been good enough to provide a rather more straightforward version which we use here. *(Fig 1.)*

The most memorable aspect of the circuit is the receiver input, and the transmitter mixer section *(Fig.2)*. The receiver and transmitter share a common buffer input device (Q5) that provides source injection for the receiver mixer, and balanced source injection for the transmit mixer (Q1,Q2).

The receiver input goes directly to a 2 chamber helical filter before any form of RF amplification takes place. The set manages to achieve a blocking performance akin to that demanded in PMR applications as a result of the copious pre-mixer filtering stages. It should certainly never suffer from blocking in a vehicular installation, although there's no accounting for those amateurs wishing to use stacked 14 element parabeams within a stone's throw of another VHF transmitter.

The main receiver processing circuitry displays a disturbing number of ICs that we have not previously encountered - and it seems fair to assume that black boxes are now filtering through using a much higher level of integration than we have hitherto encountered.

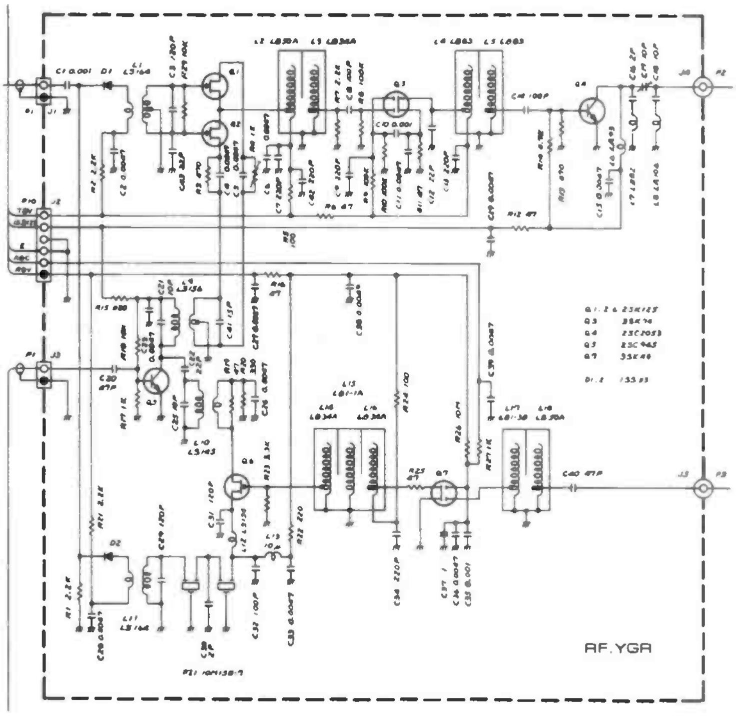


Figure 2: A closer look at the receiver input and transmitter circuitry.

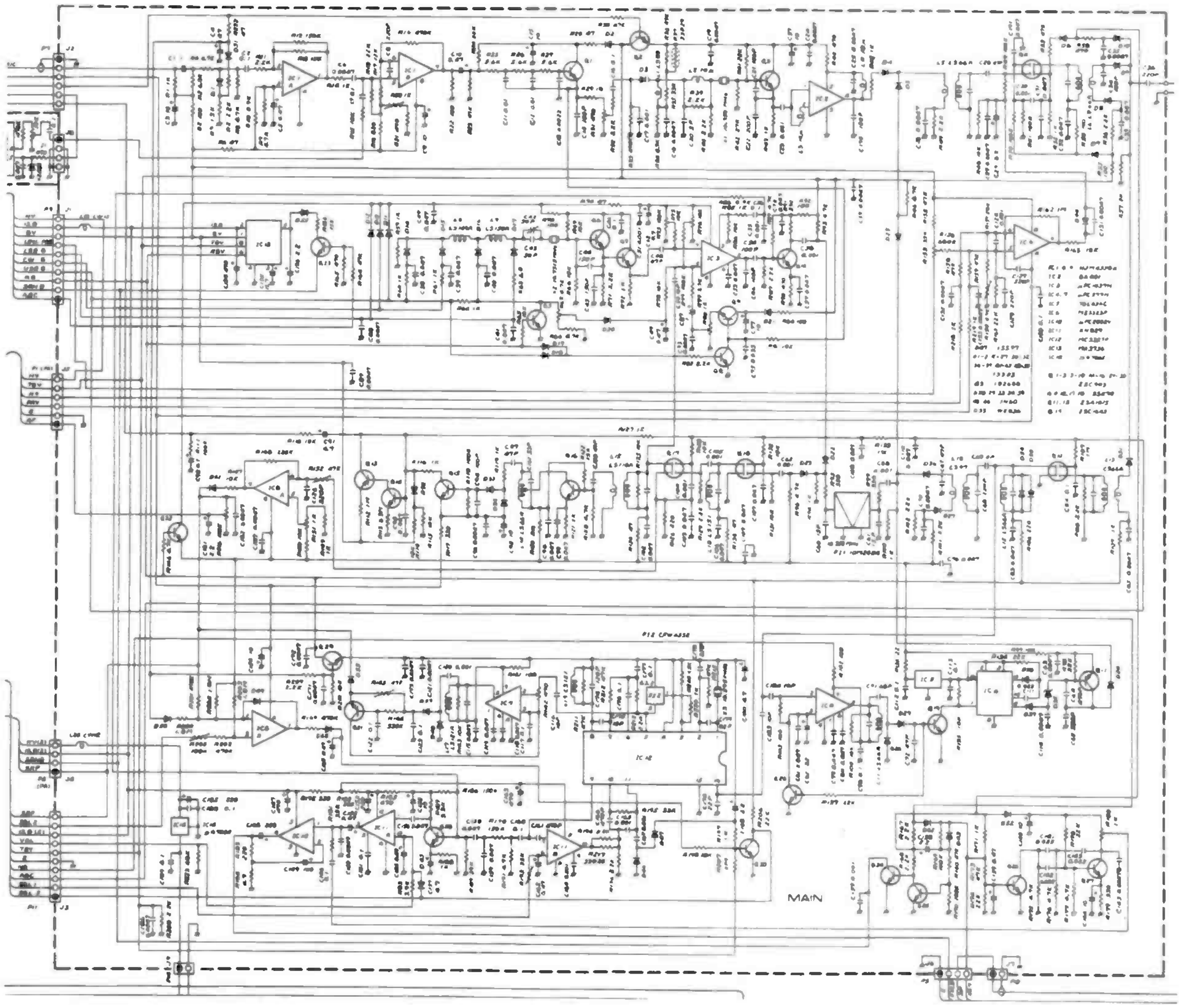


Figure 3: The IC290's makes use of a number of custom ICs.

Any readers with access to data sheets such as the μPC1037H or μPC577H are cordially invited to send us copies. (However, we have recently been introduced to the last word in semiconductor information books from an American source. £50 may seem like a lot to cough up for a linear IC data reference manual - but a brief glance reveals that the publishers really have included absolutely everything that is not strictly a 'house' or custom type. We digress....)

The IC290 noise blanker uses a short time constant AGC preamp (IC4) after the first 'roofing' filter, and a diode RF switch (D24 to D27) fed from a transistor driven by a monostable. A simple enough circuit, but usually effective. The SSB squelch circuit is derived from carrier level, by sensing the voltage on the source of the final SSB IF amplifier stage (Q17). Presumably this takes into account the condition of the agc line (which is controlling current through the device via gate 2). It's not immediately obvious why Icom use this apparently roundabout technique when the basic AGC voltage is also available - perhaps it has something to do with thermal considerations?

The signal appearing at pin 7 of IC8 then serves the dual function of 'S' meter on SSB or CW, and mute control voltage via IC8B. Q30 is switched on to to enable the mute function by shutting the attenuator path in IC11A. The FM squelch operates via IC11 - a dual voltage controlled attenuator - to set the level presented to the noise amplifier back in the MC3357 (IC1) before D46 and D47 rectify it to switch on Q30 (muted condition) - IC11B is then left free to pass the audio to the TDA2002 output stage, depending on the setting of the volume control at the same control input to the attenuator. Q30 also controls the 'busy' light in the system. It's certainly different.

The CFW455E filter in the FM IF is nominally 15kHz wide - and there may be some users who would prefer something a little narrower if the 5kHz FM resolution is to be used for anything other than 25kHz spacings. The absence of a 12.5kHz channelling option is also unfortunate, judging by the increasing amount of interchannel activity on 2m. Swapping the filter for an 8 or 10kHz version would show a good deal of faith in the restraint of 2m deviation controls, but at least the narrower channelling would have some meaning.

In case you were wondering, IC3 performs the function of SSB modulator and demodulator. Diodes 22,23,24,25 & 5 direct the DSB signal through the crystal filter on transmit. Q4 buffers the transmit signals (at the IF of 10.75MHz), and the main mixing up to the outputfrequency occurs on the RF board detailed in *Fig.2*.

The FM path is conventional, with IC1 being used as a limiter/ amplifier and low pass filter, with additional low pass filtering courtesy of Q1. The FM modulation is applied via varicap D3 to the 'IF' oscillator formed around Q3. In SSB mode, the audio signal is pulled off from the emitter of Q1 to be fed to IC3 via Q9.

ALL IN ALL..

The IC290 circuit illustrates that main bugbear of the multimode rig designer very neatly - namely getting all the necessary bits stuffed in tight enough, and keeping track of the switching required to perform the 'housekeeping' tasks around the transceiver.

There are still some functions that are not as integrated as they might be - the SSB IF and the AGC for example, but the IC290 marks a distinct progression in black box integration for Icom. A brief glance at the nature of the construction, the complexity of the wiring and the quality of the overall presentation leaves little room for any European manufacturer to get in on the action.

THE PLL

The complexity of the PLL and its associated scanning functions are not likely to be of much use to the average plaguerist. The 100Hz steps are derived via voltage synthesis techniques (like the other circuits we have examined) driving a VXO *(Fig.4)* that controls a 'side chain' in the main VCO loop that runs at the RF output frequency minus the IF of 10.75MHz. The remains of the PLL dives into an array of logic and an obscure oriental custom MPU. Our appreciation grinds to a halt with the μPD650. Any offers?

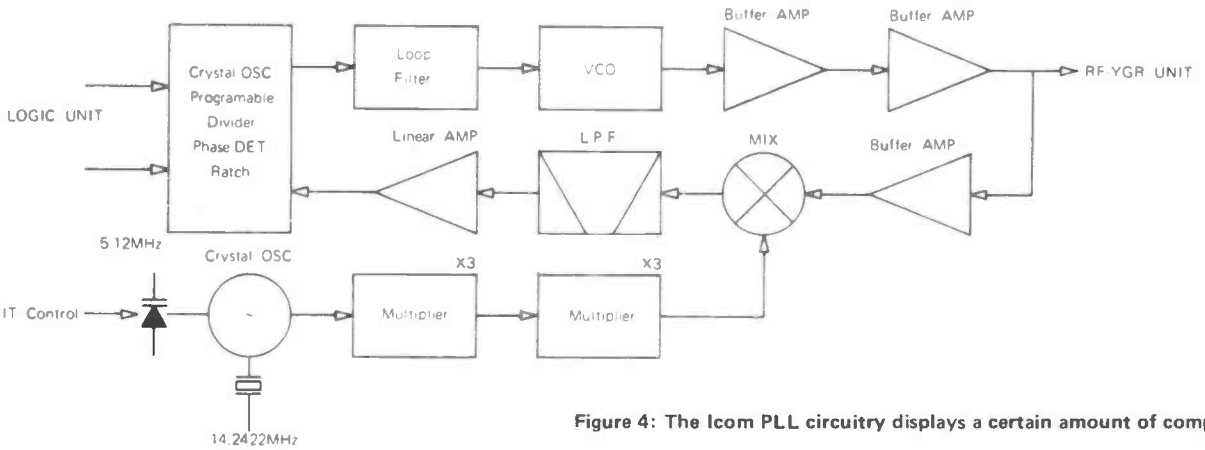


Figure 4: The Icom PLL circuitry displays a certain amount of complexity.

....AND THE NOT SO HIGHLIGHTS

We had thought that Trio had learned the lesson of LED displays with their memorably awful TR9000 display. Icom appear to need some more convincing, and it seems likely that the IC290 will provide it. The LED display is not good news.

The loss of memory suffered when the power is removed is extraordinarily frustrating, especially if used in any form of base station application. Look on the bright side, there are no memory batteries to replace.

USER COMMENTS

The set performed well for all those who tried it, but the display brightness got a universal thumbs down. It looks a bit too much like a fancy CB set (what 2m rig doesn't?) for most users to have enough nerve to leave it fitted inside a car overnight, and when parked in a public place.

Overall operation was straightforward enough, and not as confusing as some rigs we have seen. The main competition comes from the FT290 and the TR9000, with the FT290 getting the vote for versatility (despite the various shortcomings we discovered during our earlier review). The additional power of the IC290 is handy in a vehicular application, but many 2m users are getting restless with just 10W, although it is the ideal power to drive some of the fruitier linears.

The frequency shift that occurs when changing mode is billed as a feature, but the 'old hands' of 2m found this rather annoying. Others found it useful, so it must be considered a matter of personal taste - the sort of thing the prospective purchaser can identify when comparing the various rigs on the market in this 'slot'. The selection of 25kHz channelling fails to reset the displayed frequency to the nearest 25kHz channel as a 'default', if the set had previously been tuned in using the 1kHz option; which seems rather less a matter of taste than an omission in the program.

The basic accessories provided with the IC290 include a vehicle mount kit, (with quick release feature), and a simple plug action power connector.

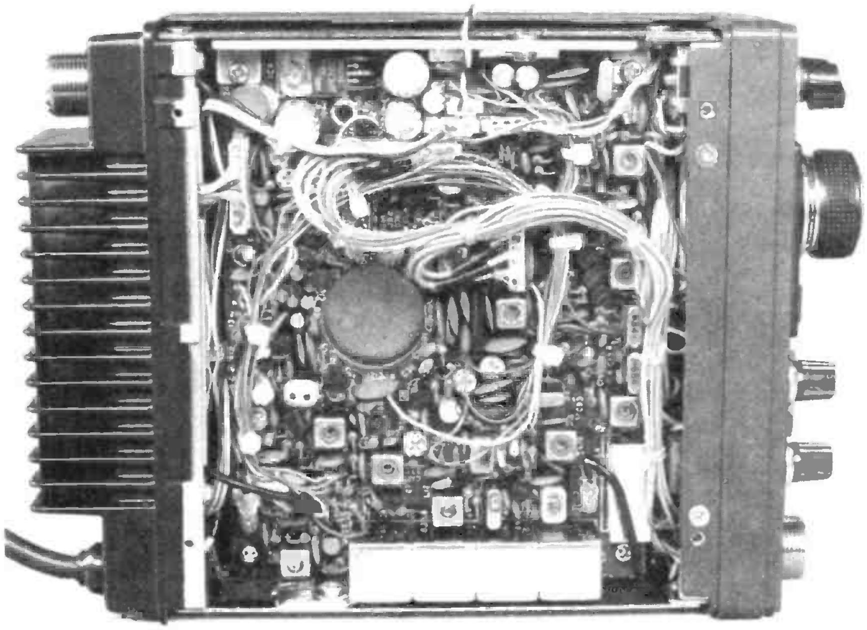
Documentation is good, although even Icom are finding it hard to keep up with the complexities of some of the features they attempt to describe. There's enough information supplied for anyone with the nerve to set up in competition (if they can get hold of the custom bits), but it seems very unlikely that anyone but the bravest of owners would attempt to ursurp Thanet Electronics' service department when things go wrong.

It's very nice thank you, but we're trying to give them up. ■ **R & EW**

Your Reactions..........	Circle No.
Immediately Interesting	48
Possible application	49
Not interested in this topic	50
Bad feature/space waster	51

Icom's IC25:

Short and sweet



THE IC25 really deserves more space than we have available here - so maybe we will return to it in a subsequent issue. Lack of space, and groans about too much 2m mania has compromised our usual practice of delving into the manufacturer's circuitry in detail, which is a pity, since with things like schottky diode ring mixers and not an MC3357 or its *ilk* in sight, you will appreciate that this little box of tricks is a horse of a different colour.

The synthesiser circuit bears a close resemblance to the IC290 that appears elsewhere in this issue - but our airy assumption that the receiver of the '25 would be the same - was rudely dashed. The front of the receiver employs a four chamber helical resonator, which - along with the diode mixer - is used in conjunction with diode switching for RF selectivity of receive, and cleaning up the transmitter before power amplification occurs.

The receiver uses a 16.9MHz first IF, which combined with the RF selectivity of the set and the 4 pole crystal filter, provides superb image rejection to complement the excellent IMD and blocking of the set. In fact, the basic receiver spec is probably the best we have yet encountered in equipment of this class and price. Even freezing to -25°C and cooking to +50°C didn't adversely affect the performance once the IC25 overcame the initial fright and returned to room temperature - so it should be quite happy sitting in the average car all year round.

A SALUTORY LESSON?

On the possibly dangerous assumption that anything with double balanced diode mixer represents the latest of the *genre*, it is interesting to see that the final IF amplifier stages comprise a very unglamorous combination of bipolar limiting amplifier stages, followed by variation on the ratio detector employing a ceramic element and diode arrangement (*Fig.1*). The use of the small CFU455 series ceramic filter possibly accounts for the less brilliant adjacent channel rejection (when compared to the rest of the spec), however, the move away from quadrature detection reflects the trend back towards ratio detection in broadcast FM car radios, due to the smoother fading effects without the raucous interruptions from blasts of noise. Noise muting is performed by a 'classic' tuned noise amplifier that even uses an *inductor* as part of the tuning element. We said it was different.

A USER'S TALE

First impressions of this exceptionally compact and feature filled 2m rig are good. The renowned sensitivity of ICOM receivers is at last matched by enough power to get to those users of 'deaf' low power transceivers, that have hitherto been the bane of users of things like IC2Es. Its mouth is as big as it's ears - to coin a phrase. ***(Remember, you read it in R&EW first!)***

The frequency display is too dim, most knobs too fiddley, and the repeater tone access technique via button a nuisance. However, as a long term IC22 user, these criticisms are much like those of AR88 fans moving onto FRG7700s. The only really serious point concerns the impossible dimness of the display when used in direct daylight. Maybe the smog in Tokyo is denser than we thought....

The adoption of either 5kHz or 25kHz steps attracts the usual snipe from the 12.5kHz channel fans, although I would concede that maybe 10kHz would be a more daring progression anyway!

Nevertheless, for a straight 2m FM user, the IC25 would seem to take a lot of beating.

■ R & EW

Your Reactions..........	Circle No.
Immediately Interesting	139
Possible application	140
Not interested in this topic	141
Bad feature/space waster	142

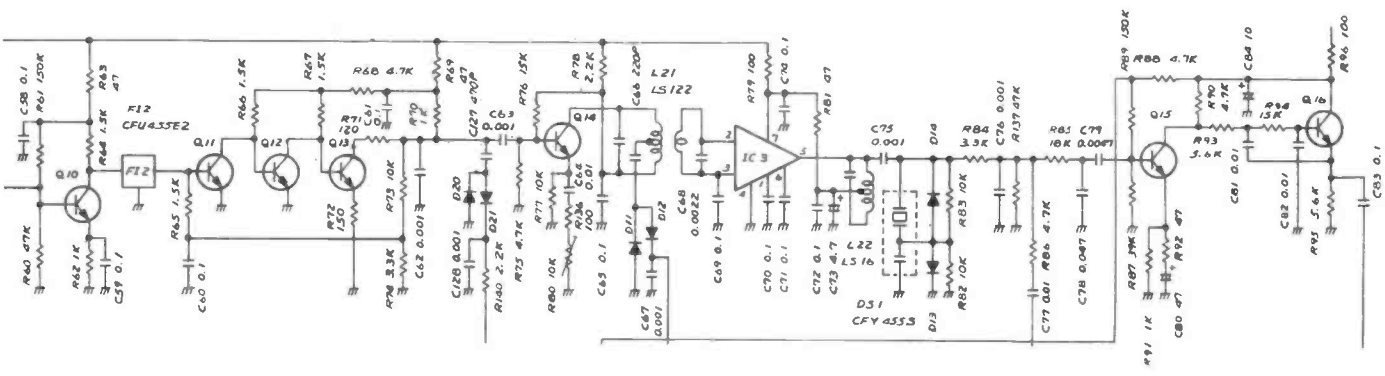


Figure 1: The final IF stages of the IC25 employ a combination of bipolar limiting amplifiers and a ratio detector using a ceramic element and diode arrangement.

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WOOD & DOUGLAS

A new range of products are available from us to cover the increased interest in video transmission

TVUP2 TV UPCONVERTER is a two r.f. stage receive converter with a crystal controlled local oscillator. The PCB accepts signal at 70cms and outputs them at channel 36 on a standard TV set. The TV output is filtered and there is a 'de-sense' input to allow monitoring of local signals without compression. Overall gain is 25dB minimum, noise figure better than 2.5dB.

Kit - £19.60 **Assembled - £26.95**

TVM 1 TV MODULATOR converts any 70cms transmit strip into a series modulated DSB video transmitter. The PCB accepts composite video signals and incorporates a sync pulse clamp and black level adjustment. With an external pass transistor the board will source up to 2 Amps current drive.

Kit - £ 5.30 **Assembled - £ 8.10**

ATV-1 VIDEO TRANSMITTER a boxed finished video transmitter giving 3W p.s.p. The unit is housed in a vinyl-topped enclosure enclosure measuring 8" x 5" x 2". Video input is via two indepently switched BNC inputs, each having a front panel mounted level control. There is a receiver output via a pin diode aerial switch for connection to an UpConverter such as the TVUP2. ; The rear panel also has a monitor output for waveform inspection on an oscilloscope. The unit has internal preset controls for black level and sync stretching circuitry. The unit is unique in that it is double mode. There is a NBFM modulator included to allow station indentification at 70cms simply by plugging. a microphone into the front panel socket. The whole unit runs from a 14V maximum PSU and will give good reliable service in either mode. A one year guarantee is offered on parts and labour.

Boxed ready to go at £87.00

ATV-2 Video Transceiver the natural propression from the ATV-1 . The highly successful ATV-1 and TVUP2 circuitry have been combined to give a complete video station. All you require is a standard TV set and a camera. What could possibly be easier?

Boxed ready to go at £119.00

incidentally, as both these units have NBFM facilities you will not be left highand dry with a white elephant should video be removed from 70cms . Simply plug in a new crystal and you can work your local FM repeater.

70LIN10/3 B is a 3W to 10W linear designed as a video booster for the ATV-1/2 to give 10W minimum output from our very popular video transmitters. The board is straight through with no power supply connected or when in receive mode. It has automatic r.f. sensed change-over when transmission takes place. The unit is of course usable for NBFM operation with the new handheld transceivers such as the IC4-E.

Kit - £28.95 **Assembled - £39.10**

Just a few examples of our ever increasing range . An SAE will bring you the latest details and prices. Technical enquiries can be answered between 7-9pm on either 07356 5324 or 0256 24611. Kits when stock are return of post otherwise allow 28 days.. Assembled /boxed items, allow 20/40 days . Prices include VAT at the current rate. Please include 70p postage and handling on total order except boxed items which should be £1.00 for recorded delivery.

we apologise for the inconvenience but we will be closed for annual holiday between 3rd to 17th july.

All prices include VAT at the current rate. Please add 70p to your total order for post and handling. Kits contain all pcb components but no external hardware. Crystals are not supplied for transceivers but are for converters, synthesisers etc. Kits when stock are 2-3 days, otherwise up to 28 days depending on component availability. Assembled modules 20-40 days depending on stock. Non-amateur frequencies can be supplied for assembled modules but we reserve the right to charge up to 20% excess to cover handling costs. All postal enquiries require an SAE please; a large one if full lists are required! *Non-technical enquiries only* can be taken 10am-4pm on 07356 5324. For technical information please call 07356 5324 or 0256 24611 between 7pm-9pm, as we are part-time.

Kits are available from the following agents:-

Amateur Radio Exchange, Northfield Road, EALING. 01-579 5311.
J. Birkett, 25 The Strait, LINCOLN. 0522 20767.
Darwen Electronics, 13 Thorncliffe Drive, DARWEN, Lancs. 0254 771 497.
United Trading AB, Box 16024, 200 25 MALMO, SWEDEN. 040 94 89 55.

9 HILLCREST, TADLEY
BASINGSTOKE, HANTS RG26 6JB

152 for further details

OS-5100

An Intelligent 'Scope with 100MHz Performance.

THE INTELLIGENT OSCILLOSCOPE is a concept that is only now becoming a reality; oscilloscope manufacturers having been rather slow to respond to the benefits gained by incorporating microprocessors within equipment. The inherent analogue nature of traditional 'scopes coupled with a lack of 'lateral thought' may have contributed to this delay, but with modern 'scopes owing as much to logic gates as to op-amps, things are changing.

The OS5100 from Gould Instruments is a micro based 'scope offering a bandwidth of 100MHz. The benefits of using the MPU, a 6809 in this case, show in many aspects of the machine's performance, the most apparent being the provision of an on-screen display of system parameters.

The front panel reveals that many of the traditional scope controls - timbase range, channel sensitivity, trigger source and coupling etc. - have been retained but that a 14 key numeric pad has been added to the scope's complement of controls.

MEASURING BY NUMBERS

The OS-5100 may be used as a convential 'scope, the instrument offering Y sensitivity to 2mV/cm, timebase range (to 5nS/cm) and a variety of trigger sources and couplings. The screen provides an alpha-numeric display of the setting of all these controls.

The automatic measurements that the OS5100 provides are controlled by the numeric keypad which has a shift function associated with it, rather like a calculator.

The measurements are defined by using one or more of four on- screen cursors each being selected by a push button below the numeric keypad and positioned by a single, rotary, shift control. Once the cursors are positioned on the trace, selection of the calculation mode gives results such as time interval, rise time etc., on-screen.

For measurements such as rise time, the cursors need only bracket the portion of the trace that is of interest, the MPU will automatically calculate the 10% and 90% points and perform the calculation.

The OS5100 has two blocks of memory - each 1Kx8 - and these, in conjunction with a fast A/D convertor using sequential sampling techniques, allow repetitive waveforms, up to the full 100MHz bandwith of the 'scope, to be captured.

Single transient waveforms at, or slower than 100 uS/cm can also be captured.

The cursor and calculation modes can be used both with realtime and stored waveforms or a mixture of both. Thus in a T & M environment it is possible to display a production sample's performance and compare it with that of stored 'reference' data.

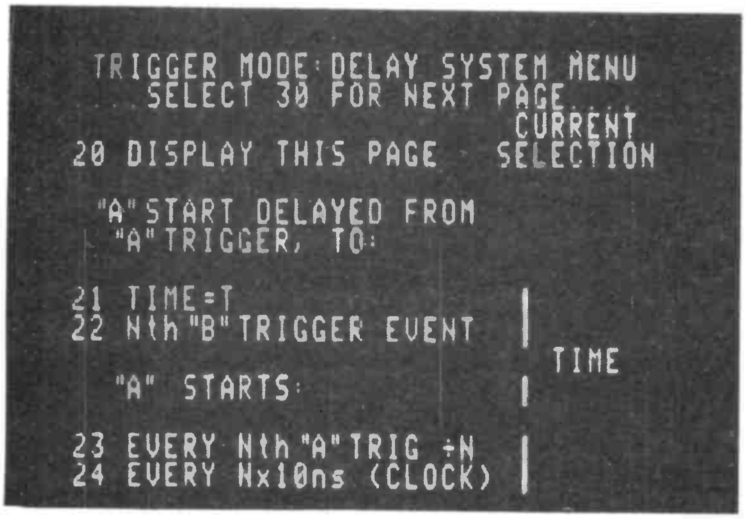
The extensive trigger facilities of the OS5100 offer such functions as delay-by-time and delay-by-event and, by using an optional logic analyser word recognition pod it is possible to trigger on specific words.

