Monsén

ISSN 0262—2572