ON THE BUS

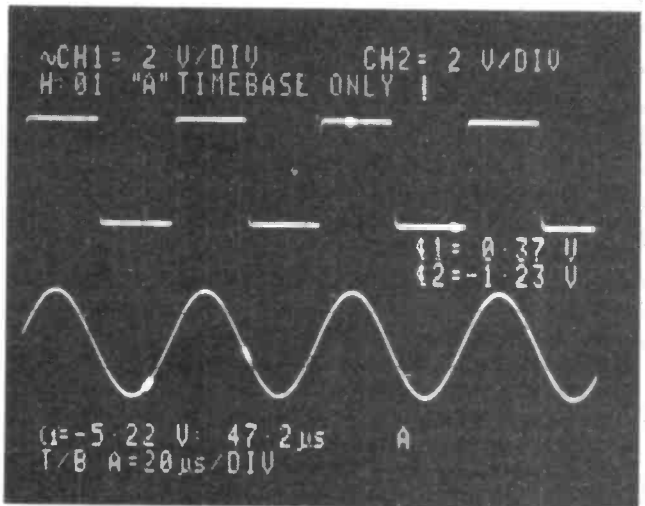
The digital nature of much of the OS5100's circuitry means that interfacing the machine to external equipment is possible. The 'scope is provided with an IEEE port and an optional IEEE card will allow the device to be operated as a listener or talker. These facilities mean that further computer analysis of stored data may be undertaken.

The OS5100 is also provided with a dedicated XY plotter output.

The degree of intelligence exhibited by the OS5100, particulary the measurement facilities offered by it, will mean a considerable saving in many areas of R&D and T&M. Competition between logic analysers and the new breed of intelligent scopes will continue to grow over the next few years with the 'scope remaining the hardware engineer's tool while the logic analyser finds more application in software development. The 'scope with the range of facilities it offers will probably remain the preferred tool and designs such as the OS5100 are bound to find many applications in all areas of electronic engineering. ■ **R & EW**



The precise mode of the OS5100's operation is selected from a series of menus.

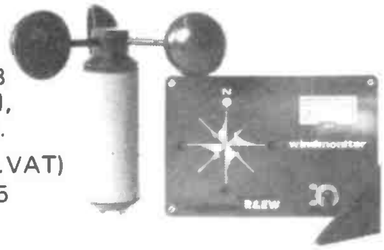


A typical dual trace display with associated alphanumeric measurement information.

R&EWPROJECTPACKS

WIND SPEED AND DIRECTION MONITOR

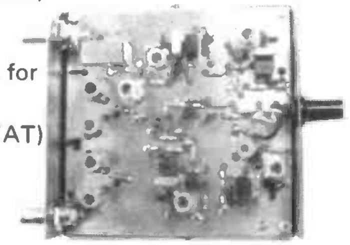
Complete kit including PCB all components, front panel, sensor assemblies and cable.



Stock No.	Price (Inc.VAT)
40-03000	£49.95

MULTIBAND UP CONVERTER

PCB, components for the 10m oscillator, components for mixer, case and sockets.



Stock No.	Price (Inc. VAT)
40-28001	**£14.90**

oscillator section, components for 4m, 6m, or CB band each:

Stock No.	Price (Inc. VAT)
40-28002	**£5.82**

Complete kit with all four oscillator sections.

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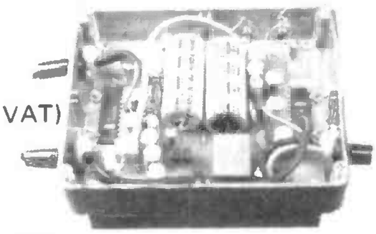
40-28003	**£30.91**

18W POWER BOOSTER

Complete kit of parts; PCB, all components, ICs, relay, sockets, di-cast box and aluminium heatsink, (both undrilled).



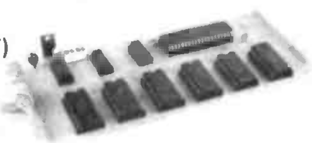
Stock No.	Price (Inc. VAT)
40-13881	**£22.60**

Kit as above but less di-cast box and heat sink.

Stock No.	Price (Inc. VAT)
40-13882	**£15.00**

ZX81 EXPANSION BOARD

Kit including PCB and all components with the exception of memory ICs.



Stock No.	Price (Inc. VAT)
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'PROJECTBOARDS'

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	LS1000	£4.56
	Watervole	£3.56
November		
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	Auto Modulation Meter	£6.10
December		
	DFCM01	£4.96
	DFCM02	£3.57
	DFCM03	£3.72
	DFCM04/5	£3.97
	Logic Probe	£1.10
	2m PA (Mk.II)	£5.91
January		
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	TV Pre-Amp PSU	£0.96
	LC7137	£2.73
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	TV Antenna Selector	£4.65
	TV Antenna Select PSU	£0.96
	TK10321 (Undrilled)	£2.04
March		
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	23cm Converter	£8.33
	Converter PSU	£1.77
	MC145151	£2,95
	ULN2283B (Undrilled)	£0.46
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	Rewbichron Rx Board	£3.04
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	KB4413 (Undrilled)	£0.58
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	KB4412 (Undrilled)	£1.43
	ULN2240 (Undrilled)	£0.94
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	2ch Mains Timer – Display	£6.40
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	Triac	£2.07
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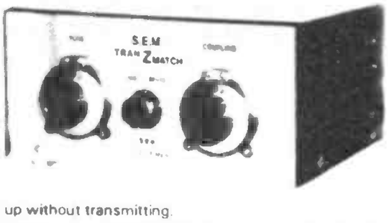

Our equipment is in use in over 100 countries.

SENTINEL AUTO 2 METRE or 4 METRE PRE-AMPLIFIER
Uses a neutralised strip line Dual Gate MOSFET giving around 1dB N.F. and 20dB gain, (gain control adjusts down to unity) and straight through when OFF. 400 W P.E.P. through power rating. Use on any mode. 12V 25mA. Sizes: 1½" × 2¼" × 4" **£28.00* Ex stock.**

PA5 Same specification as the Auto including 240 V P.S.U. £33.00*.

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These units now feature either POWER AMP alone or PRE-AMP alone or BOTH or STRAIGHT THROUGH. Plus a gain control on the pre-amp from 0 to + 20dB. Noise figure is around 1dB using a neutralised dual gate mosfet.
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3 WAY ANTENNA SWITCH 1Kw SO239s £15.00 Ex stock.

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5½" × 2" front panel, 3" deep. SO239s **£25.30 Ex stock.**

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Clean up the bands by tuning up without transmitting.

Connects in aerial lead, produces S9 + (1 – 170MHz) noise in receiver. Adjust A.T.U. or aerial for minimum noise. You have now put an exact 50Ohms into your transceiver. Fully protected, you can transmit through it, save your P.A. and stop QRM. £25.00* **Ex stock.**

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SENTINEL AUTO H.F. WIDEBAND PRE-AMPLIFIER 2-40 MHz, 15dB gain. Straight through when OFF. 9-12 V. 2¼" × 1½" × 3". 200W through power. £19.55* **Ex stock.**

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Same specification as above pre-amp but with no R.F. switching. £12.62* **Ex stock.**

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The ultimate auto keyer using the CURTIS custom LSICMOS chip. Tune and sidetone Switching. **£34.50 Ex stock.** Twin paddle touch key. **£12.50 Ex stock.**

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*Means Belling Lee sockets, add £1.90 for SO239s or BNC sockets. Ring or write for more information. Place orders or request information on our Ansaphone at cheap rate times.

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Basic DC Accuracy	0.1%	0.1%	0.5%	0.1%	0.1%
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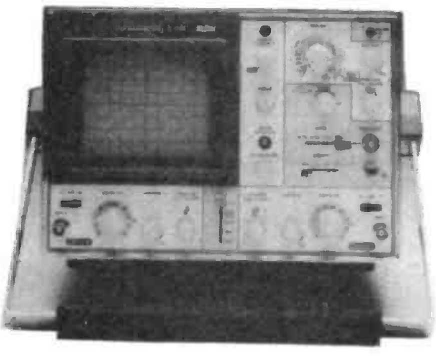

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169 for further details

SUPERKIT

Cambridge Learning's introduction to digital electronics is evaluated by Gary Evans.

MENTION THE WORD 'LOGIC' nowadays, and most peoples' minds will think of a computer or, at the very least, a microprocessor. Such systems or devices are, however, merely a collection of logic gates configured in a specific pattern. The Cambridge Superkit aims to impart an understanding of these gates, the fundamental building blocks of all digital circuitry. Anyone working religiously through the course should gain enough knowledge, and confidence, to design a variety of practical digital circuits.

Cambridge Learning have been producing Self-Instruction courses for a number of years now, and their experience in this field shows in the well produced handbook. Supplementing the book is a collection of 'hardware' that enables the reader to 'breadboard' each logic block as it is introduced in the text.

POINTS TO NOTE

The handbook begins with a few notes about the course and what can be gained from its completion. It's interesting to note that one of the course's aims is to teach improvisation, a skill that seems sadly lacking in many of today's engineers.

The next section of the book gives some advice on the practical aspects of building the various circuits to be described in later chapters. Component identification is covered, with the section on IC orientation - often a source of confusion - being particularly thorough. The resistor colour code is reproduced and there is even some advice on the easiest way to strip wire that suggests that teeth can be used 'as a last resort' - I'm not sure how well that would go down with the British Dental Association.

Q&A

At the end of this, and every, section there is a question and answer session in which the reader's appreciation of what has gone before is ascertained. The answers given in the back of the manual are clear and concise and should serve to clear up any point that has caused confusion.

With Chapter Two the work starts, the first task being to assemble a DIL switch, buffer IC and four LEDs which will provide the input and output indication for the later circuits. It is suggested that different coloured wire is used for the various connections depending on their function - black and red for power rails (nice to see these making a return, rather than blue and brown) with blue being used for 'logic' interconnections. Wiring layouts are shown both as point-to-point line drawings and as a list of connection points.

Before connecting power to the circuit Cambridge warn that the orientation of the IC should be checked on penalty of 'a nasty burning smell'.

The next chapter runs through truth tables for AND and OR gates, or rather leaves the reader to complete the tables having investigated a gate's behaviour in practice. It may seem very simple stuff, but at least one university's first year undergraduate course devotes a couple of hours to this very area as part of its *Introduction To Logic* programme.

One helpful touch is that a separate sheet of IC pin-outs is provided, thus avoiding having to flip from page to page in the manual when working on a layout.

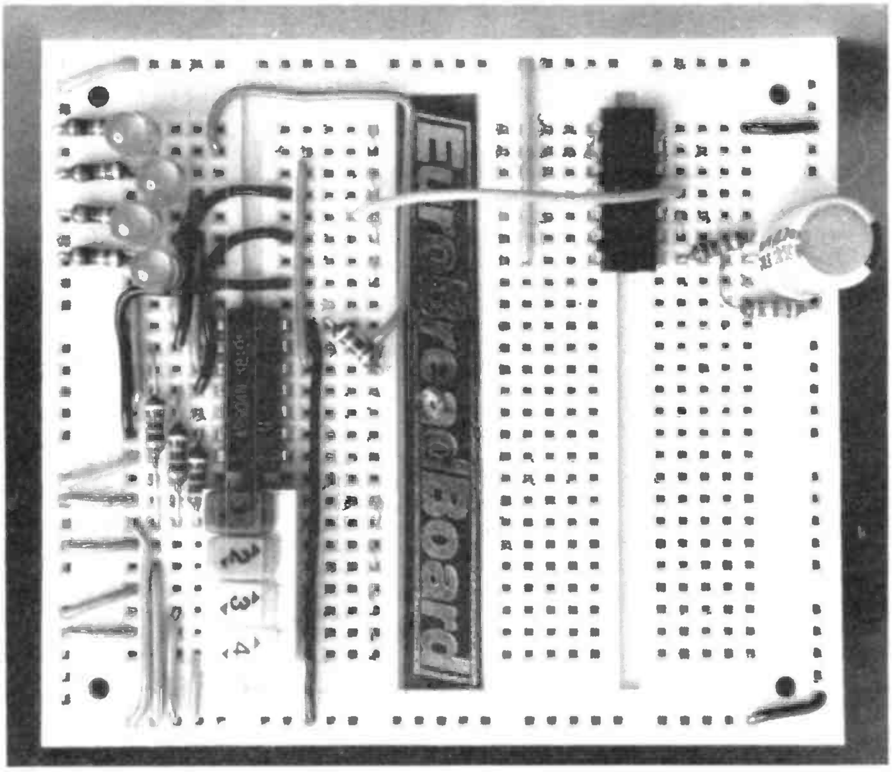
MORGAN'S MOMENT

Chapter two finishes with an introduction to de Morgan's theorem showing its use in analysing the behaviour of various combinations of gates and in optimising a circuit.

Chapter three continues the basic ground work with the introduction of the most common types of gate, the NAND and NOR. The concept of hysteresis is explained and a circuit designed around a Schmitt inverter reinforces the idea and shows it 'in action'.

R-S flipflops, J-K flipflops and their application in counter circuits and shift registers is covered in the following chapter culminating in an exercise that asks the reader to design a full adder. Concepts such as switch bounce and how to overcome it, up/down counting, twisted ring counters etc. are taken in along the way.

This section of the handbook ends with a look at the various logic families in use today with a brief look at their characteristics.



NEVER SAY DIE

Perhaps we should reinforce the fact that this is a self-teaching book and as each new concept is introduced, the reader is asked to try it in practice to understand it, and is questioned to confirm that the important points have been grasped. The diligent reader should finish with a sound grounding in the principles of digital electronics.

The final section of the handbook contains a couple of 'fun circuits' including the inevitable digital dice as well as a number of pages devoted to the fundamental principles of electricity (what is current?; what is resistance?) and some basic semiconductor physics. A glossary of general, as well as specifically logic, terms is also included.

A kit that is well produced and, while it is aimed below the level of the average **R&EW** reader, should be of value to the complete beginner as well as to those *au fait* with analogue circuits but have not yet discovered what makes a digital circuit tick. It might also pay students intending to start courses in electronics to work through the course in their spare summer hours to give them a head start when they come to the digital element of their course.

■ R & EW

Your Reactions..........	Circle No.
Immediately Interesting	74
Possible application	75
Not interested in this topic	76
Bad feature/space waster	77

FOUR FIRST PRIZES OF £250 IN R&EW's

£1000 COMPETITION

DESIGN A SOPHISTICATED WIND MONITOR BASED ON OUR HARDWARE

The wind monitor project featured in this issue is based on some very soundly engineered hardware.

The electronics of the system provides a basic display, but we're the first to admit that something more adventurous is possible. Think about it — a 934 MHz low power data link version? What about formatting the data for transmission down a single data line? Connecting a number of systems together to map (and computer model) wind patterns around high buildings?

Just a few ideas to which you no doubt can add.

The winners of the competition will be the readers submitting the most original and technically innovative designs based on the wind monitor hardware.

There are two age groups, 18 and under and the over 18s. A first prize of £250 will be awarded to the winner of each group.

A further £250 will be awarded to the best overseas entry.

In addition, a £250 prize will be awarded to the best Z8 based design — this prize may be won in addition to any of the other first prizes.

Send your entries to: WIND MONITOR COMPETITION
R&EW, 117a, High Street, Brentwood, ESSEX CM14 4SG

RULES

1. Closing date is September 30th UK, November 30th Overseas; all entries postmarked later than these dates will be discounted.
2. Employees of **R&EW** and their agents are not eligible for entry.
3. The panel of judges will consist of representatives of **R&EW** and Zilog UK, their decision will be considered final and no correspondence concerning the competition will be entered into.
4. The judges reserve the right to withdraw prizes in any of the categories if, in their opinion, the standard of entry does not reach an acceptable standard.

LOW COST GaAs FETS

LOW COST GASFETS or more correctly GaAs mesfets intended for use in UHF TV tuners are now enabling the Amateur to construct low noise amplifiers in the VHF-UHF region.

Until recently GaAs fets were only familiar to the Microwave engineer, now there use is becoming more common at lower frequencies.

Figure 1 shows the construction of a dual gate Mesfet. The Mesfet (metal semiconductor field effect transistor) consists of two metal gates separated from the bulk of the semiconductor (GaAs - gullium arsenide, in this case) by a Schottky barrier layer.

Electrons in GaAs have six times the mobility of those in silicon, and reach their maximum velocity with lower electric fields. As a direct result of this, GaAs fets produce the same gain as a similar silicon device at twice the frequency. The higher mobility also means lower resistivity which results in lower noise figures.

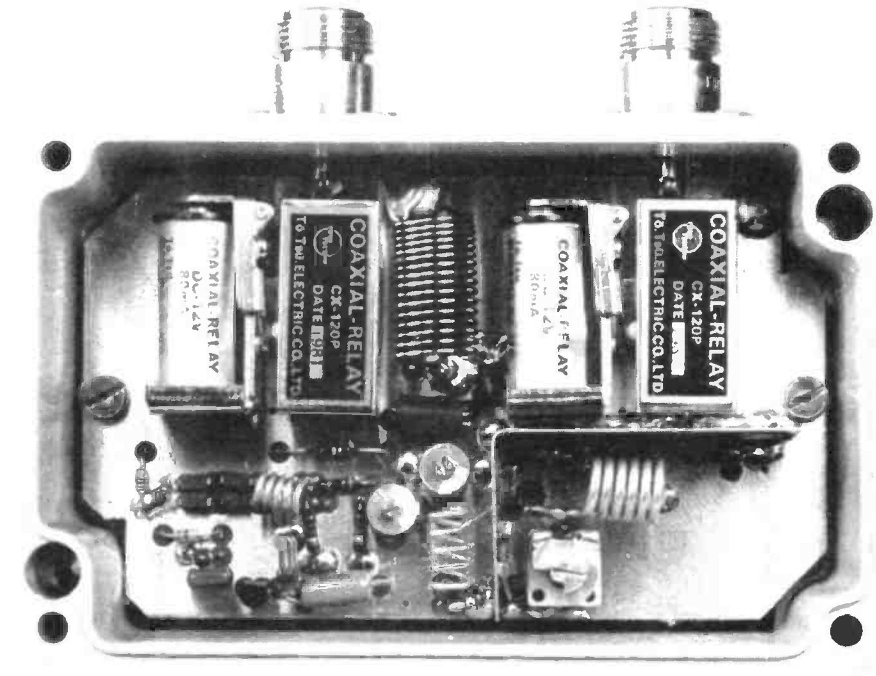
Unfortunately the production of pure GaAs substrates together with a more complex mesa structure makes GaAs fets relatively expensive. Low cost GaAs fets for use below 1GHz have become available due to relaxed tolerances and volume production for the consumer market.

Low cost (under £5) dual gate Mesfets available include the 3SK97 and 3SK98 from Matshushita and the 3SK112 from Toshiba, undoubtedly others will become available as more manufacturers begin to use them in TV tuners.

Comparing the 3SK112 GaAs mesfet to the popular 3SK88 dual gate mosfet, the 3SK112 (NF = 1.9dB at 800MHz) yields a noise figure of approximately half that of the 3Sk88 (NF = 3.8dB at 900MHz) at the top end of band V, while producing a slightly higher gain.

Thus these low cost GaAs fets are ideal for use in 144 and 432MHz receivers requiring low noise front ends. At higher frequencies better divices are required which are more expensive, although here prices are rapidly falling. For 1.3GHz and above suitable reasonable cost (under £20) GaAs fets are the NE72089 from NEC the MGF-1400 from Mitsubishi and the ALF1003 from Alpha.

Figure 3 shows the typical DC characterisics of a low cost GaAs mesfet (3SK112). The IDSS (Vgıs = 0) of these fets are fairly high, and for normal operation a negative bias on gate 1 is required. For the 3SK112 highest gain and lowest noise figure occur at a drain current of 10mA (*Fig. 4*) which corresponds to a bias voltage on gate 1 of - 1.7 volts (Vg2s = 0V). Generally in microwave amplifiers it is necessary to have the source leads directly grounded for maximum gain and stability. In the UHF region the source can be effectively decoupled and a source resistor included to provide the required biasing (170R in the above example). If this is done gate 2 should be at the same DC



Dressler VV2000 GaAs Amplifier

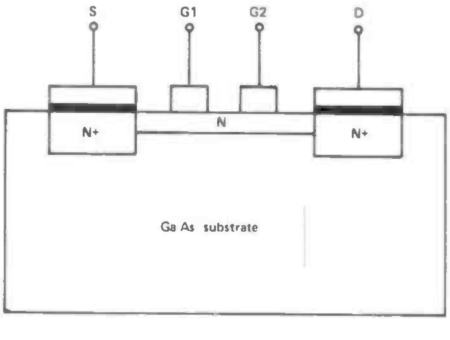


Figure 1: Construction of a Ga As dual gate MESFET.

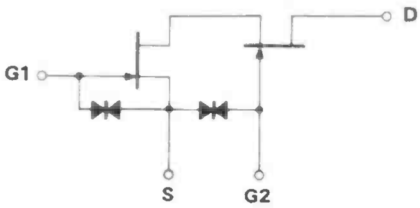


Figure 2: Equivalent circuit of a typical dual gate MESFET (3SK112).

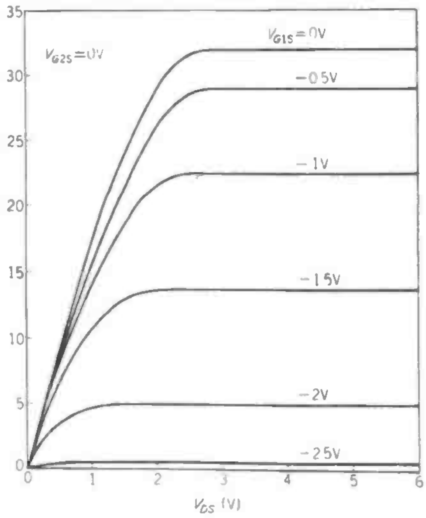


Figure 3: Typical DC characteristics of Ga As Fet.

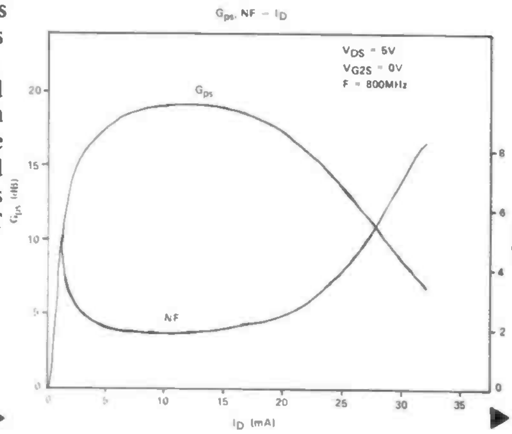


Figure 4: Gain and noise figure against drain current for the 3SK112.

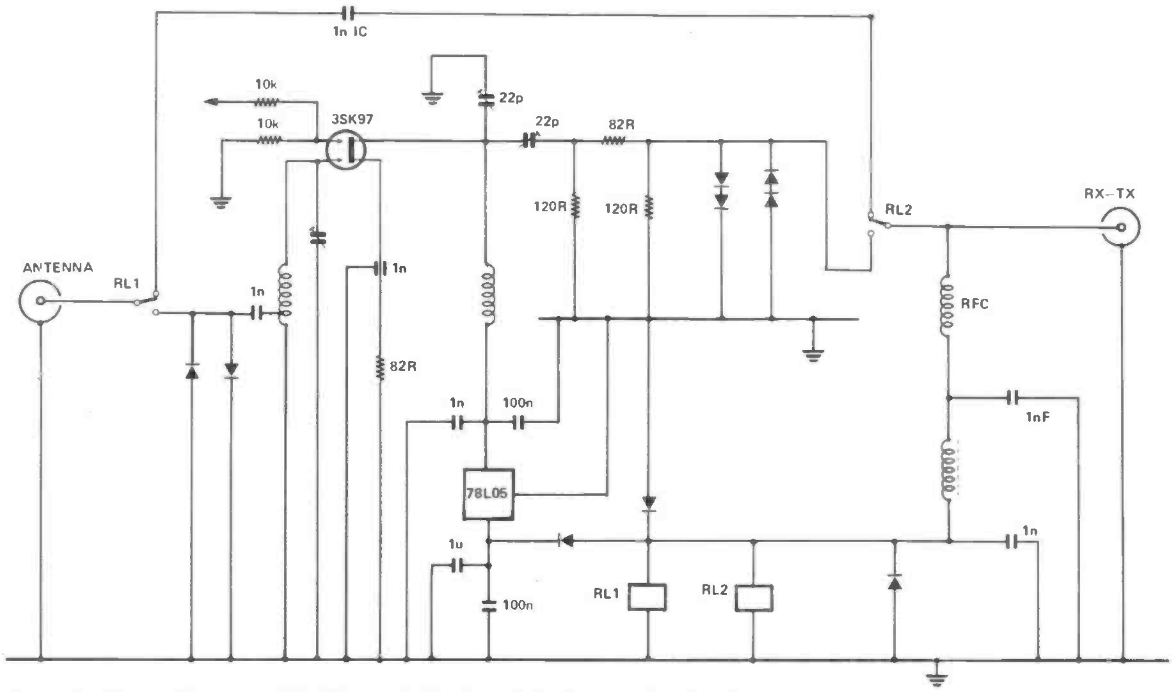


Figure 5: Circuit Diagram of the Masthead Version of the Dressler Pre-Amplifier.

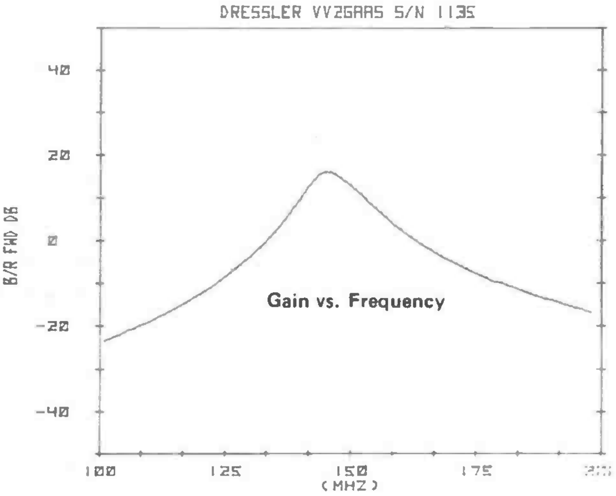


Figure 6

potential as the source for normal use. Gate 2 can be used to provide gain control as with a conventional dual gate mosfet by taking in negative with respect to the source.

One of the first to make use of these low cost GaAs mesfet in Amateur applications is the West German company Dressler. The circuit of a masthead pre-amplifier for 144MHz based on the 3SK97 is shown in *Figure 5*.

Taking in a look at the Dressler VV2 GAAS, it has a claimed gain and noise figure of 15-18dB and 0.7-1dB respectively. Our measurements reveiled a gain of 16dB with a noise figure of 1.27dB. Although the noise figure of the sample tested was outside their claimed specification it still

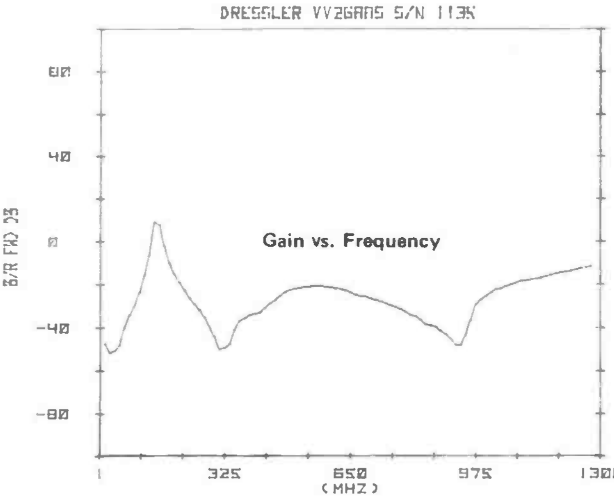


Figure 7

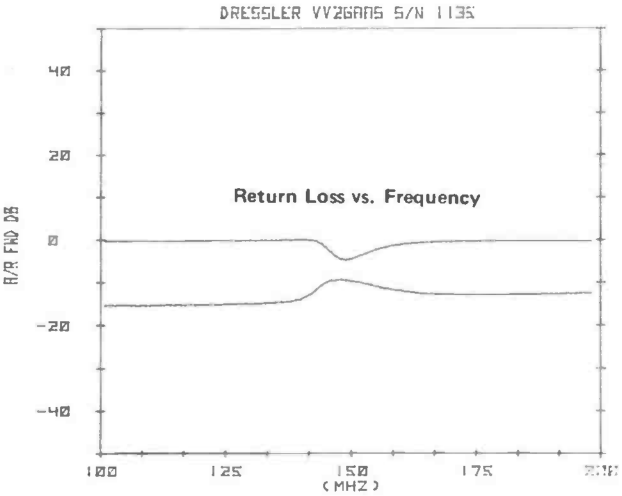


Figure 8

CHARACTERISTIC	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNIT
Gate 1 Leakage Current	I_{G1SS}	V_{DS} = 0; V_{G1S} = −6V; V_{G2S} = 0	–	–	20	A
Gate 2 Leakage Current	I_{G2SS}	V_{DS} = 0; V_{G1S} = 0; V_{G2S} = −6V	–	–	20	A
Drain–Source Voltage	V(BR)DSX	V_{G1S} = −6V; V_{G2S} = −6V; I_D = 100A	10	–	–	V
Drain Current	I_{DSS}	V_{DS} = 5V; V_{G1S} = 0; V_{G2S} = 0	20	–	45	mA
Gate 1 Source Cutoff Voltage	V_{G1S} (Off)	V_{DS} = 5V; V_{G2S} = 0; I_D = 100A	–	−2.5	–	V
Gate 2 Source Cutoff Voltage	V_{G2S} (Off)	V_{DS} = 5V; V_{G1S} = 0; I_D = 100A	–	−2.5	–	V
Forward Transfer Admittance	Yfs	V_{DS} = 5V; V_{G2S} = 0; I_D = 10mA; f = 1kHz	–	17	–	ms
Input Capacitance	C_{iss}	V_{DS} = 5V; V_{G2S} = 0	–	1.2	–	pF
Reverse Transfer Admittance	C_{rss}	I_D = 10mA; f = 1MHz	–	0.02	–	pF
Power Gain	C_{ps}	V_{DS} = 5V; V_{G2S} = 0	–	18	–	dB
Noise Figure	NF	I_D = 10mA; f = 800MHz	–	1.9	–	dB

3SK112 Electrical Characteristics

represents a good figure for a switched pre-amplifier. Plots of the pre-amplifiers response and match are shown in *figure 6-8* the reduced gain peak of *figure 7* being due to digitising errors in the plotting.

Commercially available GaAs fet pre-amplifiers available for 432MHz are the Dressler VV700 GAAS claiming 0.9 - 1dB NF and the GLNA 432u from Mutek with option of either a 0.8 or 0.65dBNF version.

In a forthcoming edition of **R&EW** we will be including a constructional project for a 144/432MHz pre-amplifier based on the 3SK112.

TEST EQUIPMENT

HP 8505 Network Analyser
TEK 7L12 Spectrum Analyser
Ailtech 75 Precision Automatic N.F. Indicator.

R & EW

Your Reactions..........	Circle No.
Immediately Interesting	96
Possible application	97
Not interested in this topic	98
Bad feature/space waster	99

JULY '82 EVENTS: MOBILE RALLYS

July						
M	T	W	T	F	S	S
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	

July 11th	Worcester & DARC Annual Mobile Rally	High School, Ombersley Road, Droitwich	Tony Blissett, G8NSL, 26 Cherry Orchard, Holt Heath, Worcester, Tel Worcester 620507.
July 18th	Pembroke & DARC 'Bucket & Spade Party'	The Regency Hall, Saundersfoot	GW3XJQ Tel 09945 267
July 18th	Sussex Mobile Rally	Brighton Raceground	G Miles, G3VB3, 65 Montgomery Rd, Hove, Sussex. Tel Brighton 778546
July 25th	Anglian Mobile Rally	Stanway School, Colchester, Essex	G3YAJ. Tel 0206-393938
June 25th	Scarborough ARS Mobile Rally	Spa Ocean Room, Scarborough	Further information from G4JAQ, QTHR, Tel 0723 862638

NB. Would Rally organisers please send details of forthcoming events to the Editor — and please also include a list of exhibitors.

SOUNDING OFF!

HOLD VERY TIGHT PLEASE - DING, DING !

It's conductors I'm on about; of the 'semi' variety.

And, perversely enough, the presence of the word 'con' in semiconductor strikes me as being singularly appropriate in these straitened times.

First, let me introduce you to the only man more egocentric than William Poel, W.J. Sanders, Chairman of Advanced Micro Devices (AMD) who declared, amid the discordant jangling of his multi-layered gold bracelets, that 'the recession is over for AMD' way back at the beginning of May.

Intel is hiring.

And Signetics is flogging more than it has been channelling out of its doors for the first time since the Spring of 1980.

Not that's not all bad.

Underlining those good folks' optimism is a recent analysis from Dataquest forecasting hefty semi growth between 1983 and 1986.

If you haven't turned the page yet looking for more stimulating stuff, bear with me a paragraph or two longer and you'll start to share my fascination with the way of the world.

Because the beautifully named Pasquale Pistorio (no jokes please), head of SGS-ATS, is worried skinny - well he *could* lose the weight - about the absence of any sign of success between European governments in creating a joint policy toward the semiconductor industry at a time when the United States and Japan are beating the living daylights out of this key market.

And now for the giggles: the semiconductor market overall fell by no less than 26% in 1981. The forecast of 4% increase for 1982 from Dataquest will leave it still way behind its former position and even the 'forecast' increase in 1983 of anything up to 20% will still mean that this most sexy of industries will not have moved an inch in the last three years at a time when inflation has meant it has been earning less and less as well!

The results have been writ large on the pages of the popular electronics press.

And, to remind you, Fairchild were absorbed by Schlumberger and have hardly been heard of since; Mostek were lost in a conglomerate, corporate maw; AMI are now part of Gould; and so on.

Now to pricing.

For years the semiconductor boys have been their own worst enemies in that they believed never a piece of business should be allowed to pass them by if they could hack away at their prices and hang onto it somehow.

Accordingly, they make very good money when the market is going rancid for components - and, like National Semiconductor, lose a packet when it ain't.

And by National Semiconductor I mean the world's third biggest integrated circuit maker!

If we exclude the Japs - to whom I now turn.

It must be apparent to everyone - and especially gifted enthusiasts like yourself - that the lovely people who brought us Pearl harbour are gulping down the Hi-tech section of the big game.

Parameter by parameter, 100 by 100K, they are mulching the memory market and leaving the Americans to concentrate on the semicustom and mass production areas of opportunity.

(Hence, by the way, AMD's romantic feelings of optimism and AMI's success in luring Gould to their side.)

But, when it comes to the '74 series, the basic building blocks of any old hunk of equipment, and those good ol' discretes, nobody ain't making no money.

And you watch how the slant eyes will come along and take a hefty swipe at the market sector before too many suns have risen.

The result will be renewed and anguished appeals for protection.

'Keep them all out!' will be the plea.

But the most fatuous feature of the way economies function is that in Japan, whom you would imagine must be doing a truly wonderful job by all that you've read above, it costs £18 to get a haircut in Tokyo.

And you should see the housing, smell the fumes and suffer the decibels of suburban streets.

At the end of the day it's very hard to say just who is really winning overall.

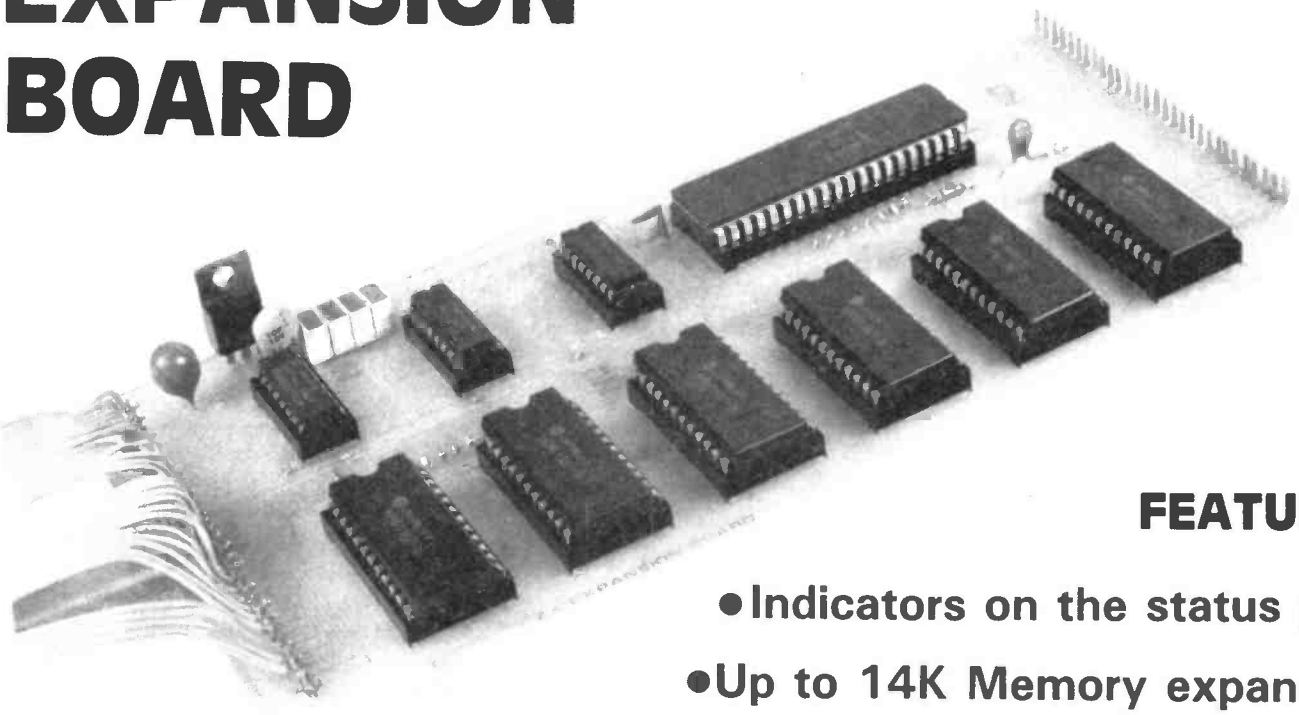
That's all for this month: I'm going back to my soldering iron now.

Bestest
Evan Steadman

ZX80/81 EXPANSION BOARD

A expansion system that offers more than just additional memory.

Design by Howard Roberts.



FEATURES

- **Indicators on the status port**
- **Up to 14K Memory expansion**
- **Directly addressable D/A converter**
- **Three 8 bit directly addressable ports**
- **Possibility of constructing an A/D converter**

CONSIDERING THAT MANY people who own ZX80/81's have probably only spent around £50 for the computer, the prices asked for some memory and expansion boards seems rather prohibitive.

Thus, the design criteria for the expansion board was primarily maximum expansion for minimum expense, a requirement that until recently tended to be either too expensive or rather complex.

As can be seen from the board's specification, this expansion system offers far more than just additional memory.

CONSTRUCTION.

The low component count of the design, plus the use of a double sided PCB, make construction of the expansion board very easy.

First, insert all the pins linking the tracks on the upper and underside of the PCB. Solder the ribbon cable to the connector and then to the relative pads on the board. All the IC sockets can now be inserted followed by all the other discreet components.

Do not insert the ICs yet except IC 1 & 2.

TESTING

The board should be plugged into the edge connector on the ZX80/1 and the computer switched on. Assuming that there are no short circuits on the board the usual inverse L should appear on the TV screen.

Check that the +5V supply is present on the correct pins of the IC sockets as shown in the circuit diagram. If all is well switch off and insert the other ICs. Remember to avoid touching the legs of MOS ICs.

To do this, run the following program:-

```
10 POKE 30723,128
20 POKE 30722,10
```

Leds 2 and 4 should now be lit and Leds 1 and 3 be unlit.

Now enter the following line and check that Led's 2 and 4 extinguish and Leds 1 and 3 light.

```
POKE 30722,5
```

Now switch off and connect pins 2 to 9 inclusive to pin 1 via a 10k resistor. Switch back on and enter the following program:-

```
10 POKE 30723,144
20 PRINT PEEK 30720
```

This should return an answer of 255. i.e., Port A = 11111111 (Decimal 2 55,FF HEX).

By repeating the above procedure, but with different combinations of 1s and Os on this and other ports will give corresponding results.

To test the D/A converter, firstly confirm that link A is made and then type in the following program:-

```
10 POKE 30723,128
20 POKE 30721,255
```

Now messure the voltage on pin 10. This should be 2V4 -OV2

Now type in:-

```
POKE 30721,0
```

The voltage should change to OV4 + OV2

To check that the RAM expansion is working enter the following program:-

```
PRINT PEEK 16388 256 PEEK 16389
```

This should return the answer 29696 if all six 6116's are in place and your ZX80/81 has 1k internal RAM.

As this figure is the location of the first non-existant byte in the RAM area, it can

ZX80/81 EXPANSION BOARD

MEMORY MAP

TABLE 1

ADDRESS			
16384 - 18431	1st	2k RAM	(IC1)
18432 - 20479	2nd		(IC2)
20480 - 22527	3rd		(IC3)
22528 - 24575	4th		(IC4)
24576 - 26623	5th		(IC5)
26624 - 28671	6th		(IC6)
28672 - 30719	Internal RAM (only used if all six 6116's are in place)		
30720 up		8255	(IC7)
30720	8255	Port A	
30721	8255	Port B	
30722	8255	Port C	
30723	8255	Control Register	

Table 1 System memory map

be used as a useful diagnostic aid in the event of a fault condition.

For example, suppose the above program returned the answer 20500, it can be seen from the memory map above that this lies in IC3 and the fault probably lies in this area. Obviously, the first check is to plug another IC into this socket and try again after checking for dry joints etc.

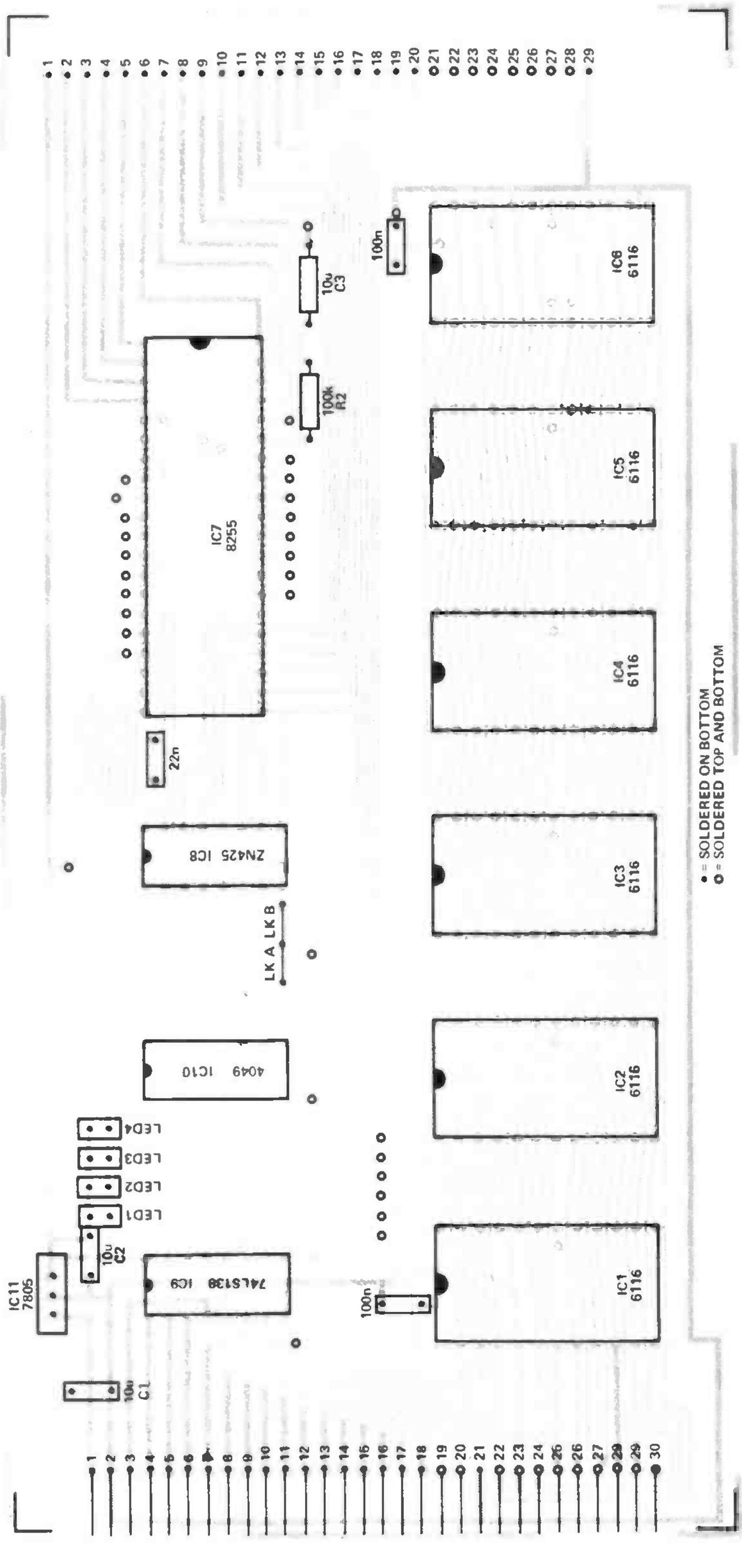
CONCLUSION

This board will convert the ZX80/1 into a useful machine for communicating to the outside world. More or less anything can be tied on to the ports, remembering that port C can drive transistor bases directly. You will soon be controlling your son's train set or even your own nuclear power station.........

Control Word	Port A	Port B	Port C upper	Port C lower
128	out	out	out	out
129	out	out	out	in
130	out	in	out	out
131	out	in	out	in
136	out	out	in	out
137	out	out	in	in
138	out	in	in	out
139	out	in	in	in
144	in	out	out	out
145	in	out	out	in
146	in	in	out	out
147	in	in	out	in
152	in	out	in	out
153	in	out	in	in
154	in	in	in	out
155	in	in	in	in

Table 2 8225 Control register commands

Figure 1 The Expansion PCB's overlay



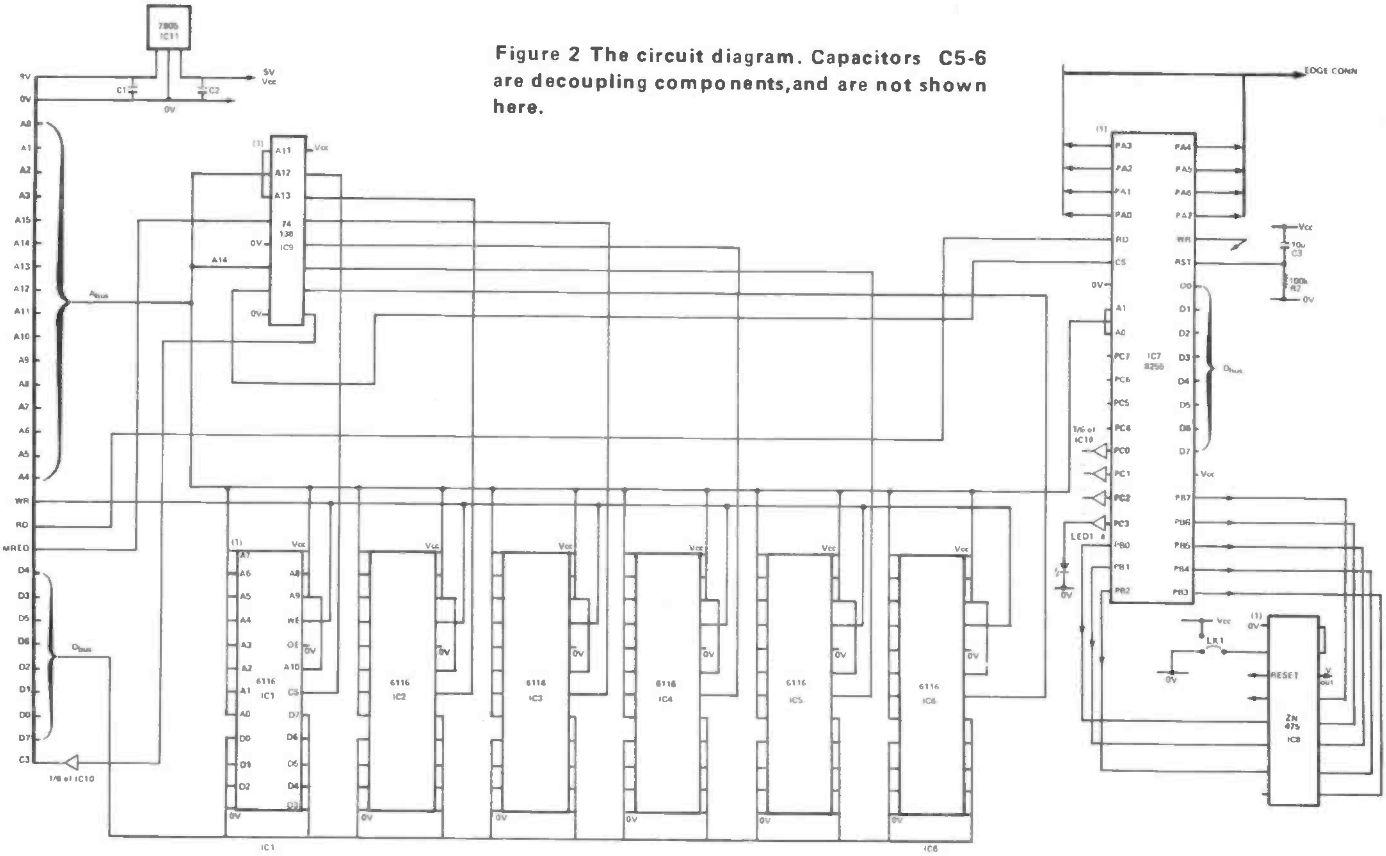


Figure 2 The circuit diagram. Capacitors C5-6 are decoupling components,and are not shown here.

MODE 0 OPERATION

the table opposite lists the control word to be POKE'd into the 8255 control register at location 30723 in order to acheive different Port configurations.

If information is required on how to configure the Ports in Modes 2 and 3 (handshake and interrupt) the 8255 Data Sheet should be consulted.

CIRCUIT DESCRIPTION

The various 'Blocks' of the expansion board will be discussed separately, starting with the memory.

STATIC VERSUS DYNAMIC

As will be seen from the circuit diagram static RAM has been used. This may seem an expensive luxury when dynamic RAM ICs i.e., 4116 are now very cheap.

However, static RAMs have very distinct advantages. Firstly, modern CMOS memories consume very little power, typically 200mW. This is a far cry from the days of central heating by 2114s, thus enabling the mains adaptor for the ZX80/1 to be used.

Secondly, static RAMs only require one PSU rail, thus simplifying the DC side of the design.

Thirdly, as most modern static RAMs are 'byte wide' i.e., they are constructed in an 8 bit format (1K x 8 etc), RAM can be added chip by chip. Thus, if only 2K is required only one IC needs to be inserted.

Finally, no dynamic refresh is required. For the benefit of readers who are not familiar with this term, a short description follows. Those who wish to can skip the next paragraph.

In a dynamic RAM the storage elements do not hold their information indefinitely, - it can be considered to behave like a leaky capacitor. Thus, to store information inefinitely, some method is needed to refresh the storage cell before the charge has leaked away. The principle used is to read the memory location while the data is still there and then to write it back in again. This is done at a high enough frequency so as not to interfere with the operation of the computer. However, it does mean extra hardware which in turn means extra expense.

I/O PORTS.

The chip that is used in the expansion is the Intel 8255. The zilog Z80PIO was considered, but it was felt that as the Intel chip has more I/O lines and is cheaper, it offered a better choice. The IO ports are memory mapped to the ZX80/81. Thus a simple program such as:-

```
10 POKE (LOCATION), STATUS WORD
15 POKE (LOCATION), DATA.
```

will cause the data on line 15 to be output to the specified port. Line 10 is necessary in order to tell the 8255 how to configure the ports. A table of the status words is included at the end of the article.

The above program will cause the data to be output immediately, in Intel language this is 'Mode zero'.

Suppose however that the peripheral connected to the port was not ready to accept the data that was output. We need some way to tell the peripheral that the port has information for it. Luckily the 8255 does exactly this if a port is configured in 'Mode 1'. When data is written to the port in this mode then the 'data available' pin on the 8255 will go high. This tells the peripheral that the port has information for it. Conversely, if the port is expecting information from the peripheral, then the data will not be acepted until the 'data strobe' pin for that port is taken high. This process is called 'handshaking'.

It should also be noted that Port C on the 8255 is capable of driving a transistor stage directly thus eliminating the need for a buffer.

D/A CONVERTER.

The Ferranti ZN425 was chosen to perform this function. There are other cheaper ICs but unlike the Ferranti IC they cannot be formatted as an A/D converter. This is because the ZN425 has an integral 8 bit binary counter in its structure, thus enabling a counter type A/D to be constructed with minimum external components.

To control the D/A converter which is located on port B it is only necessary to output a number to the port. An analogue voltage corresponding to this output can then be obtained off pin 14 of the ZN425. A simple Op-Amp buffer can be included off the board to convert this voltage to any level required.

A/D CONVERTER

A simple counter type A/D converter can be constructed using a minimum amount of external logic as illustrated below. Links have been incorporated on pins 2, 3 and 4 of the ZN425 to allow simple selection of this function if required.

On the negative edge of the CONVERT COMMAND pulse, the counter is set to zero and the STATUS output to logical 1. On the positive edge, the counter starts to count up from zero. The analogue output ramps until it equals the analogue voltage applied to the other input of the comparator. At this point, any further clock pulses are inhibited and STATUS goes low to indicate that the output data is valid.

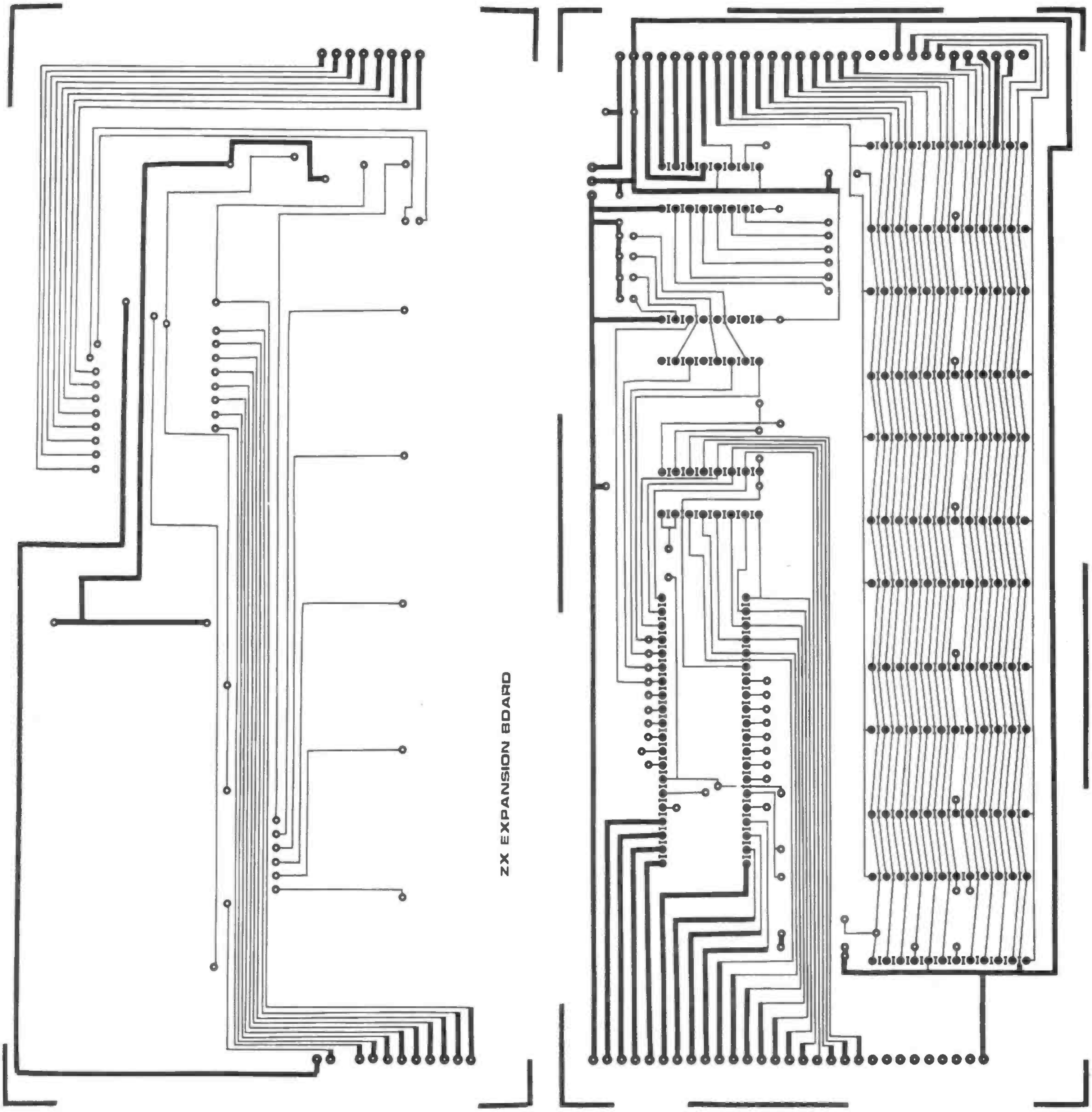
The conversion time depends upon the value of the analogue input, and for full scale reading is given by the clock frequency divided into the number of counts.

For example if F clock = 256 kHz

$$\text{Conversion (for F.S.R)} = \frac{28 \text{ seconds}}{256000}$$

$$= 1 \text{ millisecond.}$$

ZX80/81 EXPANSION BOARD



PCB foils of top and bottom track of ZX81 expansion board.

PARTS LIST

RESISTORS

R1	100k

CAPACITORS

C1	100u 10V tantalum bead
C2,3	10u 10V tantalum bead
C4	22n ceramic
C5,6	100n ceramic

SEMICONDUCTORS

IC1-6	6116
IC7	8255
IC8	ZN425E
IC9	4049
IC10	74LS138
IC11	7805

MISCELLANEOUS

PCB,Connectors,Sockets,Etc.

ACKNOWLEDGEMENTS

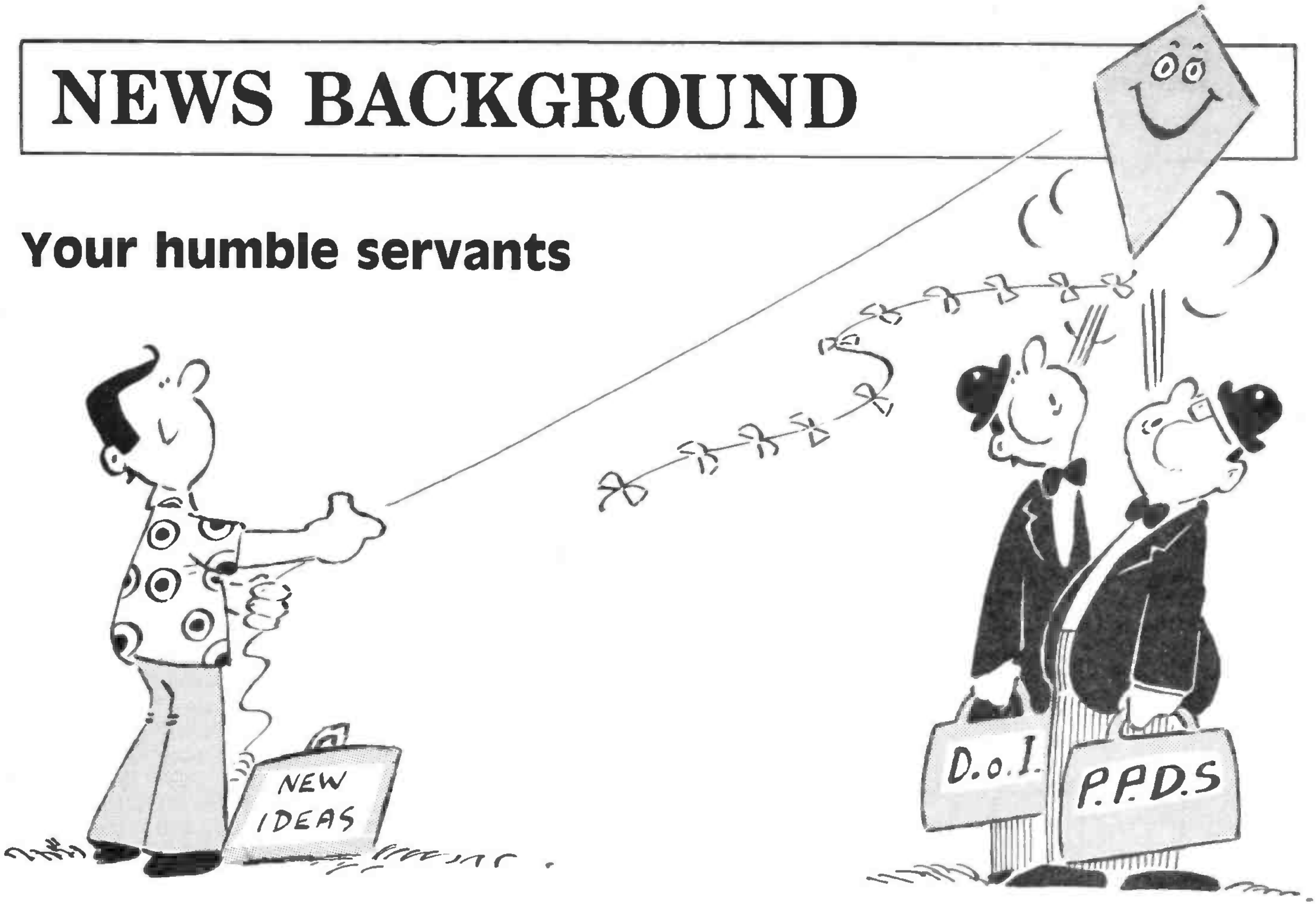
Ferranti Semiconductors Ltd.
Intel Inc.

■ R & EW

Your Reactions......	Circle No.
Excellent - will make one	143
Interesting - might make one	144
Seen Better	145
Comments	146

NEWS BACKGROUND

Your humble servants



DON'T OVERLOOK the various forms of assistance available from the Department of industry to assist the development of worthy products in the field of high technology products. The various awards are specifically aimed at the electronics business, and come either in the form of an outright grant, or up to 50%,whichis recoverable by a levy on sales.

Contrary to popular belief, these schemes are administered by reasonable and understanding persons, who are eager to be able to assist British companies in pursuit of technological goals that might otherwise be abandoned or compromised through lack of funds. The schemes are not constrained by area - indeed, there are many other grants and incentives available to those of you operating in regions designated as development areas of one sort or another. The capital grants available for plant and machinery are quite spectacular in many instances, although these are not described in this particular feature. A booklet from the DoI entitled 'Incentives for Industry' contains the relevant information.

Although the dreaded MAP (Microprocessor Applications Project) is one that most people have heard of, there is another more versatile scheme entitled the PPDS (Product and Process Development Scheme). The PPDS is designed to assist in the development of any new product or process to the point of manufacture. The project size should be between £25,000 and £2 million - although smaller projects are considered in the context of smaller firms. Indeed, as we found out, the terms of reference of the costing are such that it is frighteningly easy to cost out a project at £25,000 when you start to roll in all the peripheral expenses that you might normally amortise in the running of the business when considering such a development.

The DoI provides a very useful and comprehensive cash forecasting sheet that acts an effective discipline to ensure that the proposer understands exactly what he is letting himself in for. It must scare quite a few potential applicants to see just how rapidly any form of R&D operation can run away with the funds.

FUNDING SCHEMES

The PPDS provides up to 25% of the project cost in a straight grant. There are surprisingly few strings attached, and the only qualification is that the proposer should be technically and managerially capable of completing the project. A bit like the R&EW sponsorship scheme. The project should be seen to be commercially viable (another aspect of the analysis form), and the final point is a curious one, in that the project would otherwise not be undertaken at all, or within a reasonable timescale, without government support.

The apparent implication of this is that companies are encouraged to fly kites - with the penalty that if you have already started on a project before you find out about the grant, then you are not eligible for support, in spite of the fact that your project may easily have been worthy if put forward before work had commenced. In other words the scheme is encouragement, not reward.

The MISP (Microelectronics Industry Support Programme) scheme is specifically aimed at the microelectronics business, and operates on basically similar parameters. A further aspect is a grant of up to 25% of the cost of production plant, equipment and buildings, with all sorts of additional facilities to help in establishing production units if you are prepared to site yourself in one of the special development areas.

The MAP scheme is perhaps primarily renowned for the £3000 grant facility (max) for consultancy work carried out by approved consultants in connection with feasibility studies and the like. However, the same 25% grant, 50% shared cost scheme is available under the very broad direction that 'the scheme is open to all sectors of UK manufacturing industry. Firms receiving assistance under the MAP scheme are not eligible for other forms of assistance under government scehems - except regional development grants.

So if your firm is developing a microprocessor controlled, microprocessor controller - and you are prepared to move to one of the many special development areas, you may find that launching a product is a good deal cheaper than you imagined. But even if you are engaged in a more mundane end of the electronics business, write to the DoI (IT Division, Dean Bradley House, 52 Horseferry Road, London SW1P 2AG) and ask for the details of their various schemes.

NEWS BACKGROUND

ANOTHER FIRST FOR R&EW?

One of the more constructive aspects of being newcomers to the business of publishing, is the fact that we had very few fixed ideas on how to go about the whole business. One of the first frustrations we faced was the delay between writing a feature, and seeing it appear in print.

Well, we have just taken a fairly bold step, and installed a digital phototypesetter in the shape of the Compugraphic 8400 MCS. Along with the hardware, we installed the necessary software in the shape of 'Titch' Delafield' - without whom none of this would be possible.

The 8400 produces typeset text around ten times faster than the previous system, together with the facility for up to 16 alternative typefaces 'on line'. But this isn't the main reason we have adopted the system (admittedly, it means that the lab staff can produce their words within 6 hours of the press starting to roll, instead of the present 24 hours). The 8400 comes with an optional asynchronous communications interface (ACI), which is probably the most significant development in typesetting since Caxton since it enables any RS232 terminal device to communicate and load typesetting directly into the composing system.

NEW TECHNOLOGY

Virtually any wordprocessor and any computer can be used to supply text for direct typesetting. This means that text is only keyed-in once, and that proof checking can be carried out using lowcost listing paper output, not costly photoset text. The ACI option includes the facility to translate character groups in typesetting formatting instructions - so the material can come straight in, where it is queued on disk and automatically paginated. All Titch has to do is to 'compose' - which is the process that looks up the character sizes for the various different typestyles, and fits the text into neat columns.

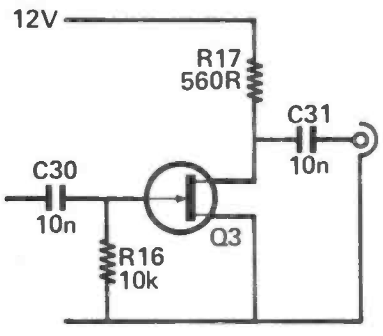
The much-vaunted R&EW computer is gradually coming together, and at least the word processing software is working reliably. Virtually all of the text in this issue will have been set using this process. There have been a few teething troubles, and a few frustrating hours spent establishing some of the bugs not yet fully documented - but the facility is now running smoothly, and our next dramatic step is to use telephone line modems to provide access to instant low cost typesetting to anyone with an RS232 ASCII terminal system.

There's a little way to go yet before we can provide the facilty via REWTEL, but it's not far away. We will also be able to 'download' pages from REWTEL for typesetting. Meantime, however, Titch will be pleased to offer this magnificent facility to anyone requiring typesetting - and if you can send the text under Wordstar on a standard 8 inch floppy, then the cost will probably be less than 25% of what you would normally pay, and that has to make a lot of sense.

The facility is ideal for catalogue and pricelist work as well, since all record maintenance and updating can be carried out on a 'normal' computer or word processor, which is where most such material resides these days anyway. The days of illegibly duplicated bits of paper may well be numbered, and the service that Titch can offer is obviously well practised in the problems of the electronics business.

FEEDBACK

JULY '82



(R18 IS NOW OMITTED)

Figure 1.

10.7 MHz SSB GENERATOR

The output section of the module is now as shown in *Fig. 1* and not as shown in the circuit diagram.

The change can be easily implemented on the existing PCB.

AUTOBRIDGE

Overlay shown in *Fig. 5* of the article shows components mounted on 'board' side of PCB. In fact, the components should be mounted on the foil side of the PCB as described in the text.

R&EW Data Brief

KB 4436

KB4436 : Noise Cancel System

This device is designed for use in FM radios and tuners to suppress pulse type noise.

It is most effective in suppression of the noise generated in a car's ignition circuit and in various types of electrical equipment.

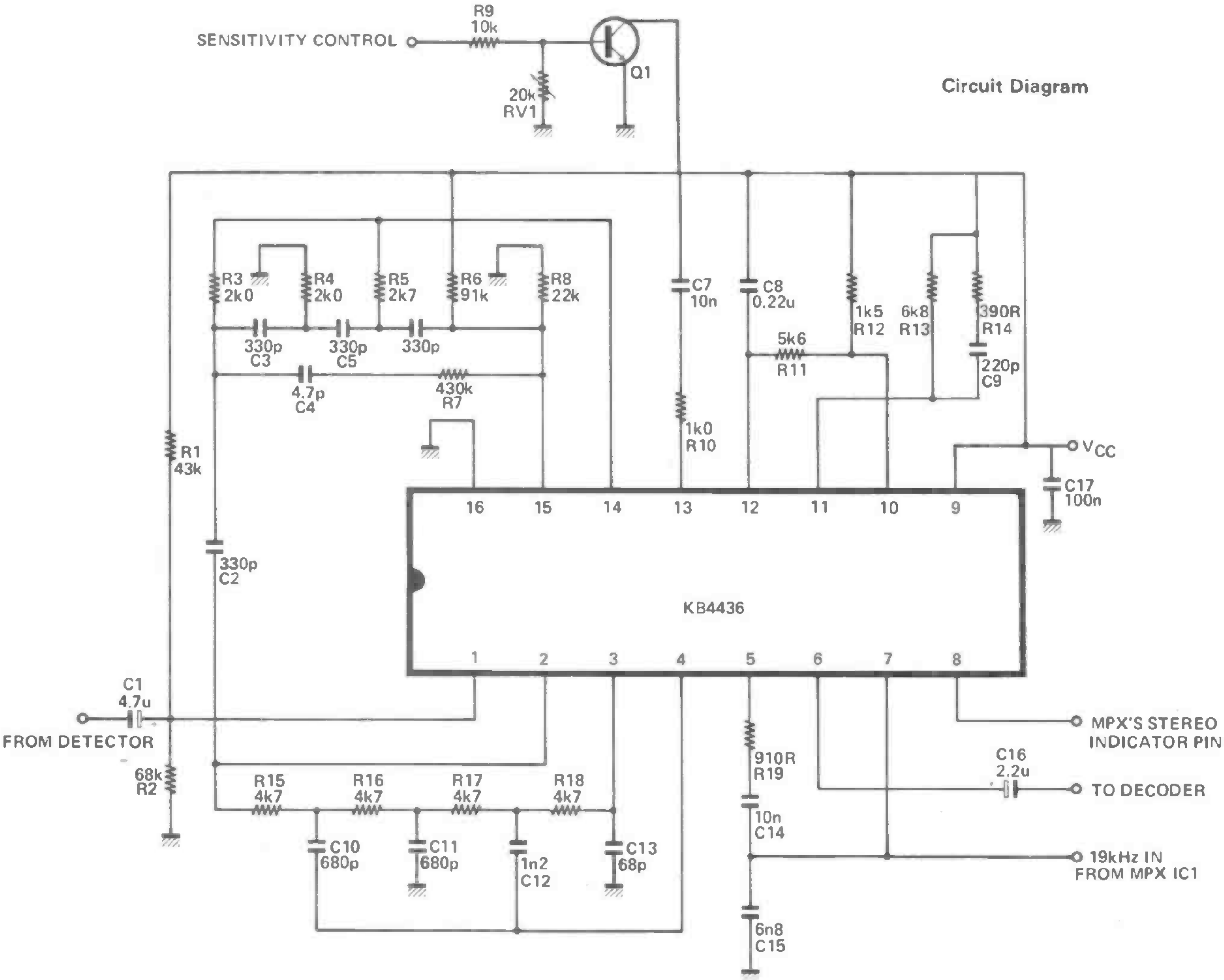
It is possible to achieve superior results in FM stereo receivers when incorporated in a system with a PLL MPX IC.

FEATURES

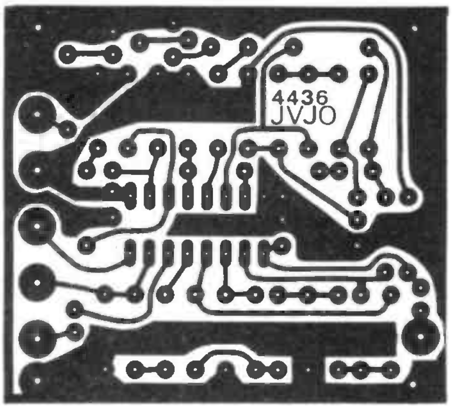
High noise cancel ratio.
Internal 19kHz switch.
Noise AGC circuit.
Low distortion.
Wide dynamic range.

Electronic characteristics

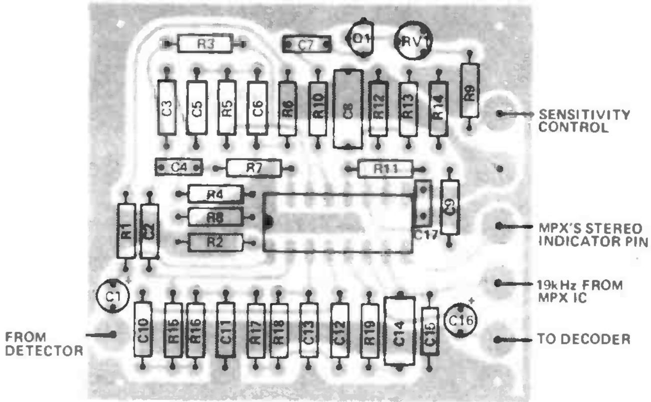
ITEM	NOTATION	SPECIFICATION			UNIT	CONDITION
		MIN	TYP	MAX		
Current Consumption	I_{CC}			28mA	mA	W/no signal
Voltage Gain	G_V	–1.0		1.0	dB	at 1kHz
Maximum Output	V_{outmax}	1.5			Vrms	at 1kHz KF = 1.0%
Input Impedance	Z_{in}		30		kΩ	at 1kHz
Distortion	THD			0.1	%	at 1kHz V_{out} = 500mVrms
Gate Time	T_S		25		μs	Pulse voltage; 100mV Pulse width: 1μs Rep. freq. 1kHz
Noise Input Sensitivity	V_N	40			mV	Pulse width: 1μs Rep. freq. 1kHz
19kHz Switch on output	V7 on			0.2	V	V8 = open
19kHz Switch off output	V7 off	11.5			V	V8 = 2.2V



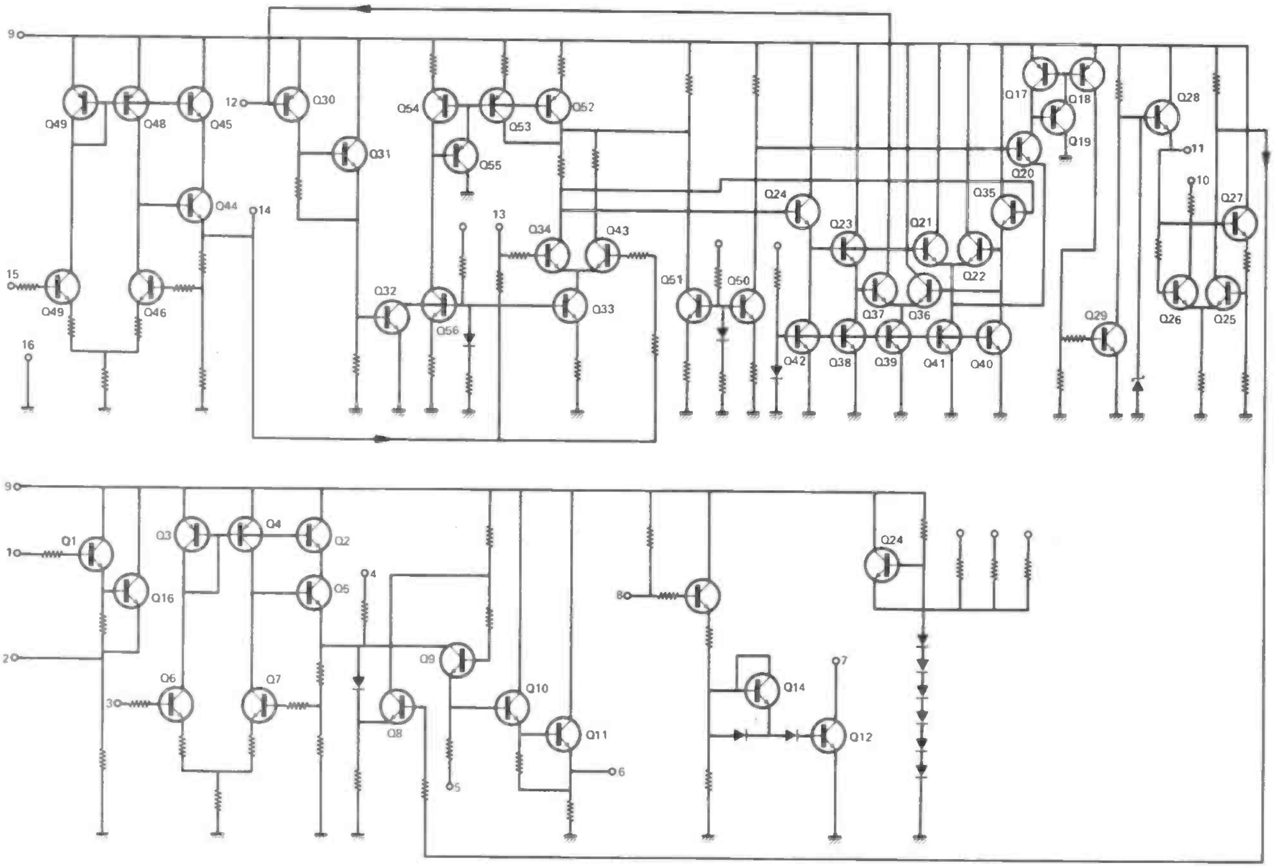
Circuit Diagram

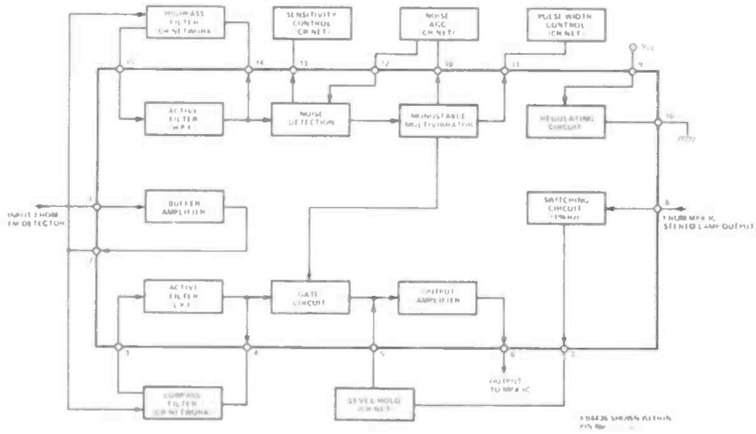


PCB Foil.



PCB Overlay.





SEE PROJECT PACKS FOR PRICE

Block Diagram

MULTIBAND UP-CONVERTER

Used with a 2m transceiver, this converter provides coverage of 10, 6 and 4m bands plus CB and band I TV. Design by Graham Leighton.

THIS CONVERTER WILL ALLOW the reception of any four 4MHz (2MHz with a 144-146MHz IF) bands in the range 26 to 75MHz using a two meter receiver/tranceiver as the IF. This range includes the 10, 6 and 4m amateur bands, citizens band, European and American public service bands and band 1 television. These can make interesting listening and provide useful propagation data. Table 1 gives details of some of the services present in this part of the radio spectrum.

SYSTEM DESIGN

There is about 8dB conversion loss in the converter which, given a sensitive two meter receiver, provides adequate performance for most purposes. Despite the simplicity of the input filter, it is effective in reducing the level of IF breakthrough and other spurii to an acceptable level. The inclusion of a tuned preamplifier, such as that described in reference 2, increases the sensitivity and the immunity to out of band signals considerably. Most two meter receivers, however, suffer from severe intermodulation and adjacent channel interference if the preamplifier is included in a system for receiving citizens band. This should not be a problem above 28MHz where the band occupancy and signal strengths are generally lower.

The frequency range of the original design was 26 to 60MHz. It was thought that the harmonic relationship of the local oscillator, input and IF frequencies would be the cause of spurious responses if this range was increased. In fact, despite the compromise of a 75MHz input filter cut off and the 120MHz LPF for the local oscillator, the performance remained acceptable. It is advisable, to use a tuned preamplifier above 50MHz to improve the selectivity and to reduce the oscillator radiation.

Table 1

Frequency (MHz)	Use
30-50	Public Service (USA)
33.42-33.98	Fire Depts (USA)
46.06-46.50	Fire Depts (USA)
37.02-37.44	Police Depts (USA)
39.02-39.98	Police Depts (USA)
42.02-42.94	Police Depts (USA)
45-08-46.04	Police Depts (USA)
50-54	6m Amateur band
45-75+	Band 1 TV
70.025-70.500	4m Amateur band
68-88	Public Service (UK)
66-73	OIRT FM Broadcasting (E Europe)

1. The above list contains details of only some of the services operational between 30 and 75MHz.
2. The reception of some services listed is subject to special licencing in some countries.
3. There are a number of beacons in the 6m and 4m bands. A full list is available from the Radio Society of Great Britain.

The converter may be used with one to four oscillators without circuit changes. These oscillators are DC switched and may be remotely controlled (within reason).

CONSTRUCTION

Thread some wire through the holes (marked X) around the mixer and solder top and bottom. Assemble the components on the PCB. Where an earth connection is required (with the exception of the mixer) it is easier and more reliable if the component leads are soldered to the top of the PCB only. The uncommited pads on the under side of the PCB are only present to assist in the location of the components.

Wind the transformer T1 as follows:-
1)Take three 6 inch lengths of 0.25mm enamelled wire, twist them together (about 8 t.p.i.).
2)Wind two turns of the twisted wire onto a Fair-Rite 28- 43002402 core.
3)Separate the ends; identify each winding using a multimeter.
4)Connect the start of one winding to the finish of another. This forms the primary (two windings in series). The remaining winding is the secondary.

Fit the transformer to the PCB ensuring that the primary is connected to Q2. Solder some pieces of tinned copper wire to form tags for the input, output, power and oscillator switch connections. Fit the mixer. The 'MCL SBL-1' legend should line up with that printed on the overlay. Check the PCB for dry joints, incorrect components and solder bridges. Assemble the PCB into the case, connect the power leads, bnc sockets and switching control (if required). If a switch is to be mounted remotely, the leads should be screened to prevent 144MHz pick up.

TESTING

Warning: The mixer is easily damaged if DC or a high RF level is applied to the LO port (IF output). Take care not to press the ptt when using a transceiver as an IF.

Set the cores of L4,5,6 and 7 to about 2mm above the top of the formers - make sure they are all set to the same level. Set the core of L3 level with the top of the former.

Connect the unit to a 10V power supply, preferably with current limit set to 50mA. The current drawn should be about 11mA. Switch on an oscillator by earthing the appropriate switching line. The supply current should rise to about 15mA.

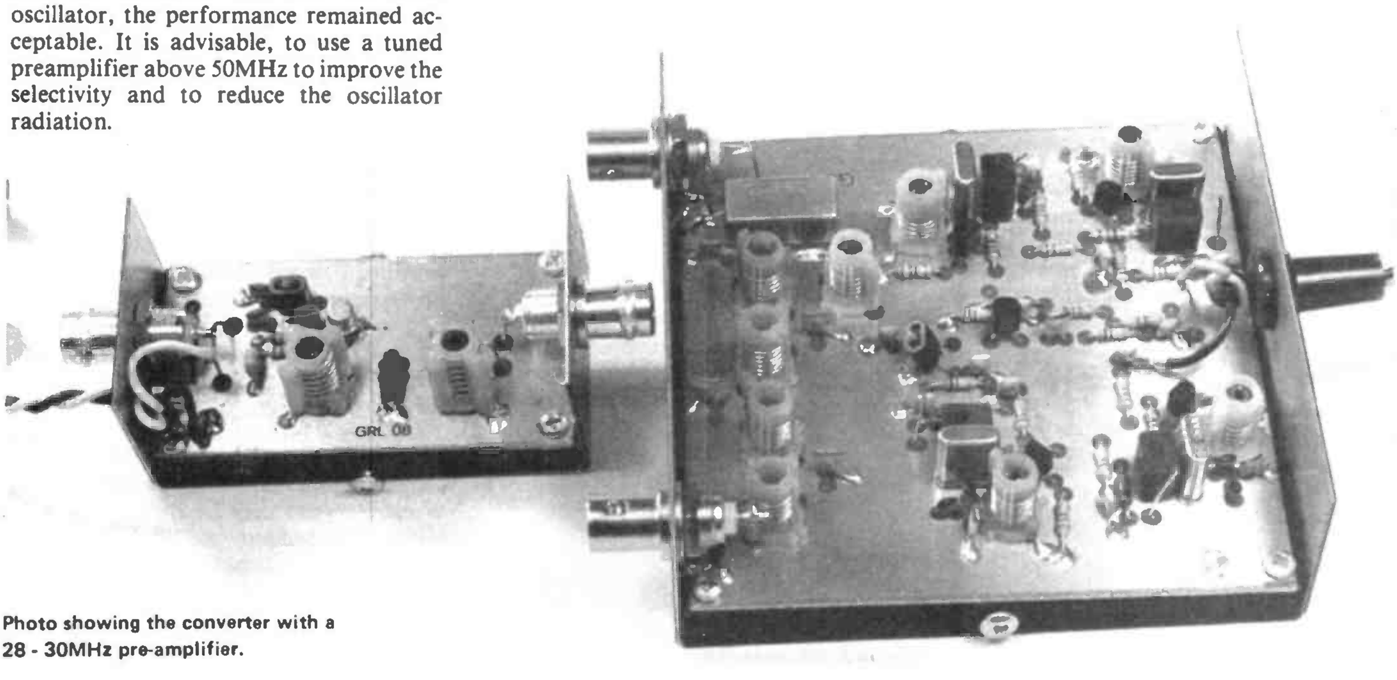
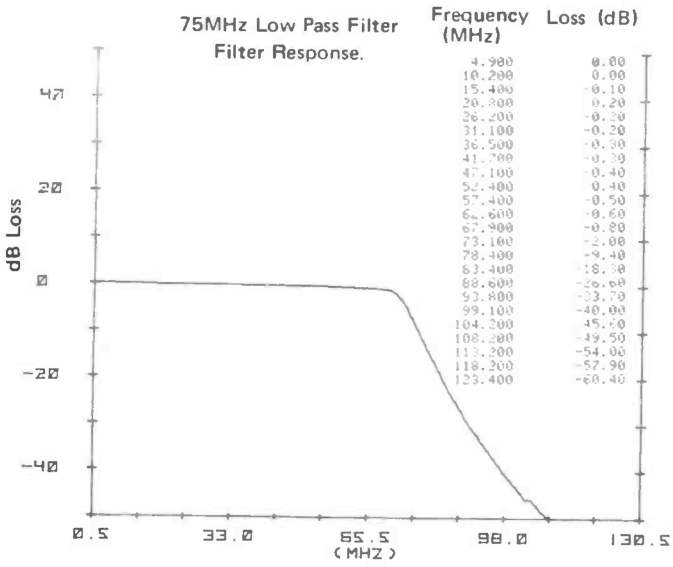
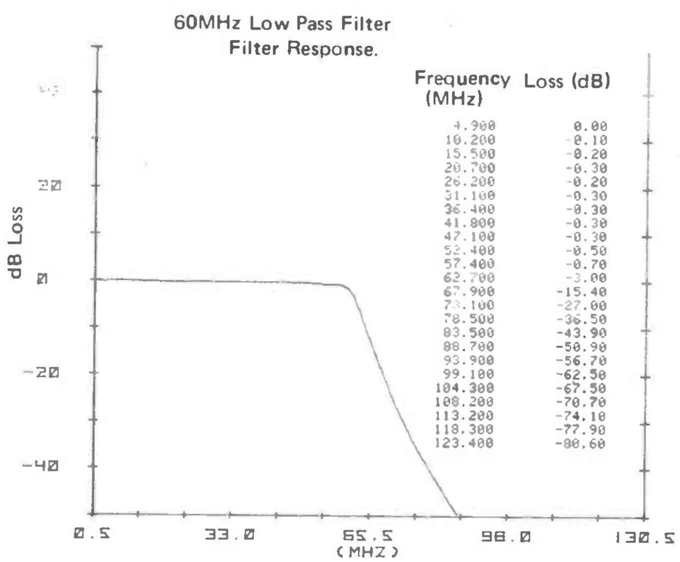


Photo showing the converter with a 28 - 30MHz pre-amplifier.



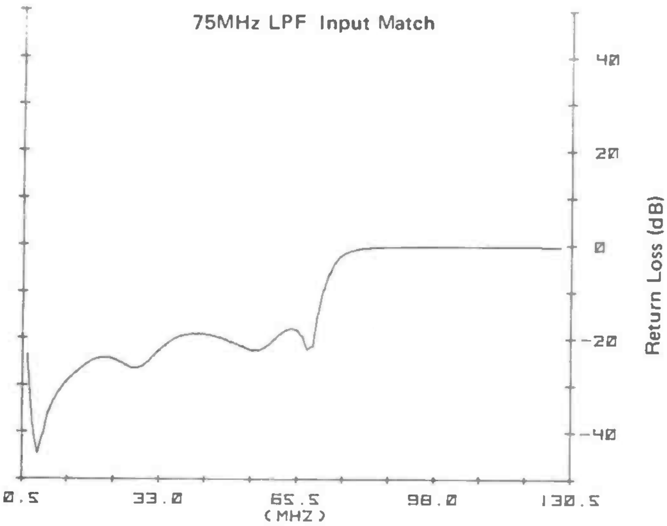
Frequency (MHz)	Loss (dB)
4.900	0.00
10.200	0.00
15.400	-0.10
20.800	0.20
26.200	-0.30
31.100	-0.20
36.500	-0.30
41.700	-0.30
47.100	-0.40
52.400	0.40
57.400	-0.50
62.600	-0.60
67.900	-0.80
73.100	-2.00
78.400	-9.40
83.400	-18.30
88.600	-26.60
93.800	-33.70
99.100	-40.00
104.200	45.60
108.200	-49.50
113.200	-54.00
118.200	-57.90
123.400	-60.40

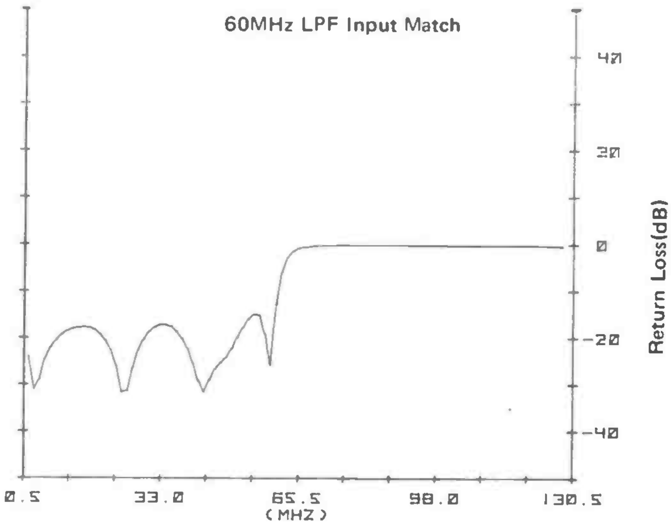
Figure 1: 75MHz filter terminated with 50ohms, component values as stated on the circuit diagram.



Frequency (MHz)	Loss (dB)
4.900	0.00
10.200	-0.10
15.500	-0.20
20.700	-0.30
26.200	-0.20
31.100	-0.30
36.400	-0.30
41.800	-0.30
47.100	-0.30
52.400	-0.50
57.400	-0.70
62.700	-3.00
67.900	-15.40
73.100	-27.00
78.500	-36.50
83.500	-43.90
88.700	-50.90
93.900	-56.70
99.100	-62.50
104.300	-67.50
108.200	-70.70
113.200	-74.10
118.300	-77.90
123.400	-80.60

Figure 2: 60MHz filter terminated with 50 ohms, component values:— L4, 5, 6, 7, 6½t; C14, 18 56p; C15, 16, 17 110p.





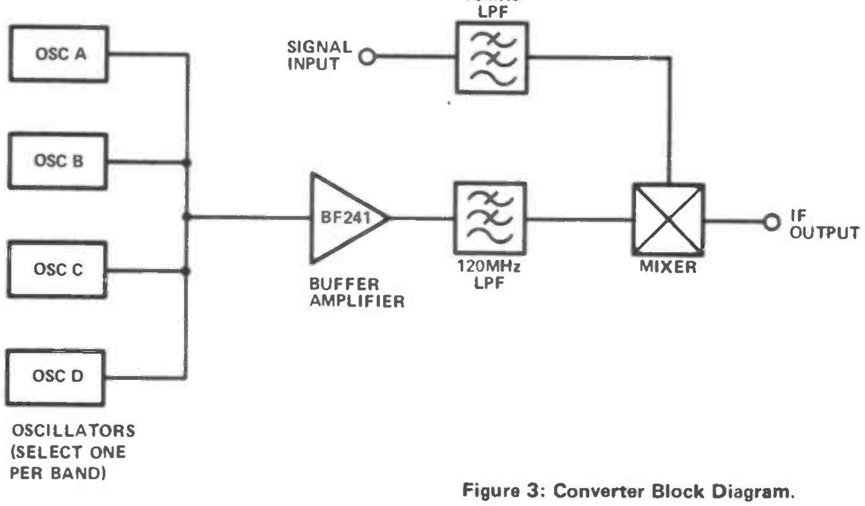


Figure 3: Converter Block Diagram.

Monitor the voltage on Q2 emmiter and adjust the oscillator core until there is a slight reduction. This is typically 1V045 to 1V038 and corresponds to the oscillator starting. This reduction is just observable on a multimeter, alternatively a diode probe may be used to monitor the RF level on the secondary of T1. A frequency counter may also be connected to this point to set the exact frequency of the oscillator.

Connect a 2m receiver to the output and an antenna to the input. If a frequency counter is not available, the exact frequency of each crystal may be trimmed by adjusting the oscillator coil whilst monitoring a known frequency standard such as a beacon etc.

Repeat the above procedure for each oscillator.

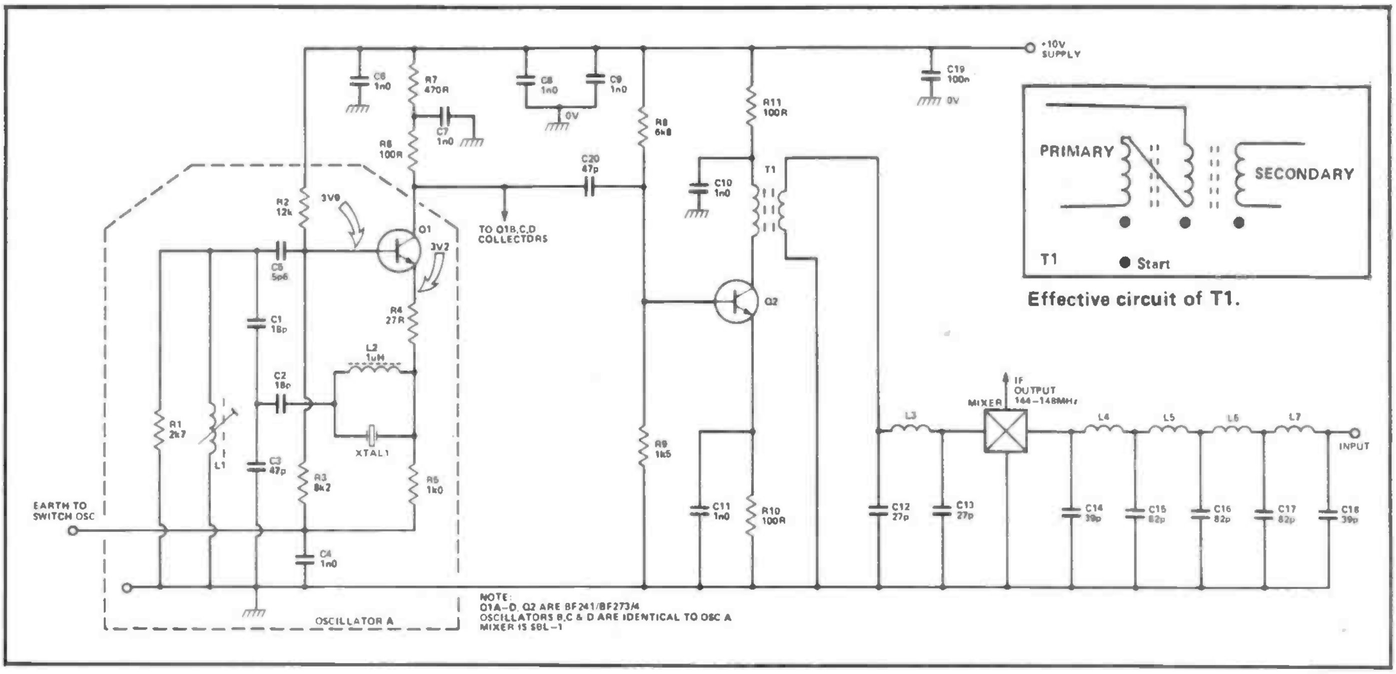


Figure 4: Circuit Diagram.

CIRCUIT DESCRIPTION

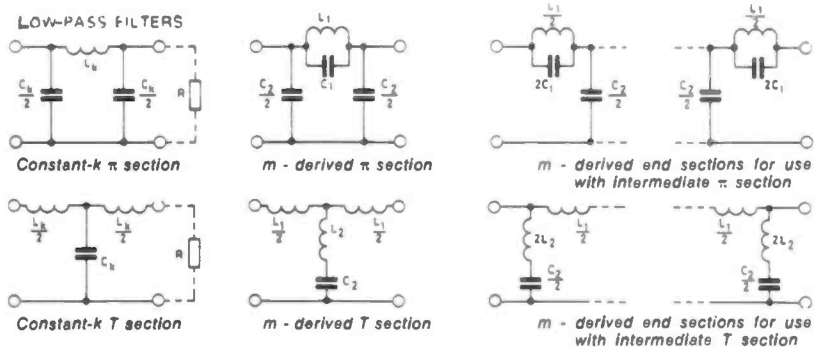
The four identical oscillators are similar to those used in reference 3. The resonant circuit comprising L1, C1 and C3 is set to the approximate frequency of the overtone crystal. This, together with L2, ensures operation on the correct overtone of the crystal. Table 2 contains details of the coils required to cover the various oscillator frequencies.

The oscillator output appears across R6 which is a collector load common to all the oscillators. This is fed to the wideband amplifier, Q2. The output of this stage is matched to 50R by T1. L3, C12 and C13 form a 120MHz low pass filter which reduces the harmonic content of the local oscillator (LO). If the upper limit of the LO is 110MHz or so, the cut off frequency of this filter may be reduced by setting the core of L3 to about 3mm below the top of the former.

The filter output is connected to the LO port of the SBL-1 mixer. The RF input to the mixer is fed via a four pole constant-K low pass filter (some filter design information is contained in Appendix A and reference 1). The response of the filter is shown in *Fig 2*. An elaborate low pass filter design using several M derived sections was investigated but this proved difficult to implement. The rejection of the LPF together with the mixer isolation results in the IF breakthrough being minimal. IF breakthrough is more likely to occur through insufficient screening of the receiver and/or interconnecting leads. The rejection of 144MHz from the power supply input is also important - ferrite beads can help here.

APPENDIX A

Basic filter sections and design formulas. In the formulas *R* is in ohms, *C* in farads, *L* in henrys, and *f* in hertz.



$$L_k = \frac{R}{\pi f_c} \qquad C_k = \frac{1}{\pi f_c R}$$

$$L_1 = mL_k \qquad C_1 = \frac{1-m^2}{4m} C_k$$

$$L_2 = \frac{1-m^2}{4m} L_k \qquad C_2 = mC_k$$

Close-up view of T1.

TABLE 2

OSCILLATOR COIL DETAILS (L1)

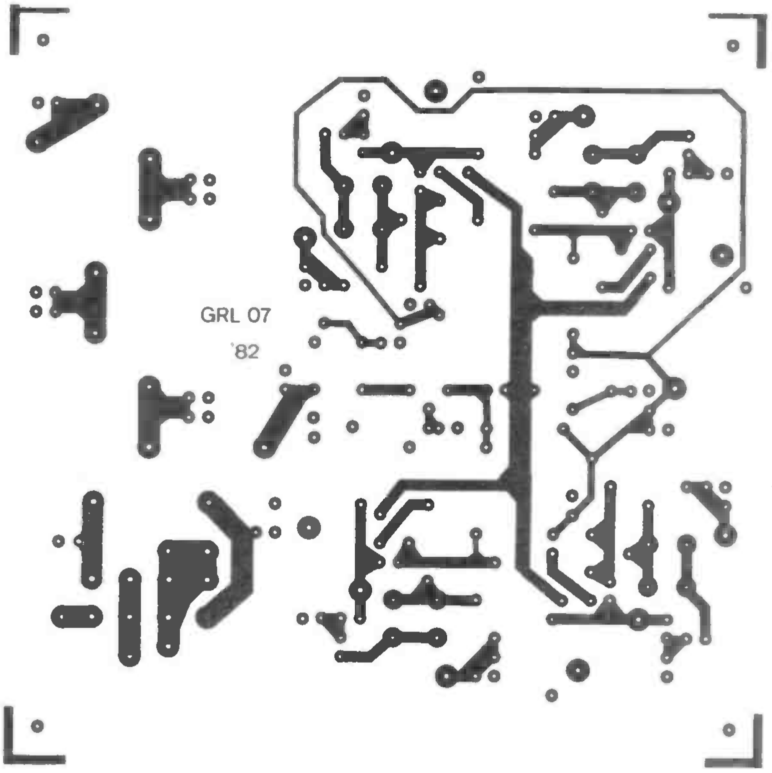
Crystal Frequency (MHz)	Coil
74-88	5.5t (Green)
88-103	4.5t (Yellow)
103-118	3.5t (Orange)

RESULTS

Using an FT290 and an IC290 as the IF a sensitivity (on FM) of between 0.5μV and 1μV was obtained across the range of the converter. In use, it was found that a tuned preamp, such as that to be described next month, together with this converter provides an excellent receive system for the frequencies covered. The sensitivity is increased to about 0.2μV for 12dB sinad on an FM signal.

The scanning facilities of the 2m transceiver make the monitoring of these bands very simple and convenient.

Many East European broadcast stations in the 66 - 73MHz band are audible during the summer months and their presence gives early warning of sporadic -E conditions on band 2 and 144MHz.



Frequency	Callsign	Location
50.003	PY1RO	Rio de Janeiro
50.005	H44HIR	Solomon Islands
50.010	ZS1STB	Still Bay, S.A.
50.015	SZ2DH	Athens
50.020	GB3SIX	Anglesey
50.025	6Y5RC	Jamaica
50.030	ZS6PW	South Africa
50.035	ZB2VHF	Gibraltar
50.039	FY7THF	French Guiana
50.040	ZS6VHF	South Africa
50.041	WA8KGG	NE Ohio
50.075	VS6HK	Hong Kong
50.080	TI2NA	San Jose
50.088	VE1SIX	New Brunswick
50.099	KH6EQI	Pearl Harbour
50.498	5B4CY	Cyprus
70.040	GB3WRA	AL71D
70.050	GB3BUX	ZN61A
70.060	GB3ANG	YQ35C
70.112	5B4CY	QU51B
70.120	ZB2VHF	XW64G

Some 6 and 4m Band Beacons.

Figure 5: PCB Foil Pattern - track side.

PARTS LIST

OSCILLATOR (Up to 4 required)

Resistors (all 0.25W 10%)

R1	2k7	R4	27R
R2	12k	R5	1k
R3	8k2		

Capacitors

C1,2	18p	Min ceramic 0.1" spacing
C3	47p	
C4	1n	
C5	5p6	

Inductors

L1	TOKO S18 (see Table 2)
L2	TOKO 7RB 1u0

Semiconductor

Q1	BF241/BF273/4

Miscellaneous

Crystal	As required (e.g. 74,94, 116,118MHz for 4m,6m, 10m and CB respectively)

BUFFER AMPLIFIER/MIXER/FILTER

Resistors (all 0.25W 10%)

R6,10,11	100R	R8	6k8
R7	470R	R9	1k5

Capacitors

C6,7,8,9,10,11	1n0	Min ceramic
C12,13	27p	
C14,18	39p	
C15,16,17	82p	
C19	100n monolithic ceramic	
C20	47p min ceramic	

Semiconductor

Q2	BF241/BF274/3

Inductors

L3	TOKO S18 4.5t
L4,5,6,7	TOKO S18 5.5t

Miscellaneous

T1	0.25mm enamel wire on Fair-Rite 28-43002402 core
PCB	Double sided GL-07
Case	21-06102
Sockets	2 x BNC single hole fixing

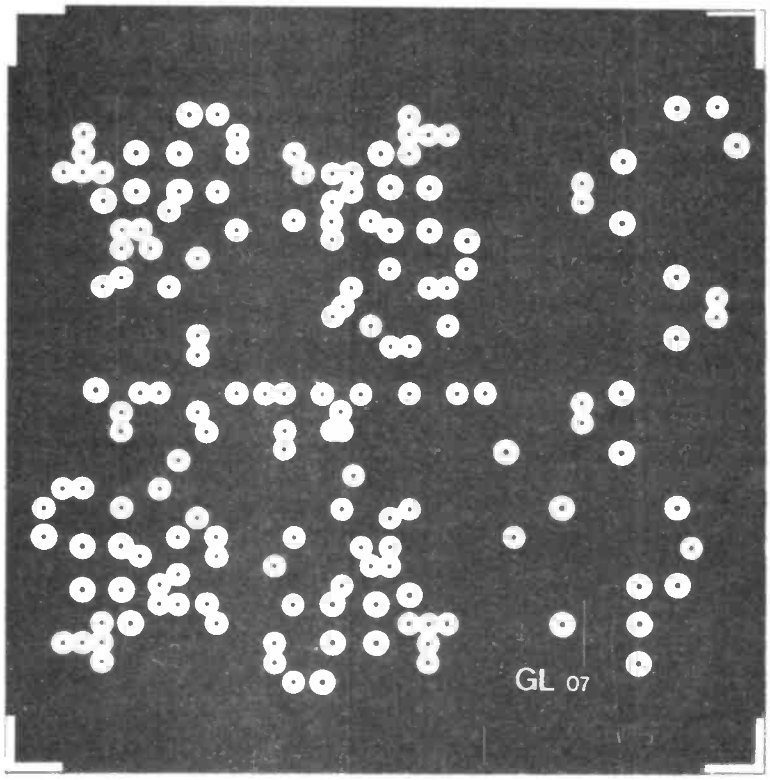


Figure 6: PCB Foil Pattern - Component side.

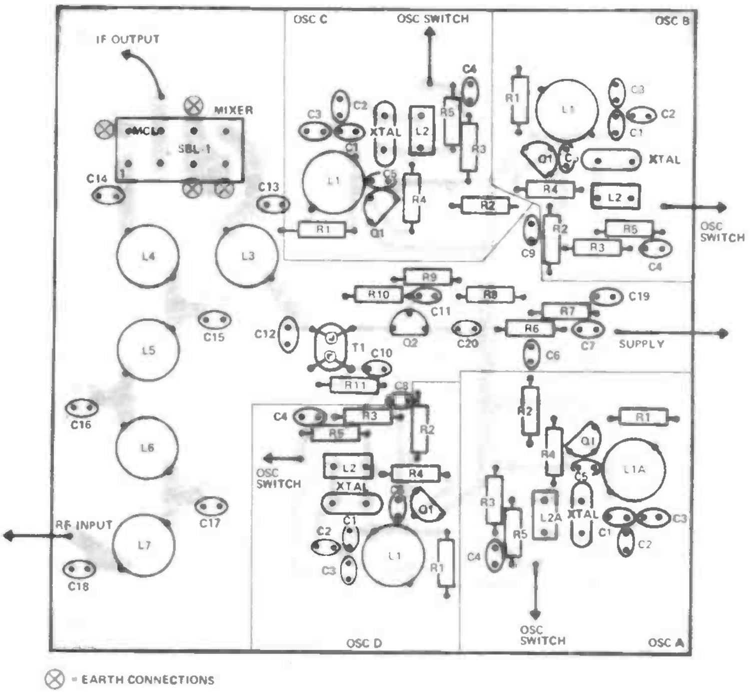


Figure 7: Component overlay.

ZB2VHF on 50.035MHz has been heard on many occasions (during May) as have some band 1 TV sound and vision signals from Scandanavia.

■ R & EW

REFERENCES

1. F.R. Connor; 'Networks' Pub. Arnold.
2. 4, 6, 10m Preamplifiers to be published in R&EW Sept. 1982.
3. Leighton G. R. 70cm to 2m and TV Converter R&EW Jan. 1982.

Your Reactions......	Circle No.
Excellent - will make one	15
Interesting - might make one	16
Seen Better	17
Comments	18

Data File No. 9

Ray Marston introduces a unique new circuit 'building block' that can provide very sophisticated power control of low-voltage DC loads such as lamps, heaters, blower motors and model locomotives, etc.

THE AUTHOR HAS, for some years, been experimenting with precision DC motor control circuitry and has, in the course of this work, evolved what is believed to be a brand new type of circuit element. In essence, this new circuit converts a DC input voltage signal into a switched-mode output signal of almost identical mean DC value, and maintains that value independent of wide variations in load characteristics. It enables high-power DC loads to be precisely and variably controlled, with negligible power losses, via low-power local or remote input voltages.

When used to drive DC electric motors, the new circuit continuously monitors the motor's speed via its 'dynamo effect' generated voltages, and automatically adjusts the power feed to maintain the speed at a constant level, irrespective of load variations. This new circuit has no official name so we will, for the sake of simplicity refer to it here as the SMVF (Switched-Mode Voltage Follower) circuit.

The SMVF circuit has lots of practical applications. It can be used to efficiently control the brilliance of lamps, or to give high-precision feedback sensing speed control of servomotors, mini-drills, and model locomotives, etc.

THE BASIC SMVF CIRCUIT

Figure 1 shows the basic SMVF circuit, and *Fig 2* shows its two generated waveforms, together with their special terminology and formulae. The circuit is powered from a single- ended supply and uses a 3140 op-amp as its active element. Unique and important features of the op-amp in this application are that its input and output signals can both swing all the way down to 0V. In *Fig 1*, a non-inverting power-booster is interposed between the output of the op-amp and the output of the circuit, to boost the available output current to a useful level.

The op-amp is used as a voltage comparator, with a reference or control voltage applied to its non-inverting terminal from RV1, and a feedback voltage applied to the inverting terminal via R4-C1. When the non-inverting terminal voltage is above that of the inverting terminal, the output of the circuit switches high (to +20V), and when the non-inverting terminal voltage is below that of the inverting terminal the output switches low (to 0V if a resistive load is used). The circuit operates as follows.

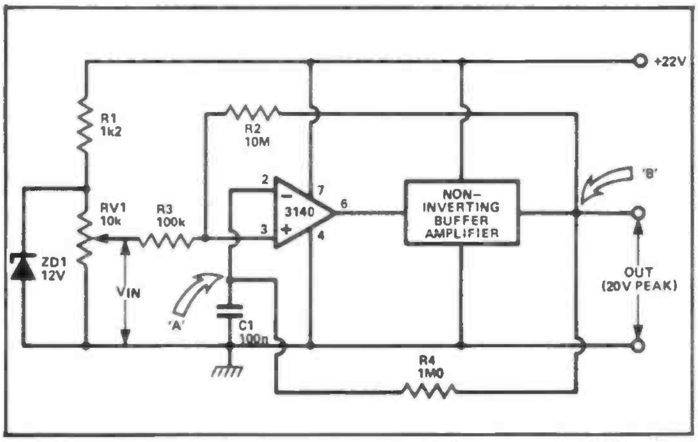
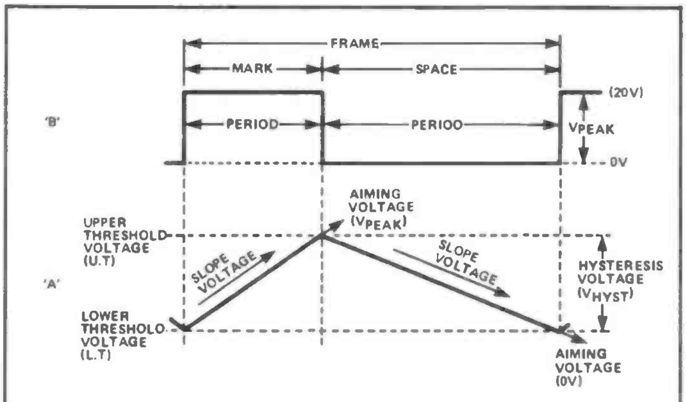


Figure 1: The Switched-Mode Voltage Follower (SMVF) circuit.



$$\text{UPPER THRESHOLD VOLTAGE (U.T)} = V_{IN} + \left(\frac{V_{PK} - V_{IN}}{R2/R3}\right)$$

$$\text{LOWER THRESHOLD VOLTAGE (L.T)} = V_{IN} - \left(\frac{V_{IN}}{R2/R3}\right)$$

$$\text{HYSTERESIS VOLTAGE } (V_{HYST}) = \text{U.T} - \text{L.T} = \frac{V_{PK}}{R2/R3}$$

$$\text{MARK SLOPE} = V_{PK} - \text{L.T}$$

$$\text{SPACE SLOPE} = \text{U.T}$$

$$\text{MARK OR SLOPE PERIOD} = \frac{V_{HYST} \times C(uF) \times R(M\Omega) \times 6500}{V_{SLOPE}}\ \text{mS}$$

$$V_{OUT}\ \text{(MEAN)} = \frac{V_{PK}}{\left(\frac{M_{SLOPE} + S_{SLOPE}}{S_{SLOPE}}\right)} = \frac{V_{PK}}{\left(\frac{M_{PERIOD} + S_{PERIOD}}{M_{PERIOD}}\right)}$$

Figure 2: Measured performance of the SMVF circuit of Fig 1, at three values of input voltage, with light and heavy resistive loads, illustrating the good tracking and regulation characteristics of the design.

Suppose that a voltage V_{in} (in the range 1 to 12V) is set on the slider of RV1, that the C1 (inverting terminal) voltage is initially below this value, and that the circuit's output has just switched high. Resistors R2-R3 act as a potential divider between the output +20V and the RV1 slider potential, and apply a voltage slightly greater then V_{in} (the upper threshold voltage) to the non-inverting terminal of the op-amp. Simultaneously, C1 starts to charge towards the 20V 'aiming volts' via R4 until, eventually, it reaches the upper threshold value and the ouput of the op-amp comparator starts to switch low.

Because of the 'hysteresis' feedback action of R2-R3, a regenerative switching action is initiated at this point and the output of the circuit switches abruptly low. R2-R3 then pull the non-inverting terminal voltage to some value below that set on RV1 slider (to the 'lower threshold' value). Simultaneously, C1 starts to discharge towards the 'zero volts' aiming value via R4 until, eventually, it reaches the lower threshold value, at which point the output of the op-amp comparator starts to switch high again, initiating another regenerative switching action in which the output abruptly reverts to the high ' +20V' state again. The whole process then repeats ad-infinitum.

Thus the circuit acts as an oscillator and generates a rectangular or pulsed (switched-mode) output waveform, and maintains the mean values of the op-amp inverting and non- inverting terminal voltages at identical values. Because the 'hysteresis' voltage generated by R2-R3 is fairly low, however, the mean voltage on the non-inverting terminal is almost the same as that on RV1 slider. Note, however, that R4-C1 integrates the switched-mode output waveform of the circuit, so that the **mean** value of the output waveform is identical to that on the non-inverting terminal of the op-amp and almost identical to that on RV1 slider. The circuit thus lives up to its title of a 'Switched-Mode Voltage Follower'.

TRACKING AND REGULATION

Table 1 shows the measured performance of the *Fig 1* SMVF circuit, at three values of input voltage and with light and heavy resistive loads. It illustrates the very good tracking and regulating characteristics of the design. When the output is lightly loaded it has a peak value of 20V, giving a hysteresis value of 200mV, and when the output is heavily loaded it is assumed to have a peak value of only 15V, giving a hysteresis value of 150mV.

Note that the tracking of the circuit is very good, with the mean output voltage differing from the input by no more than 170mV, and that the regulation is excellent, with a 25% drop in peak output voltage (caused by heavy loading) resulting in negligible drop in mean output voltage. Also note that the **mark** period of the circuit increases only moderately as the input voltage is increased, but that the **space** period (and hence the **frame** period) decreases by very large amounts under the same condition. The SMVF circuit can thus be regarded as a variable-frame type of pulse generator.

DC MOTOR CONTROL

The basic SMVF circuit gives excellent self-regulating speed-control of DC electric motors; far better, in fact, than that obtainable from either variable DC-voltage or pulse-width control systems, the two best known alternative types of power control system. To understand why, we must digress slightly and look at the basic principles of motor control and at the two alternative control systems.

DC electric motors of the types used in car fans, mini-drills and model locomotives, etc., are configured in the same way as a dynamo. Consequently, when running, they generate a dynamo voltage that opposes the externally applied voltage. *Fig 3* shows the effect that this Generated Dynamo Voltage (GDV) has on a DC voltage control system when a 12V motor is powered from a 6V source.

When lightly loaded the motor runs at medium speed and produces a GDV of 5V, which opposes the externally applied 6V and gives an Effective Applied Voltage (EAV) of 1V, so the motor consumes a fairly low running current (equal to EAV divided by the motor resistance).

When motor loading is increased, speed and GDV decrease, causing EAV and running current to increase, thereby tending to return the motor speed back to its original value. In *Fig 3*, for example, the motor drive power (proportional to the square of EAV) is sixteen times greater than in *Fig 3a*. DC voltage control systems are thus inherently 'feedback speed- sensing' and provide DC motors with excellent speed **regulation** characteristics. Unfortunately, however, their speed **control** characteristics are very bad at low- and starting-speeds.

An alternative way of controlling motor speed is to feed it with variable pulses of power. Most pulse-control systems feed fixed-peak-amplitude, fixed-frame, variable-width pulses to the motor. They give good starting- and speed-control characteristics, but at the expense of regulation. *Fig 4* illustrates the reason for the poor regulation, assuming that the pulse has a peak amplitude of 12V and a frame width of 7mS.

Figure 4a shows that, to give the same GDV of 5V, mean EAV of 1V and Mean Terminal Voltage (MTV) of 6V as in *Fig 3a*, the width of the *Fig 4a* pulse must be 1mS. Consequently, when the motor is loaded so that its GDV falls to 4V (*Fig 4b*), this same pulse width gives an EAV of only 1V14 and a MTV of only 5V14. When the loading is increased so that GDV falls to 2V, the MTV falls to a 3V43, and the applied power is only twice as great as in the unloaded case. Conventional fixed-frame pulse-width control

V_{IN}	UPPER THRESHOLD	LOWER THRESHOLD	MARK SLOPE	SPACE SLOPE	MARK PERIOD	SPACE PERIOD	V_{OUT} (MEAN)
PERFORMANCE WITH OUTPUT LIGHTLY LOAOED (V_{PK} = 20V)							
10.0V	10.1V	9.9V	10.1V	10.1V	12.9mS	12.9mS	10.0V
5.0V	5.15V	4.95V	15.06V	5.15V	8.64mS	25.24mS	5.10V
1.0V	1.19V	0.99V	19.1V	1.19V	5.24mS	109mS	1.17V
PERFORMANCE WITH OUTPUT HEAVILY LOADED (V_{PK} = 15V)							
10.0V	10.05V	9.9V	5.1V	10.06V	19.1mS	9.70mS	9.95V
5.0V	5.10V	4.95V	10.06V	5.1V	9.70mS	19.12mS	5.05V
1.0V	1.14V	0.99V	14.1V	1.14V	6.92mS	85.5mS	1.12V

Table 2: Waveform shapes, terminology and formulae of the Fig 1 circuit when driving a resistive load.

systems thus have limited 'feedback speed-sensing' characteristics and give poor speed regulation, with the MTV falling as the motor loading increases.

The action of the SMVF circuit, on the other hand, is such that it is fully 'feedback speed-sensing' and maintans a constant mean output voltage irrespective of loading variations, as shown in *Fig 5*. It provides regulation that is as good as that of a DC-voltage control system, but with speed control that is greatly superior to that of a conventional pulse-control system.

In *Fig 5a*, to give the same GDV, EAV and MTV as the *Fig 4a* circuit, the widths of the mark pulse and frame are again 1mS and 7mS respectively. As the motor loading increases, however, the frame width reduces to maintain the MTV at a constant 6V. The SMVF circuit thus gives the same excellent speed regulation as a DC-voltage system. This regulation is automatic because, during the space part of each operating frame, the aiming voltage of C1 (*Fig 1*) is equal to the motor's GDV, rather than 0V.

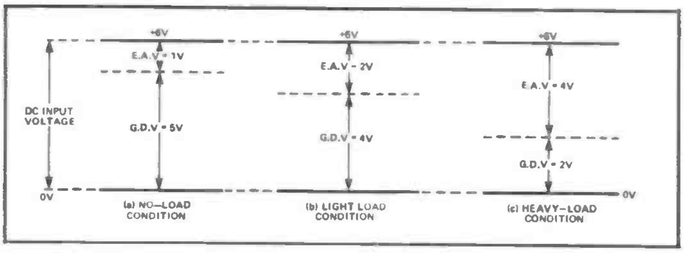


Figure 3: A voltage-controlled DC motor has excellent regulation, because its speed-dependent 'Generated Dynamo Voltage' (GDV) decreases as the load increases and thus causes the Effective Applied voltage (EAV) to increase. Its low-speed control is, however, very poor.

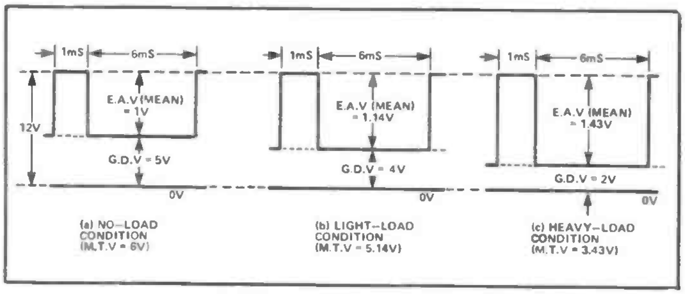


Figure 4: A conventional 'fixed-frame' pulse-controlled DC motor has good low-speed control, but poor regulation.

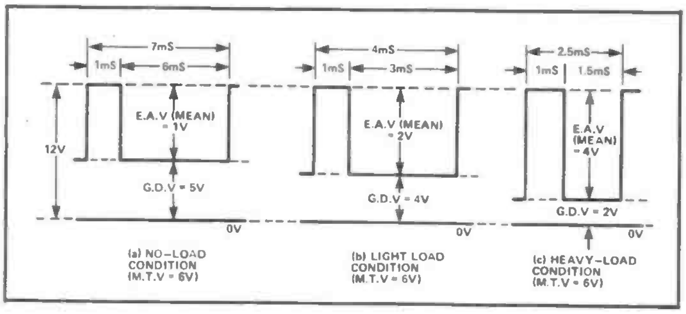


Figure 5: A SMVF-controlled Dc motor has excellent regulation (equal to that of a DC-controlled system) and superb speed control (far better than that of a fixed-frame system).

The low speed control of the SMVF circuit is greatly superior to that of a conventional fixed frame pulse-control system. This is because, at starting, the motor's applied pulse width must be greater than a certain minimum value, or the motor will not turn, but at medium to high speeds the frame width must be below a certain level to ensure smooth running. Suppose that the minimum useful pulse width is 10mS, and that at medium speed the maximum useful frame width is 100mS.

In a fixed-frame system, this means that the MTV of the circuit can be usefully varied over only a 10:1 range, giving (since speed is proportional to the square of MTV) a 100:1 speed-control range.

In the SMVF system, however, the frame width is variable, and may be 1 second at low speed but 100mS at medium speed, in which case the MTV can usefully be varied over a 100:1 range, giving a 10,000:1 speed-control range.

PRACTICAL CIRCUITS

So far, we've dealt in depth with the theory of the Switched-Mode Voltage Follower circuit and seen that it gives superb DC motor speed control and excellent 'feedback sensing' speed regulation. Later we'll introduce an 'amplified feedback' system that provides even better speed regulation. In the meantime, however, let's look at some of the practical aspects of the basic SMVF circuit, dealing with matters such as component selection, power boosting and overload-protection techniques, and a few practical circuits.

COMPONENT SELECTION

The pulse widths of the *Fig 1* SMVF circuit are determined (apart from the input voltage) by the values of feedback components R4-C1 and hysteresis components R2-R3. Widths can be increased by increasing the values of R4, C1 or R3, or by reducing the value of R2. Note, however, that R2 and R3 also influence the 'tracking error' between input and output, the error increasing as the hysteresis voltage increases (the R2-R3 ratios reduce). Thus, if (in *Fig 1*) R3 is reduced to 10k, hysteresis falls to 20mV and the tracking error with an input of 1V falls to about 20mV, but the C1 (or R4) value must be raised by a factor of ten to restore the pulse width.

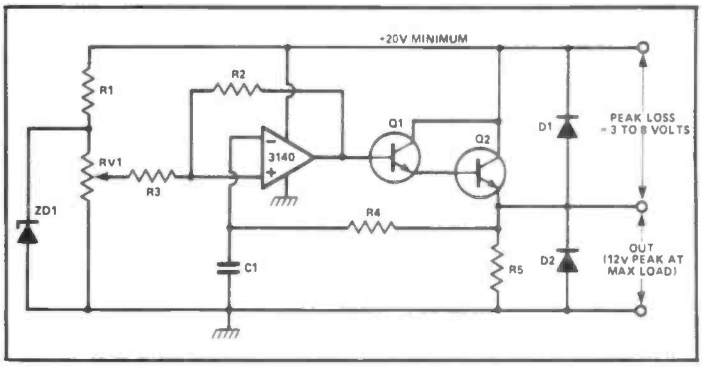


Figure 6: SMVF circuit with power boosting via a Darlington emitter follower.

The R3 value should ideally be large relative to the RV1 impedeance, otherwise RV1 will effect the pulse width and hysteresis as its value is varied. If R2 is very large ((greater than 1M0) it should be shunted by a 10p capacitor, to give sharp op-amp switching.

When driving DC motors, the minimum low-speed pulse width must be adjusted to suit the motor characteristics, and adjustment is best effected by replacing R4 with a fixed and a variable resistor in series.

BOOSTING THE POWER

In *Fig 1*, a power booster is shown interposed between the op-amp output and the final output of the unit, to boost the available output current to a useful level. Since the SMVF circuit has a switched-mode output, this booster does not need to have linear characteristics, its only essential requirements are that it should give zero overall phase inversion and should provide the required output current without excessive voltage loss. *Figs 6 to 8* show the basic circuits of three useful power boosters, in use with SMVF circuits. Note that if these boosters are used to drive DC motors or other inductive loads, diodes D1 and D2 (with mean ratings of at least 30% of the peak motor current) must be wired to the circuits as shown, to protect the output transistors from the switch-off back-EMF's of the motors, which otherwise may be as great as 100V.

In *Fig 6*, the booster takes the form of a Darlington emitter follower. A disadvantage of this circuit is that a substantial amount of voltage (and thus power) is 'lost' across output transistor Q2 when the op-amp output is high (in the mark period). This loss is about 3V off-load, rising to several volts under heavy loading. The circuit thus needs a fairly high supply voltage (at least 20V for 12V peak output) and good heat sinking of Q2.

Figure 7 shows an alternative type of booster, which provides very high efficiency, with minimal power loss across the output transistors. The op-amp output is inverted by the Q1- Q2 Darlington common emitter amplifier, the output of which provides base drive to pnp common emitter output transistor Q3, giving zero overall phase inversion between the op-amp output and the load voltage. The voltage 'loss' of the output is equal to the saturation voltage of Q3. If Q3 base current is equal to at least one tenth of the peak load current, this loss may be as low as 100mV off-load and 500mV at maximum load.

The only disadvantage of the *Fig 7* circuit is that Q3's base-current limiting resistor, R6, must pass a fairly high current and have a substantial power rating. The circuit's minimum supply voltage value is determined by the op-amp's requirements and by the output voltage requirement. with a 15V supply, the *Fig 7* circuit can provide a maximum mean output of 12V and a peak output of 14V5.

Figure 8 shows an alternative but slightly less efficient version of the *fig 7* configuration. In this case a Darlington pair are used as the output stage, and a single common emitter amplifier is used as the driver. The advantage of this circuit is that R6 has to pass only a fairly low current and can have a low power rating. The

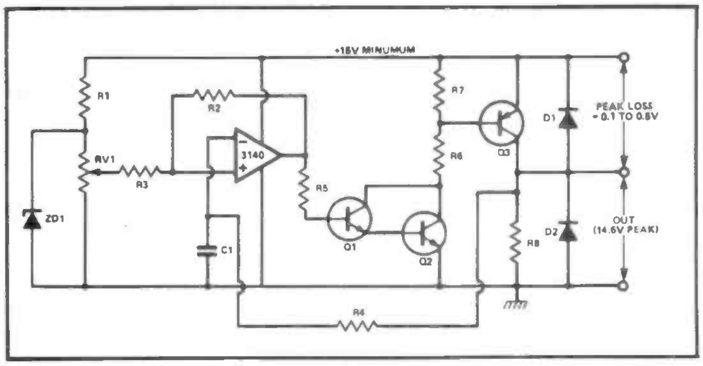


Figure 7: SMVF circuit with high-efficiency power-boosting via a pair of common emitter amplifiers.

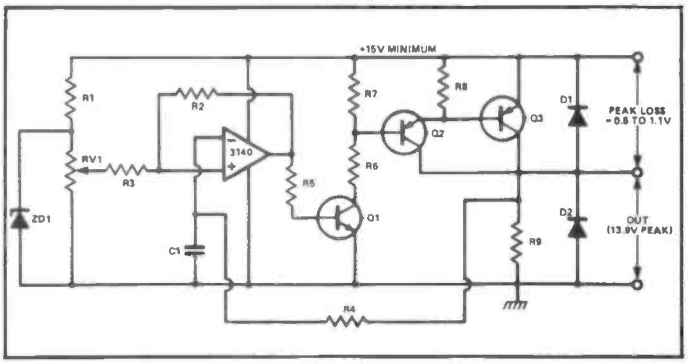


Figure 8: SMVF circuit wih slightly less efficient power- boosting via a pair of common emitter amplifiers.

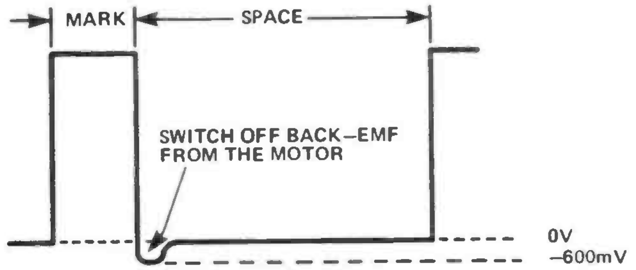


Figure 9: The negative back-EMF of a motor prevents the SMVF circuit from turning fully off when its input is reduced to zero.

disadvantage is that the saturation loss of Q3 is greater than in *Fig 7*, being about 0V5 off-load and 1V1 at maximum load. With a 15V supply, the peak output is thus limited to 13V9 at full load.

OFFSET BIASING

A point to note about the basic SMVF circuit is that, when driving a motor or other inductive load, it does not turn fully off when the input is reduced to zero. To obtain switch off, the voltage on the op-amps's non-inverting terminal must fall permanently below C1's lower space value, which is slightly negative under 'zero input voltage' motor driving conditions. *Fig 9* shows that this negative space voltage occurs because, at the end of each mark pulse, the motor produces a negative switch off' back-EMF that, even when clamped by an output diode, has a peak negative value of 600mV which, when integrated by C1-R4 (*Fig 1*) gives a mean negative value of several millivolts.

To obtain complete switch-off from the SMVF circuit, therefore, some form of 'offset biasing' must be applied to the design. Any one of three techniques can be used, as shown in *Figs 10 to 12*.

In *Fig 10*, offset biasing is applied to the internal circuitry of the op-amp via pin 1. The biasing resistor value must be in the range 18k to 470k (typically 100k), its value being selected to suit the individual op-amp.

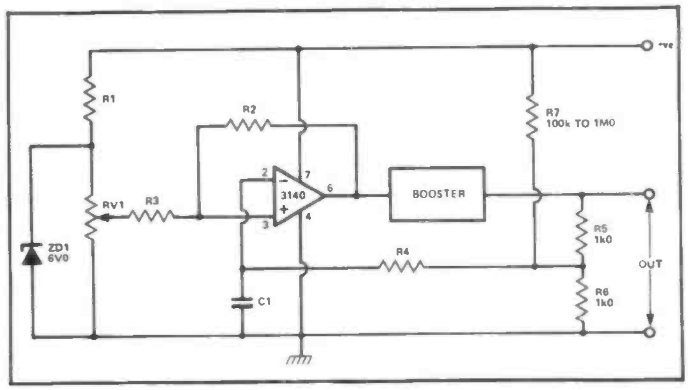


Figure 12: Offset biasing via potential divider.

In *fig 11*, offset biasing is obtained by wiring a 3140 voltage follower between the output of the circuit and the input of R4-C1. The op-amp output can not fall below a few millivolts positive, so (as far as R4-C1 are concerned) it effectively eliminates the negative back-EMF of the motor; R5 protects the op-amp input from excessive voltages.

Finally, *Fig 12* shows a particularly useful offset biasing technique, in which biasing is applied to the C1-R4 'integrator' via potential divider R7-R6, ensuring that the C1 voltage never falls to zero. R5-R6 form a 2:1 potential divider across the output of the circuit and feed C1-R4, so it is this point (rather than the output) that is directly regulated by this circuit; since the output voltage is double that on R5-R6 junction, however, the output is indirectly regulated by this design. Note that the maximum input (RV1) voltage is 6V, giving a maximum final regulated output of 12V.

Note in *Fig 12* that hysteresis components R2-R3 are fed from the op-amp's output, rather than from R5-R6 junction. Consequently, the peak voltage feeding R2 is double that on the R5-R6 junction, so this design gives better pulse-width linearity than the basic *Fig 1* circuit, and can be given almost any desired degree of offset via R7.

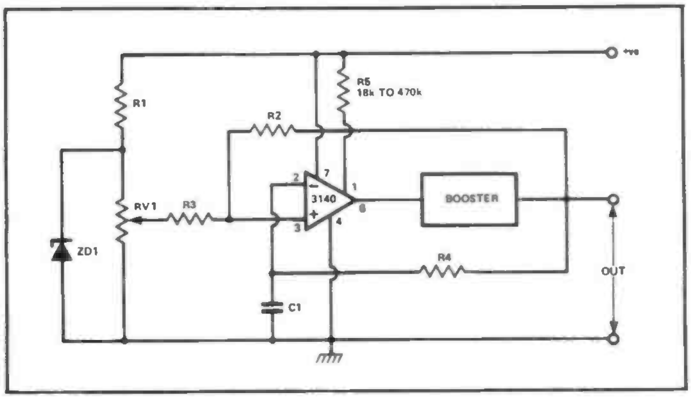


Figure 10: Offset biasing via pin 1 of the op-amp.

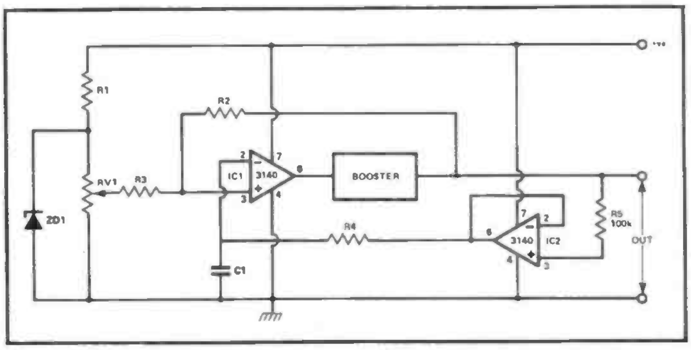


Figure 11: Offset biasing via an op-amp buffer.

SMVF CIRCUITS

Figures 13 and 14 show practical SMVF circuits that use techniques already described. These circuits are designed to provide fully variable power to 'fixed' loads such as lamps and mini-drills etc. Note, however, that they are not provided with short-circuit protection and are thus not suitable for driving loads such as model locomotives, etc. in which output shorts are likely to occur.

The *Fig 13* circuit is designed for use in cars and is battery powered at 12V. It can supply maximum output currents of about 5 amps. Power boosting is achieved via a pnp output transistor and a Darlington driver, to give minimal power losses in the output stage. The output stage base drive is 250mA, giving an output saturation 'loss' of only 500mV at 3 amps load, under which

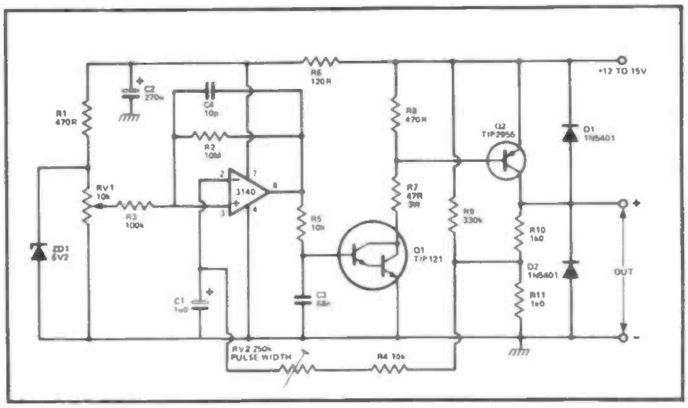


Figure 13: High-efficiency battery-powered SMVF circuit, for use in cars.

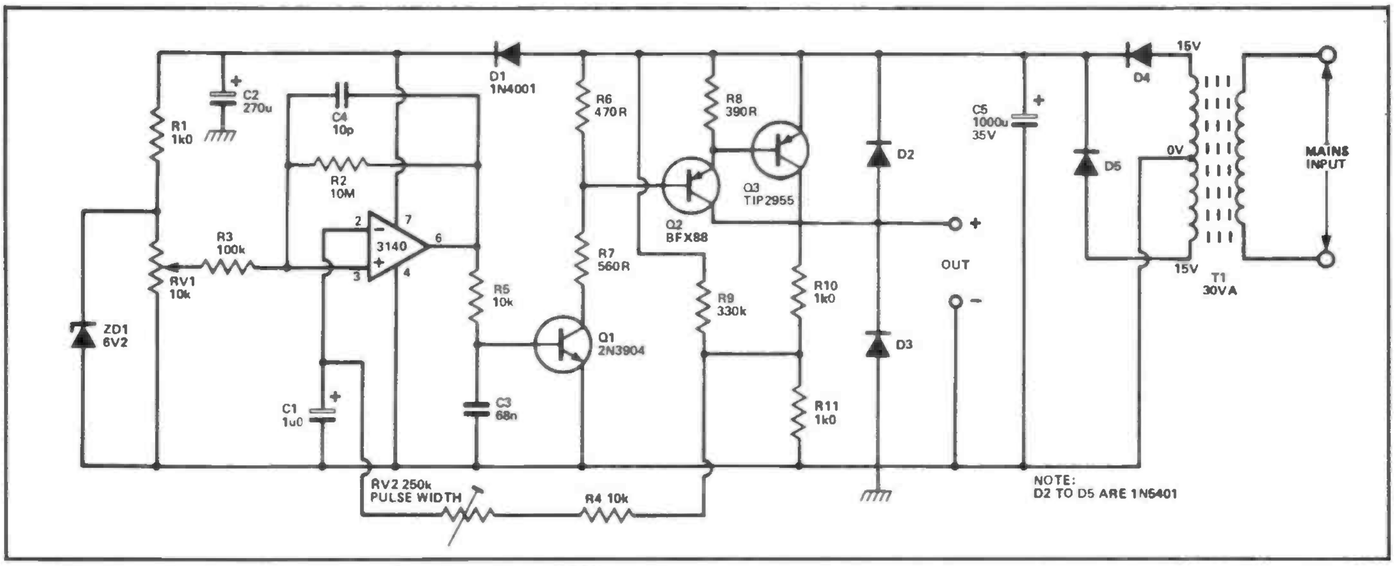


Figure 14: High-efficiency mains-powered version of the SMVF circuit.

condition 34.5 watts are developed in the load and 1.5 watts are lost across Q2. Capacitor C3 is wired across Q1 base to enhance circuit stability.

The circuit uses potential-divider offset biasing (via R9 and R11), with a 2:1 divider (R10-R11) across the output and with the maximum input limited to 6V2 by ZD1. The maximum mean output is thus limited to 12V4. At 12.6 battery volts, this is beyond the circuit's control range when RV1 is set to maximum, so the op-amp output locks high and turns Q2 fully on, giving maximum power drive to the load. If the battery voltage is close to 15V (under full charge), the output limits to 12V4.

Pre-set RV2 is wired in series with R4, enabling the circuit's pulse widths to be pre-set to suit specific applications. When driving resistive loads such as lamps, RV2 can be pre-set to zero. When driving DC motors, RV2 should be set so that the motor turns with slight 'judder' at minimum speed.

Figure 14 shows a mains-powered version of the SMVF circuit. It can power DC motors with stall currents of up to 3 amps; under the latter condition, the output impedance of the 30VA mains transformer causes its output to fall to about 12V giving about 30 watts of dissipation in the motor.

This circuit is similar to that of *Fig 13*, except that it uses a Darlington output stage with a single driver. This configuration results in a Q3 voltage loss of about 1V1 at 3 amps load, but eliminates the need to give R7 a high power rating. The supply line has a value of about 20V off-load, and if the *Fig 13* configuration were used here, R7 would need a power rating of 10 watts.

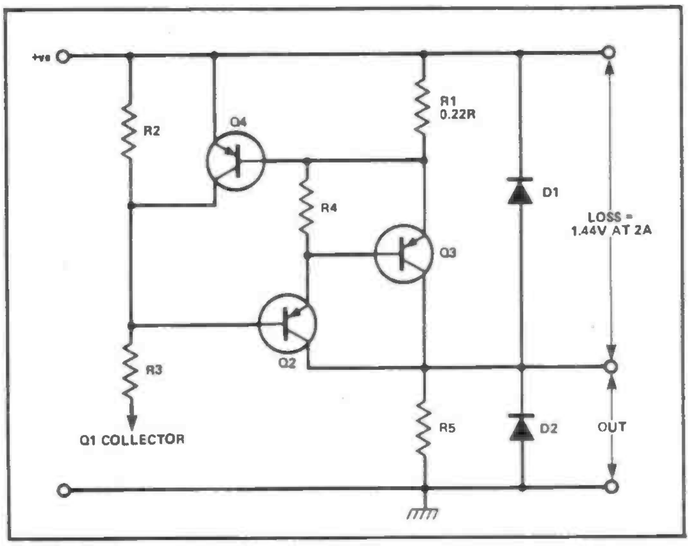


Figure 15: 3 amp output-current limiter.

The supply to the op-amp is ripple-reduced by D1-C2, and the DC supply to the entire circuit is derived from a centre-tapped mains transformer and full-wave rectifier, rather than a single-ended transformer and bridge rectifier, since the latter option would result in an additional supply-volts drop of about 600mV.

OVERLOAD PROTECTION

The *Fig 13* and *14* circuits are intended for use in fixed-load applications, and are provided with no form of overload or short-circuit protection. Such protection can be given by the various 'add-on' circuits shown in *Figs 15* to *18*.

Figure 15 shows a one form of load-current limiter. The load current flows through monitor resistor R1, developing a current-proportional voltage. When this monitor voltage exceeds the base-emitter voltage (about 600mV) of Q4, Q4 is biased on and starts to 'rob' base-drive current from the Darlington output stage. the Darlington stage and Q4 form a negative feedback loop, causing the output current to self-limit at a value determined by R1 (about 3 amps when R1 value is 0.22ohms). With a 12V supply and 3 amp current limit, Q3 dissipates about 35 watts under short-circuit conditions, and must be suitably heat sinked.

Figure 16 shows a useful modification of the above circuit, in which two transistors (Q4 and Q5) turn on under the 'overload' condition. Q4 limits the output current as already described, and Q5 activates a LED (or, better still, an audible alarm), to give a warning of the overload condition. R4 and R5 (in series with Q4 and Q5 bases) ensure that both transistors receive equal base-current drive.

At 'starting' speeds, the peak current of a pulse-driven DC motor is equal to its stall current, so a minor defect of the *Fig. 16* circuit is that Q4 and Q5 both pulse on at 'start' if the R1 value is such that it causes limiting at or below the stall current value of the motor. This defect is overcome in the circuit of *Fig 17.*

Here, the current is limited by either Q4 or Q5 turning on, but Q4 turns on at a peak current of about 9 amps (via potential divider R4-R5), while Q5 turns on at a mean current of 3 amps (via the R6-C1 integrator and R7). If a short occurs at the output, Q4 instantly limits the current to 9 amps peak, and a few tens of milliseconds later Q5 turns on and reduces the current to 3 amps. Optional transistor Q6 can be used to activate a LED, indicating the SHORT/OVERLOAD condition.

Finally, Fig 18 shows an even more sophisticated circuit, in which the peak value is limited to 3 amps (or whatever value is desired) via R1 and Q4, but the mean output current falls to only 3 mA or so under short-circuit conditions, thus eliminating the need for heavy heat-sinking of Q3. The circuit operates as follows.

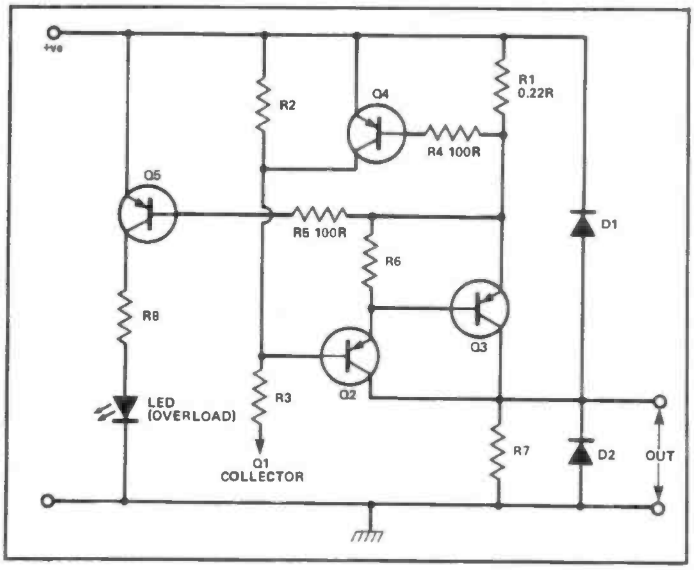


Figure 16: 3 amp output-current limiter with LED indicator.

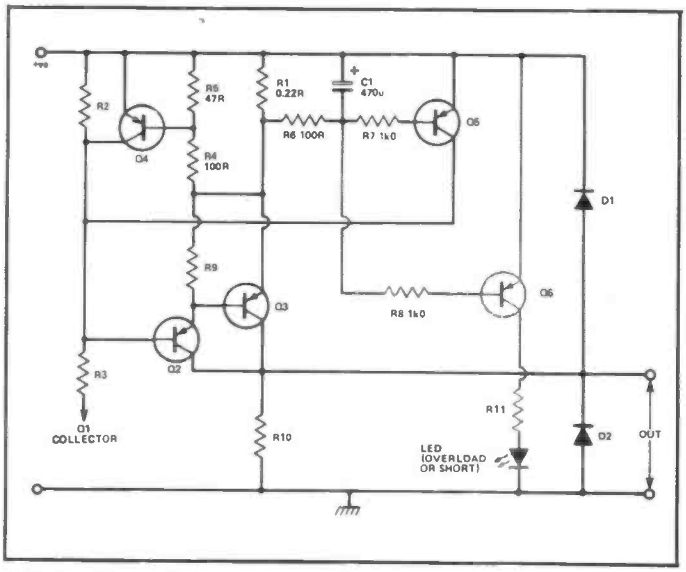


Figure 17: Circuit limits current to 3 amps MEAN but can supply brief transients of 9 Amps. LED indicator is optional.

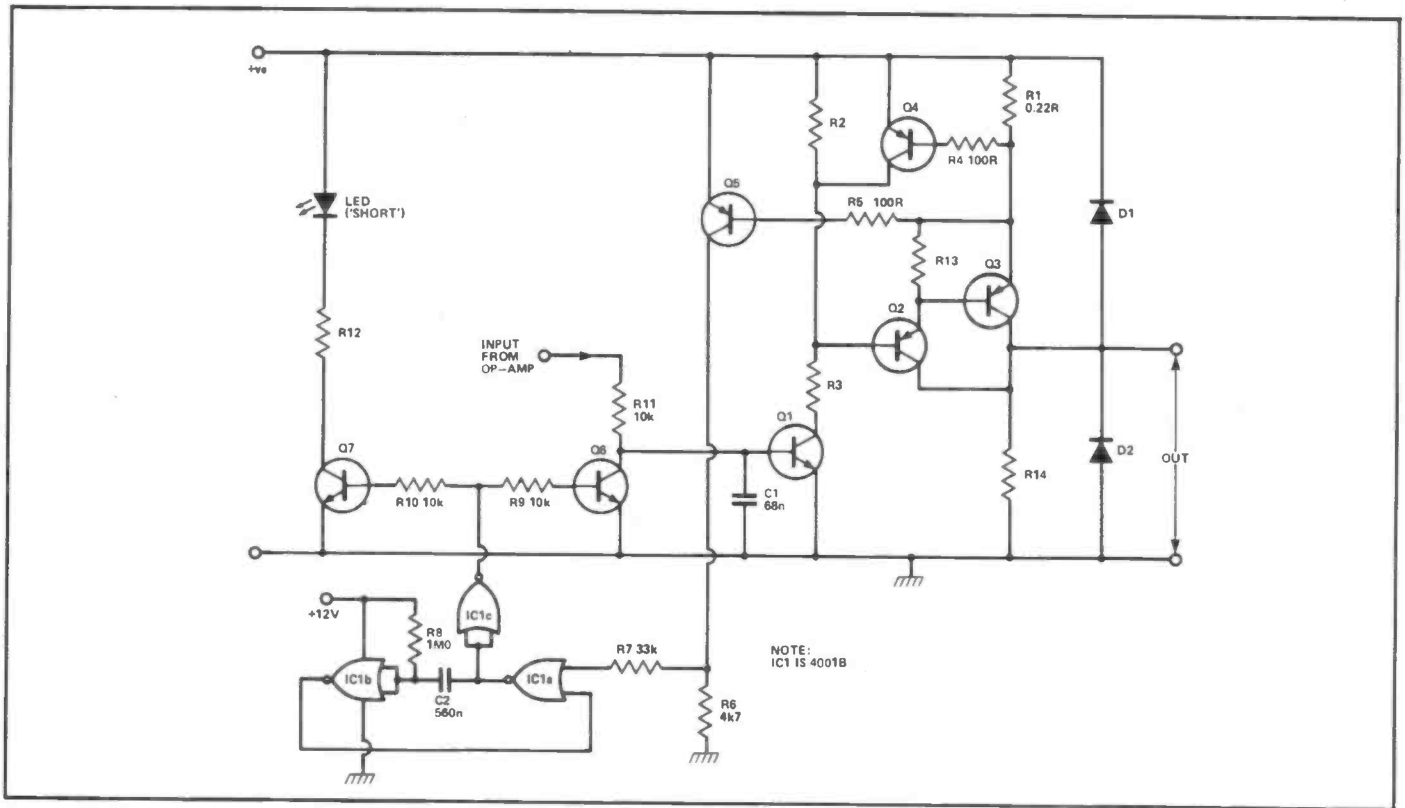


Figure 18: The load current of this circuit limits to 3 Amps peak under normal driving conditions, but falls to about 3mA when a short occurs.

Both Q4 and Q5 turn on when an overload occurs. Q4 limits the peak output current to about 3 amps, as already described, but the output of Q5 pulls R6 high and triggers CMOS monostable multivibrator ICI, which applies a 500mS positive pulse to the bases of Q6 and Q7 via limiting resistors R9 and R10. As Q6 turns on it 'robs' Q1 of all base drive, causing the Darlington output stage (Q2-Q3) to turn fully off, and as Q7 turns on it activates the 'short-circuit' LED. At the end of the 500mS period, Q6 and Q7 turn off and the Darlington stage is re- enabled. If a short or overload still exists, however, the monostable fires again and turns the Darlington off for another 500mS. Suppose, then, that the 'delays' of the circuit are such that they cause an effective 5uS delay before the monostable activates. In this case, in each 'overload' cycle, the output is 3 amps for 5uS and zero for 500mS, giving a MEAN output current of 3mA.

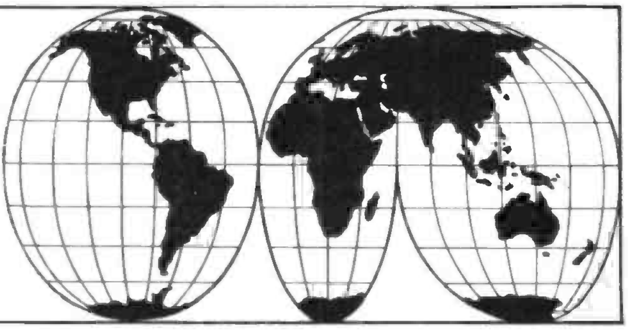
Note that the *Fig 15* to *18* circuits are all shown in use with a Darlington output stage, in which the Darlington's base drive current is only a few tens of mA. These circuits can all be adapted for use with single-transistor output stages, but in this case they may have to cope with base-drive currents of a few hundred milliamps. Also note in all cases that the presence of R1 causes a slight reduction in the maximum full-load output voltage that is available from the circuits.

More SMVF circuits next month.

■ R & EW

Your Reactions	Circle No.		Circle No.
Immediately Interesting	52	Not Interested in this Topic	54
Possible Application	53	Bad Feature/Space Waster	55

SHORT WAVE NEWS FOR DX LISTENERS



Frank A. Baldwin

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

Just for a change I thought I would commence this month with details of some of the rather meagre results obtained whilst listening on some of the amateur bands. Rather meagre by virtue of other calls on my available spare time and the fact that what time there is for operations within the shack has to be shared with broadcast band observations and CB activities, all of which add up to quite a few hours each month.

1800 - 2000 kHz

Top Band has always been a favourite band for me, probably because it was the very first short wave range over which my home-brew 1-valve breadboard special managed to operate way back in the early thirties, nostalgia therefore plays a part it would seem.

Four sessions on the band at differing periods of the month produced some Dx as the following results will show, all heard on the dots and dashes mode.

From West Germany there was DL9HAZ and DL9SAL/A; from Spain signals were heard from EA3JJ; from across the Channel in France both F6AUS and F6BKP put in good signals whilst HB9CM in Switzerland also made it with a whacking signal. Across the North Sea from Norway LA1EKO was heard working several G (England) stations.

Signals from Czechoslovakia abound on Top Band CW mode, to mention only a few of those logged there was OK1AQO/P (P = portable operation), OK1DDF, OK1KZD, OK3CWQ, OL3BAP, OL4BDY, OL5AZN, OL6BEK. From the Netherlands (Holland) PA0LVB was the sole representative as far as I was concerned whilst from Sweden the logbook shows entries for reception of SM1IAI, SM2IOG, SM4AXY and SM5BLH. the Soviet Union showed up in the guise of UA3LDT and also RA1WCP and RB5GFM. Lastly we have Yugoslavia entered into the logbook as YU2HDE.

7000 - 7100

This band proved to be a dead loss despite several attempts to brighten up the picture by adding to the log some of the Dx that is available on the band when conditions are reasonable. In fact, as far as I was concerned, the band was downright unreasonable!

However, despite the European and East European QRM the log does show three lonely entries, these being K4BI, VE1AI and lastly W1BU. Well - at least I tried!

21000 - 21450

Twenty-one provided some interesting calls during the period under review and of these are selected the following - which means the remainder are not worth mentioning.

From Uruguay we have CX4GL and CX6CW; from Haiti (that's the voodoo Republic) there was HH2VP whilst from Djibouti the sole representative was J20Z. Brazil furnished signals from PY1CBW and PY4LH; the Indian sub-continent being logged via signals from VU2FBT. Bermuda in the West Indies came through with a transmission from VP9DR, South Africa with those from ZS5UG, ZS6BUX. Lastly, from Cyprus there was 5B4JK. All of which just about rounds up the Amateur Band adventures for this month, 14MHz band being given a miss just for once.

AROUND THE DIAL

In this section of the monthly rendering an attempt is made to inform readers of some of the transmissions that can be heard on the short wave ranges. Whenever possible the published loggings include the various transmissions in English so that station identifications can be made by beginners and old timers alike.

All of the details published here are correct at the time of writing but there is an inevitable time-lag between that and the receipt of the magazine - which is another reason why you should take out a regular subscription if you haven't already done so - you'll get the news quicker.

We commence with -

RWANDA

Kigali on **3330** at 1940, OM (Old Man = male announcer) with a talk in French. This is the Home Service of Radio Rwanda and it operates from 0300 to 0600 (Sundays until 0900), from 0900 to 1200 (Saturday and Sunday until 2100) and from 1330 to 2100. The power is 5kW.

GHANA

Accra on **3366** at 1944, OM with a talk in English in the domestic GBC2 programme. This English service is on the air from 0530 to 0800 (Sunday until 0900) and from 1530 until 2300. The power is 10kW.

TURKEY

Ankara on **15220** at 1520, OM with the Turkish programme for Turks abroad, timed from 0700 to 1700 on this channel. Also logged in parallel on **11955**.

ALBANIA

Tirana on **7065** at 2046, YL with comments on current world affairs in the English transmission for Europe, scheduled from 2030 to 2100. Also heard in parallel on **1395**, for those interested in the lower frequencies.

VATICAN

Vatican City on **11700** at 2050, YL with a news coverage in the English Service to Central and South Africa, scheduled from 2045 to 2100 on this channel and also logged in parallel on **9625**.

GREECE

Athens on **9655** at 1920, YL with station identification followed by a newscast of local events in the English programme for Europe. this is timed from 1920 to 1930 and consists of a newscast only.

SPAIN

Madrid on **11840** at 2004, was radiating a programme about Spanish legal procedure and the trial of the military faction that attempted to usurp Parliament. This was followed by a press review and a weather forecast for Spain. All in the English transmission for Europe and scheduled from 2000 to 2100.

ROMANIA

Bucharest on **9690** at 1957, YL with the English programme for Europe, currently scheduled from 1930 to 2030. All about agriculture and the country life.

POLAND

Warsaw on **7125** at 2000, YL with station identification at the commencement of the English programme for Africa, scheduled from 2000 to 2030 on this channel.

ZAIRE

'La Voix du Zaire', Kinshasha on **15350** at 1955, OM with announcements in vernacular followed by a programme of typical African instrumental music and songs.

CZECHOSLOVAKIA

Prague on **11855** at 0830, OM with announcements in the English programme for Africa, the Far East, South Asia and the Pacific, scheduled from 0830 to 0900 (Saturday and Sunday to 0930).

Prague on **11990** at 1805, OM with a talk about environmental pollution in Czechoslovakia in the English programme for African consumption, scheduled from 1730 to 1825.

BULGARIA

Sofia on **15160** at 0632, OM and YL with announcements, frequencies and programme times in the German programme for Europe, scheduled from 0630 to 0700.

Sofia on **15310** at 2052, when a programme all about African current affairs was being radiated in the English service to Africa, timed from 2030 to 2130.

FINLAND

Helsinki on **15265** at 0837, classical music by Finnish composers in the English transmission to Europe, the Far East and the Pacific, scheduled from 0800 to 0925 Sundays only.

AUSTRIA

Vienna on **15165** at 0856, OM with station identification at the end of the English programme for Europe, the Middle East, South East Asia, the Far East and Australasia, scheduled from 0830 to 0900.

DENMARK

Copenhagen on **15165** at 0858, interval signal, OM with station identification in English repeated several times. full station indentification at 0900 in English then into a Danish programme for Southern Europe and West Africa, scheduled from 0900 to 0955. QRM (interference) from Radio Peking on the same frequency but Copenhagen dominant.

ITALY

Rome on **15330** at 0928, OM with station identification and announcements at the end of the Italian programme for Australia, the National Anthem, birdsong tuning signal and off. This programme is timed from 0830 to 0930.

SOUTH AFRICA

SABC Johannesburg on **3250** at 1913, OM announcer and a programme of pop music. This is Radio Five, a mainly pop music station which operates on this channel from 0300 to 0545 and from 1520 to 2200. From 2200 to 0300 the All Night Service is in operation on this frequency. Both English and Afrikaans are used in the announcements. The power is 100kW.

TOGO

Lama-Kara on **3222** at 1915, OM with a talk in French, this being heard with some difficulty due to the surrounding interference. Lama-Kara is in operation from 0530 to 0830 and from 1630 to 2230, the power being 10kW.

SOMALIA

Radio Mogadishu on **6790** at 1755, YL with a song, presumably in Somali, together with local orchestral music. This is a new one, details of transmission times being unknown at the time of writing.

MADAGASCAR

Radio Nederlands Relay with a programme of African affairs on **15220** at 2035, in the English transmission for Central and West Africa, scheduled from 2030 to 2120.

EGYPT

Cairo on **17670** at 1843, OM and YL announcers alternate with an Arabic music programme in the Domestic Service, which can be heard on this channel from 1300 to 1900.

JAPAN

Tokyo on **15195** at 0812, OM with a newscast in English in the English and Japanese General Service, in operation on this frequency from 0800 to 0930. A Japanese programme commenced at 0815.

CHINA

Radio Peking on **9965** at 1831, YL with a newscast in the Italian transmission to Somalia, scheduled from 1830 to 1900. Radio Peking on **11575** at 1835, YL with the French programme for Africa and Europe, on the air from 1830 to 1900.

Radio Peking on 11685 at 1800, 'East is Red' on chimes, YL and OM with the Hausa programme for West Africa, scheduled from 1830 to 1900.

Radio Peking on **15165** at 0900, 'East is Red' tuning signal on chimes, OM with station identification in Chinese at the commencement of the Standard Chinese programme to South East Asia, scheduled from 0900 to 1000. QRM (interference) from Copenhagen on the same channel.

AUSTRALIA

Melbourne on **15115** at 0817, OM with a programme for Dxers and SWL's in the English programme for Europe and the Pacific, scheduled from 0630 to 1030 on this particular channel.

Melbourne on **15240** at 0620, OM with details of Sunspot activity in the same programme as that above, obviously all on tape.

NORTH KOREA

Pyongyang on a measured **6576** at 2000, YL with station identification and a newscast followed by a talk on Korean affairs in the English transmission for Europe, scheduled from 2000 to 2150. Also logged in parallel on **9360** and **11660**, the best channel however for listeners here in the UK being **6576**.

NETHERLANDS ANTILLES

Bonaire on **21685** at 2032, OM with news of African affairs in the English programme directed to Central and West Africa and timed from 2030 to 2120, this being a relay of Radio Nederlands in Hilversum.

CANADA

Montreal on **15325** at 1953, Glen Hauser - a much respected Dxer - with a programme specifically for Dxers and short wave listeners in an English programme for Europe, scheduled from 1900 to 2000 on Saturday and Sunday only on this channel.

Montreal on **17875** at 2010, YL with news of domestic affairs in the English transmission for Europe and Africa which can be heard on this frequency daily from 2000 to 2030.

INDIA

AIR (All India Radio) Delhi on **11620** at 1846, YL with station identification at the commencement of the programme in English directed to the UK, North and West Africa and West Europe, scheduled from 1945 to 2045.

ECUADOR

Radio Popular, Cuenca, on a measured **4801.5** at 0407, OM's in chorus with a pop song in Spanish. the schedule is from 1000 to 0700 and the power is 2kW. Cuenca is the capital of Azuay province and is rated as the third city of Ecuador, being set in the fertile basin of the Andes. The town is noted for the production of Panama hats!

COLOMBIA

Radio Super, Medellin, on **4875** at 0416, OM with a political harangue in Spanish, all about Colombian affairs and complete with chants and applause from an enthusiastic audience - he was obviously preaching to the converted! Radio Super operates around the clock and has a power of 2kW. Medillin is the capital of Antioquita province and is the second city of the republic.

PERU

Radio Atlantida, Iquitos, on **4790** at 0404, OM with an excited account of a local sporting event. This one is on the air from 1000 through to 0500 and has a power of 1kW but the frequency is liable to vary slightly from that shown on occasions. The town of Iquitos is set on the banks of the Amazon in the North Eastern part of Peru.

La Voz de la Selva, also in Iquitos, on **4825** at 0500, just caught this one when it was signing off with orchestral version of the National Anthem after the station identification in Spanish. The schedule is from 1000 to 0500 and the power is 1kW.

Your Reactions.........	Circle No.
Immediately Applicable	40
Useful & Informative	41
Not Applicable	42
Comments	43

DX-TV Reception Reports

Compiled by Keith Hamer and Garry Smith.

WITH THE SPORADIC-E SEASON due to commence at any moment (it should be in full swing by the time this is read), the month of July is a good time for long-distance television enthusiasts to check their receiving equipment to ensure that the receivers are in good working order. Attention should also be given to the aerial installation, in particular to corroded connections. The inside of the aerial connector box should be dry. If water has penetrated, seepage into the end of the coaxial cable may have also occurred and replacement is recommended. This problem can be prevented by greasing the end of the cable.

During the Easter break, one of the two aerial masts used by the author was completely overhauled which involved de-rusting the ageing lattice work. The 4-element Yagi Band I aerial was completely rebuilt and a larger boom used. A dipole cut to 84 MHz was fitted ahead of the second Bank I director (cut to 70 MHz) which conveniently formed a reflector for the dipole allowing a degree of wideband Bank II (TV) coverage for the reception of Eastern European television channels.

Following the installation of a Jaybeam ABM 11 wideband 11- element Bank III array, it was found that regular reception could be obtained from Eire (RTE) on channel IH (207.25 MHz vision) and Belgium (BRT) on channel E10 (210.25 MHz vision). The ABM 11 array is quite popular amongst DX-TV enthusiasts.

For UHF reception, a Wolsey Colour King aerial, covering the whole of the UHF spectrum, has ousted an ageing Jaybeam multi- element array. Initial tests revealed a marked improvement in results. Time will tell whether the rather wide acceptance angle of a single Colour King will prove a problem with co-channel transmissions during a busy tropospheric opening.

April often brings one or two surprises in the way of signals. Sporadic-E (Sp.E) activity tends to be on the increase, usually with several small openings before the main Sp.E Season. On the 1st, at 1804 BST, a frequency-grating pattern was noted on channel E2 (48.25 MHz) with the aerial to the south. It is thought that this pattern originated from Ghana or Nigeria but there is speculation that it could have come from the Kisumu transmitter located in Kenya. This pattern, or at least a very similar one, was noted many times during F2-layer activity of recent years. On several occasions, the pattern was interrupted for no apparent reason as if there was a fault at the transmitter. At other times, programmes would be received on E2 from the south/south-east with intermittent breaks in transmissions to be replaced by the frequency-grating pattern. One of our correspondents in South Africa has reported that there does indeed appear to be a fault at the Kisumu outlet. During the reception noted on April 1st, there was co-channel reception from te ZTV-Zimbabwe transmitter at Gwelo.

FROM DARKEST AFRICA

At lunch time on the 5th, a Philips PM5544 electronically generated test card was noted on channel E2 from Zimbabwe. The test card had the identification 'ZBC' at the top and 'TV' in the lower black rectangle. A digital clock was incorporated in the central black bar. This reception was propagated via improved F2/TE (Trans-Equatorial) activity.

There was a short Sp.E opening on the 23rd which included weak reception on channel R1 (49.75 MHz) at 0800 BST with programmes possibly originating from the USSR. Stronger signals were noted at lunch time with the PM5544 test card from Sweden on channels E2 and E3 (55.25 MHz) carrying the usual identification 'TV 1 SVERIGE'. Signals were also logged from Denmark on E3 with the PM5544 and the identification 'DR DANMARK'. This was followed by reception from Finland, also on channel E3, with the electronic FuBK test card carrying the identification 'YLE TV 1'. This was followed by reception from Finland, also on channel E3, with the electronic FuBK test card carrying the identification 'YLE TV 1' rather than the more usual 'YLE HLKI'.

The 30th was quite a good day for Sp.E with a football match (Spain v. Venezuela) on channel E3 in colour from RTVE-Spain. Regional news programmes were seen from RTVE later in the day on E3 and E4 (62.25 MHz). Following the news programme on E4, RTVE transmitted the colour test card with the identification 'TVE 1' at the bottom. Reception from RTP-Portugal was noted with an end of transmission caption reading 'Fin Da Emmissao'.

Apart from Sp.E reception during April there were many short duration signals via meteor showers (MS) including the electronic test card from East Germany (DDR:F) on channel E4 and the RTVE regional test card on E3 from the Gamoniteiro transmitter. On the 26th at 1701 BST, a PM5544 test card appeared briefly on channel E4 and it is suspected that this was RUV-Iceland. On the 27th there was possible reception via MS on E4 from JRT-Yugoslavia with their FuBK test card.

An electronic test card from Spain showing transmitter identification.

The only notable reception via enhanced tropospheric conditions during the month was from NOS-Netherlands on channels E6 (182.25 MHz), E29 and E32 (both in the UHF band) plus colour reception on channel E24 from the West German television service, NRD-3.

RECEPTION REPORTS

Hugh Cocks has written from Robertsbridge (East Sussex) with details of experimental satellite reception. Hugh has received very strong signals from the first network of TSS (USSR) via the Gorizont satellite positioned over the Atlantic.

Cyril Willis (Little Downham, Cambs) has managed to receive several interesting signals during the month. On the 13th he received GBC-Ghana on channel E2. On the 18th, signals from the USSR were noted on channel R1 followed later in the day by reception on E2 from the Gwelo outlet in Zimbabwe. The propagation mode was F2/TE. Enhanced tropospheric conditions resulted in the appearance of several West German stations (ARD/ZDF) plus reception from Denmark on channels E7 (189.25 MHz) and E11 (217.25 MHz). On the 30th, Cyril was very fortunate to receive the Canary Islands (RTVE/TVE) on test card from the channel E3 outlet. Signals from Spain on E2 and E3 and from Portugal (RTP) on the same channels were also noted.

From Victoria in Australia, Robert Copeman has sent details of his DX-TV reception during April. On the 4th he logged signals from Lanchow (China) on channel C1 (49.75 MHz vision) and programmes from the USSR on R1. The USSR signals were from the Vladivostok transmitter. Both countries were received via F2 propagation. Whilst on holiday in Adelaide during the Easter period, Robert noted consistent reception from ABS 2, ADS 7, NWS 9 and SAS 10. Back home in Melbourne during good tropospheric conditions, Robert received many stations including BTV 6 and ABRV 3 in Ballarat (Victoria), GLV 8 and ABLV 4 (Traralgon) ABRV 5A (Colac, Victoria) ABNT 3 and TNT 9 (both stations located at Launceston in Tasmania) and SES 8 on Mount Gambier in South Australia.

In the Netherlands, Gosta van der Linden (Rotterdam) has been busy with tropospheric reception including the NDR (West Germany) transmitters at Verden, Kiel, Flensburg and Niebuell. Weak signals from several BBC transmitters were also seen. Gosta uses a special four-standard TV sound converter (FM only) and he is able to switch between the following systems:- 4.5 MHz (US Forces transmitters in West Germany); 5.5 MHz Western Europe/Gerber system; 6.0 MHz UK and British Forces Broadcasting Service (BFBS); 6.5 MHz Eastern Europe/OIRT countries. The converter originates from West Germany and costs about DM42-. One of Gosta's DX colleagues, Ryn Muntjewerff, has found an aerial manufacturer constructing 7-element channel E2, E3 or E4 arrays. These are extremely large VHF Band I aerials by any standards. A 22-element wide-band Bank III aerial is also available. We hope to receive further details about Dutch DX-TV equipment in the near future. Meanwhile, we would be very pleased to hear from DX enthusiasts around the world with details of reception and equipment used.

"THE DYNOFONIC, OSCILLATING DOUBLE THRUSTERS MALFUNCTIONED. -A GOOD KICK'LL FIX IT!"

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Your Reactions..........	Circle No.
Immediately Interesting	147
Possible application	148
Not interested in this topic	149
Bad feature/space waster	150

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★BOOKS OF THE MONTH★

THE CHEAP VIDEO COOKBOOK

By Don Lancaster

1978; 256 pages; 145 x 230mm; Paperback **£6.25**

In the words of Don Lancaster "This book is dedicated to the yea but". It is a fascinating journey through the design ideas behind cheap video. The reader is shown how to make simple low cost alphanumeric and graphic video display systems based on the KIM-1 microprocessor system. Although a 6502 micro is assumed throughout the book, hints on other micros are given. The aim of the book is to give the reader the ability to display the contents o his microprocessor memory on a CRT screen for minimal cost. The claim made is for twenty dollars upwards, depending on options, but not very much upwards!

The introductory chapter outlines the basic principles involved in this unique approach to alphanumeric and graphic display. There is the 'scan program' which decides which row of characters is wanted, and then provides them. The 'scan microinstruction' forces the micro address lines to count at 1 MHz until all the characters in the line have been displayed. This causes the display memory to output the required symbol code by way of the 'upstream tap'. The upstream tap routes the character code to the interface hardware for dot matrix conversion and it is the output as serial video.

Chapter two starts off the practical side with a consideration of the software needed to perform this magic. The 'scan microinstruction' is covered here, along with graphics, alphanumerics, colour, black and white, scrolling, editors, 'double stuffing' and 'memory repacking'. Methods are considered for giving up to 80 characters per line on an ordinary 'not very much modified' television set.

The third chapter describes the hardware involved in interfacing your micro's memory to a television screen. The 'upstream tap' is introduced here, along with the scan microinstruction proms, character generation, and conversion to video.

A commercial example, the 'TVT 6 5/8' is covered in chapter four. All the details are there for those who want to use them. Again, it is aimed at KIM owners. Flow charts, parts lists, circuits, board layouts, step by step construction notes etc. are all in abundance.

The final part describes how to run other programs in the micro at the same time as using it to produce a continuous display on the screen. The speed penalty involved in doing two jobs at once is not as great as might first be imagined. A 16 by 80 alphanumeric display, still leaves 50% of the processing power available to the user. This technique is called 'transparency'.

The rules are simple:

1) Do as few modifications to anything as possible
2) Use standard components, e.g. a KIM-1 and an ordinary television
3) Keep the hardware simple, and use proms to reduce overheads
4) Try to use what is alrady available to do as much as possible

A 6502 micro is assumed. Changing to a 6800 should present few extra problems, although most other micros will require more major modifications. The principles outlined here can also be used togenerategraphics up to 256 by 256 dots.

The book is a fascinating study of cheap graphics. I must confess to being one of the 'Yeabut'. This doesn't stop me from recommending this book to anybody playing with computer graphics. I'm now waiting to get my hands on a copy of 'Son of Cheap Video'. There is a lot of useful information in this book, even if you don't use it in the way Don Lancaster intended. It is intended as an extension of the 'TV Typewriter Cookbook'.

KM

GUIDE TO WORLD-WIDE TELEVISION TEST CARDS

By Keith Hamer and Gary Smith

1981; 52 pages; 150 x 210mm; Paperback **£2.85**

Regular readersof this magazine will be familiar with the excellent series of articles on TV-DX contributed by Keith Hamer and Gary Smith each month. This book has been written by the same authors and recently went into a second edition.

In their Introduction the authors briefly comment on the rapidity of the technological advances since a simple Test Card 'A' was used by BBC engineers, for internal purposes only, just before World War 2.

The main part of the book consists of the reproduction of no fewer than 240 test cards; identification slides and block captions have been included. The principal purpose is to provide TV DX-ers, all over the world, with the means of signal identification.

The standard electronic test patterns are first given and then the test cards for Africa, North America, South America, Americas the Carribean, Australasia, Europe (132 test cards), Asia and the Far East and finally the Middle East. In addition, there are a number of pages of very useful notes on the use of the test cards in various countries. For example, it is noted that in South Africa the PM5544 Electronic Test card is shown, is used for all VHF and UHF stations with various forms of identification depending upon which centre the particular station is linked to, then follows a list.

The book should also appeal to those concerned with television graphic work and operators of amateur television stations.

JB

RADIO BOOKS

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by H D Hooton **£6.95**

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A look at some of the more obscure moment's from Gary Evans' month, in which the not- so-'merciful Evans' demonstrates why so few PR agencies are willing to submit themselves to trial by R&EW

THIS WAS THE MONTH of the AV presentation this was. Two particularly dreadful examples of this *art noveau* were encountered, one a high on presentation, low on content, slide show; the other a 'low on both counts' video effort.

The slide show accompanied the launch of an intelligent 'scope, one can only hope that the intelligence of the instrument was above the level of that the audience at which the endeavour had been aimed. In fact the less said about the whole thing the better.

The gathering as a whole did however feature one other point worthy of note, and that was the presence of fellow journalists from the EEC - that's European Electronic Correspondents in this case. The interesting thing was, that whether due to the traditional British reserve, or to the fact that the British contingent had been stunned by the aforementioned slide show, all the questions - with one particularly lame exception - came from the French and Germans. *(And what gems did GE contribute, then?? -WP)*

THE VIDEO VENUE

The video production reared itself at a 'press call' and breakfast on the opening day of the Commodore Computer Show. Perhaps appreciation of the item was not heightened by the fact that it was shown on a small TV situated at some distance from the audience, challenging even those with 20/20 vision to pick out any detail. In addition, it probably did not help that it was barely 10 AM in the morning. *(But that's the best time to get the attention of the press, the pubs aren't open...)*

The pictures, accepting that they were a distant blur, did not seem all that bad, but the commentary was a wonderful example of 'over the top' Americanese.

Things got underway with a history of Commodore and, much to our surprise, we learned that each new Commodore Computer had evolved from a previous model. So much better than doing things the other way round, as then we'd have probably been faced with a room full of ECC81 s.

The man on the tape went on to tell us that the new range was not another link in this evolutionary chain (with all this talk of evolution it became clear why David Bellamy had been invited to the 'Do') but a Quantum Leap from previous models. There is no truth in the rumour that the VIC 20 was the first Commodore machine to Quantum Leap, and that initial supply problems were caused by no one knowing to where they had leapt.

Returning to the present Quantum Leap and the reason for so describing the new machine's performance. That reason? Why the fact that the latest range of models is based on - wait for it - an MPU.

Having got the technical details out of the way, the ergonomics (although that word was not used) of the computers got the once-over. The screen had been designed for ease of use - nice touch that - indeed the 'sculptured' keyboard had been designed for ease of use as well. While on the subject of the keyboard, this item attracted the description of 'nearly foolproof' - can't help wondering how far down the IQ scale people would have to be in order to 'beat' the keyboard.

Things were now moving on apace as we were informed of the hi- fi quality SID sound effects chip only to be subjected to some fearful electro-music almost drowned out by 50Hz hum. Not to worry we learnt afterwards that SID was not playing on the tape. We felt like asking why play the music in the first place then but didn't for fear that the answer was obvious.

The smiles on the faces of the gathered technical press were evident to the end, the 'show' rounding off by betting us that we were wondering about the price. We weren't, the Press Kit had already told us.

GAME FOR A LAUGH

Well we've had our fun, and really it's all down to 'horses for courses'. The tape would not have been out of place running in the background of a department store, but that's not how it was announced. It was introduced as a look at a new range of machines before a gathering of technical writers and as such it was hopelessly out of place!

THE LAST WORD.

Advertisers' Index

REWTEL LIVES!

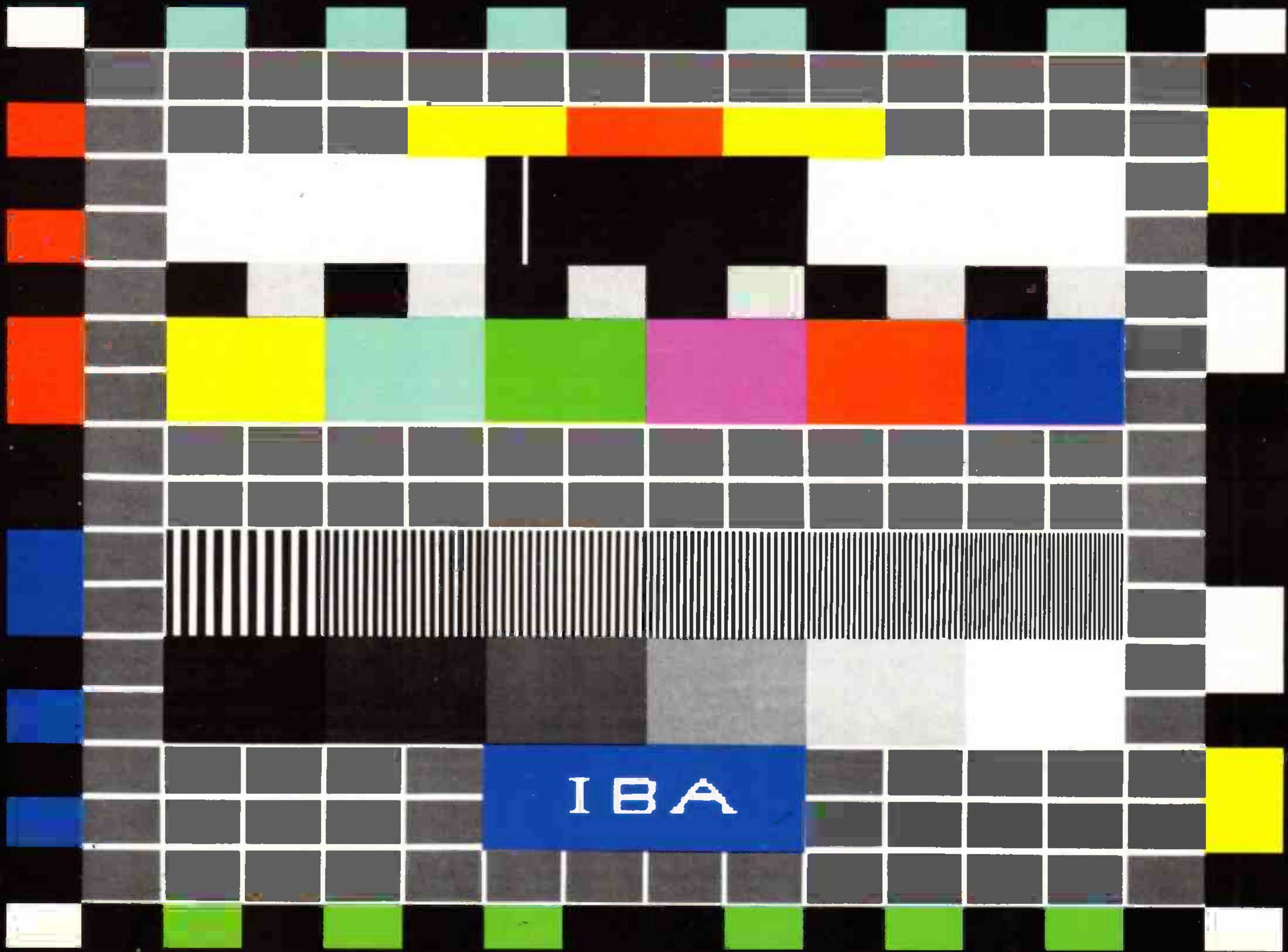
First things first. The present REWTEL number is (0277) 230959. Our sincere and humble apologies to the bemused folk at Shenfield Travel for giving the wrong number last month! We may well have changed the number by the time you read this, so don't be too surprised if you get redirected.

The system is still in an early trials phase, but in view of the number of users already phoning up for a 'go', we are building up the data base as rapidly as other committments permit, since it seems that we may well have started something that is going to be very popular. The main problem looks like being the number of lines available, and until those £10 'priviledged user' (news and ad levels are free) subscriptions start rolling in, we won't have more than a single line available. Existing magazine subscribers get the preferential rate of £8 - although we would ask that potential 'mass users' (universities, larger companies etc.) take pity on our budget and pay according to the likely number of users. After all, if you want to be able to get at REWTEL, we all need the lines and processor power!

The system contains its own driving instructions, and many of the users who have had a go with trial system have obviously found their way around. However, we will be producing a user's guide, which will be supplied to all paid subscribers. The main feature of the system is the manner in which information is accessed through chains of keywords, rather than simple and potentially ambiguous indexing. The proposed total number of pages available would make a page number index extremely unwieldy. We expect to put some background information supporting this issue on REWTEL, so start by entering 'REW AUGUST', and see where that gets you.....

R&EW Data Brief

The IBA's Electronic Test Pattern, ETP1, will over the next few years replace Test Card F.



The test pattern provides all the basic features necessary for receiver alignment, and it can be used for overall assessment of picture quality as for example, when installing a TV aerial.

Features of the IBA test pattern include:

1 crosshatch pattern – for convergence check. This may best be seen with the colour control turned down to give a monochrome picture.

So far as possible, the white grid should be free from colour fringing. In practice, most receivers tend to give some slight fringing, particularly near the edges of the picture.

2 EBU colour bars (75% amplitude, 100% saturation).

3 grey scale – 0%, 20%, 40%, 60%, 80%, 100%, amplitude. The difference in luminance signal voltage between adjacent rectangles should be approximately constant.

4 multiburst – for bandwidth/resolution check. Six sets of sine-wave gratings corresponding to the following frequencies (MHz):

625-line UHF	1·5	2·5	3·5	4·0	4·5	5·25
405-line VHF	1·0	1·6	2·25	2·6	2·9	3·4

It is normal for a colour receiver to exhibit a bluish-yellow pattern (known as 'cross-colour') on the 4·5 MHz grating; and also, to a lesser extent, on the 4·0 MHz and 5·25 MHz gratings. Because of a special filter incorporated in colour receivers, which prevents the colour sub-carrier from appearing on the screen, the 4·5 MHz bars are likely to be indistinct. Also, they are likely to be indistinct on most 405-line monochrome receivers.

5 150 kHz squarewaves – for transient response check. Just above the colour bar there is a train of 150 kHz squarewaves (0% and 75% amplitude). This is to facilitate a check on any ringing, over-shoot or preshoot. Ideally, there should be sharp transitions between the black and white rectangles, without 'smudging'. The transmitted transitions are as fast as the UK 625-line standard permits.

6 black rectangle within white rectangle – for low frequency response check. Low frequency response can be assessed by the appearance of the black rectangle within the white rectangle near the top of the pattern. Poor low frequency response shows as streaking at the right-hand edges of these rectangles, and from the border castellations.

7 white needle pulse – for reflections check. Any reflections of the television signal, from hills or large buildings, can result in displaced 'ghost' images. The effects of short-term reflections are revealed by secondary images of the white needle pulse within the black rectangle.

8 yellow-red-yellow rectangles – for chrominance/luminance delay check. The redness of the rectangle near the top of the pattern should fit snugly between the yellow rectangles.

9 line synchronization castellations – the left, right and bottom borders are formed by a pattern of alternate rectangles in black and colours with high luminance value and with a white rectangle in each corner. On monochrome receivers these rectangles appear either as black or as various lighter tones ranging from grey to white. The right-hand side border serves as a test signal for checking the line synchronization of receivers — faulty line synchronization shows as horizontal displacement of those parts of the picture on the same lines as the lighter toned rectangles on this side. These castellations, being yellow and white, provide a check on sync separator performance in the presence and absence (in 625-line transmissions) of the colour sub-carrier. The spacing of the left-hand and right-hand castellations has been staggered to identify the side from which any disturbances arise.

10 colour receiver reference oscillator castellations. The coloured border castellations can be used in checking for correct decoding: top: cyan, bottom: green, left-hand side: red and blue, right-hand side: yellow.

11 picture centering castellations. The width of each border castellation along the sides of the picture is the same as that of one of the grey rectangles within the crosshatch grid. Similarly, the height of the castellations along the top and bottom is equivalent to the height of the grey rectangles within the crosshatch grid. The picture size on receivers would normally be set for some slight overscan at the edges, but castellations should be clearly visible along all four sides of the picture.

The average picture voltage level has been set (nominally) at 50% of the white level voltage.

Test card and information by courtesy of the IBA Engineering Information Service

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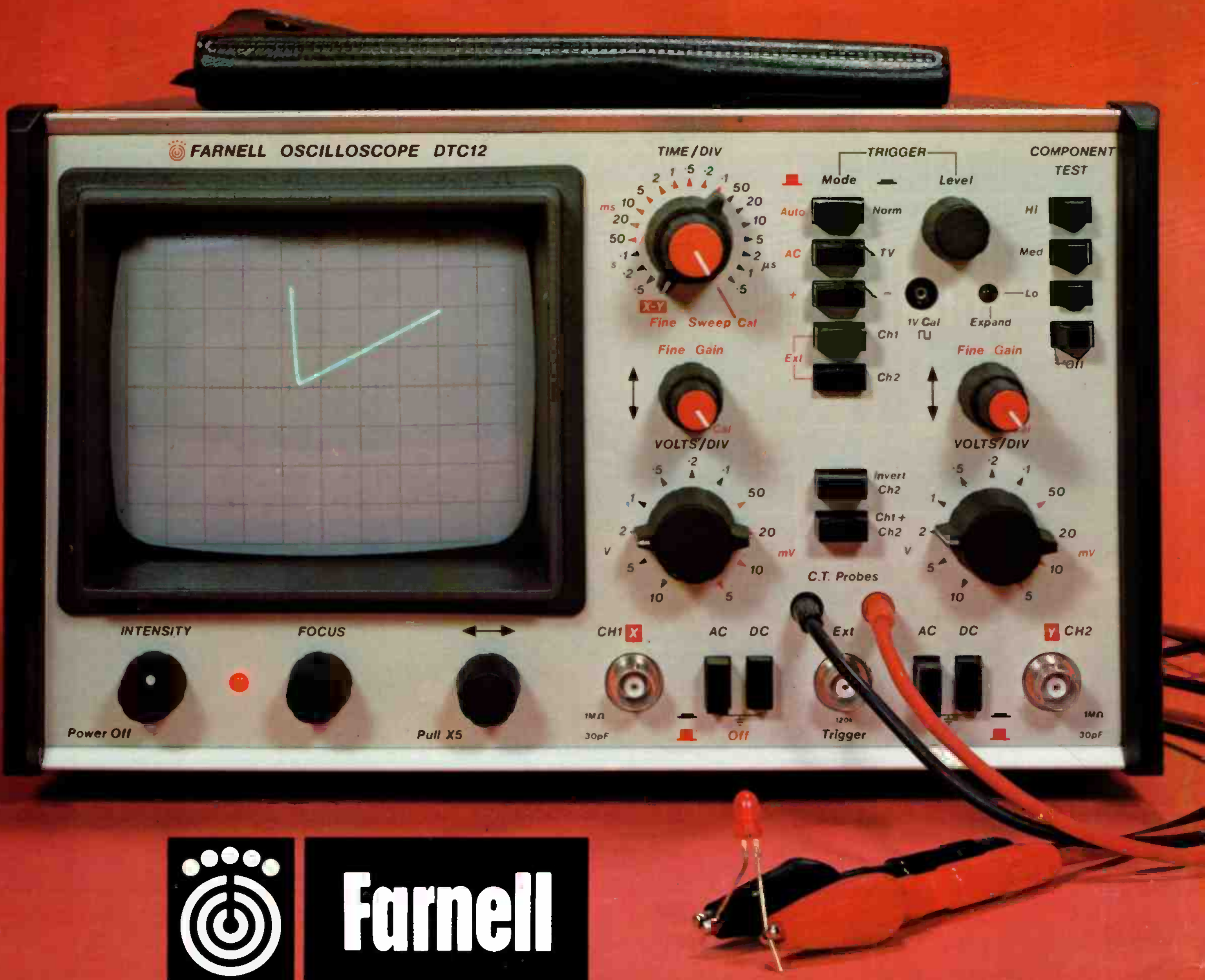

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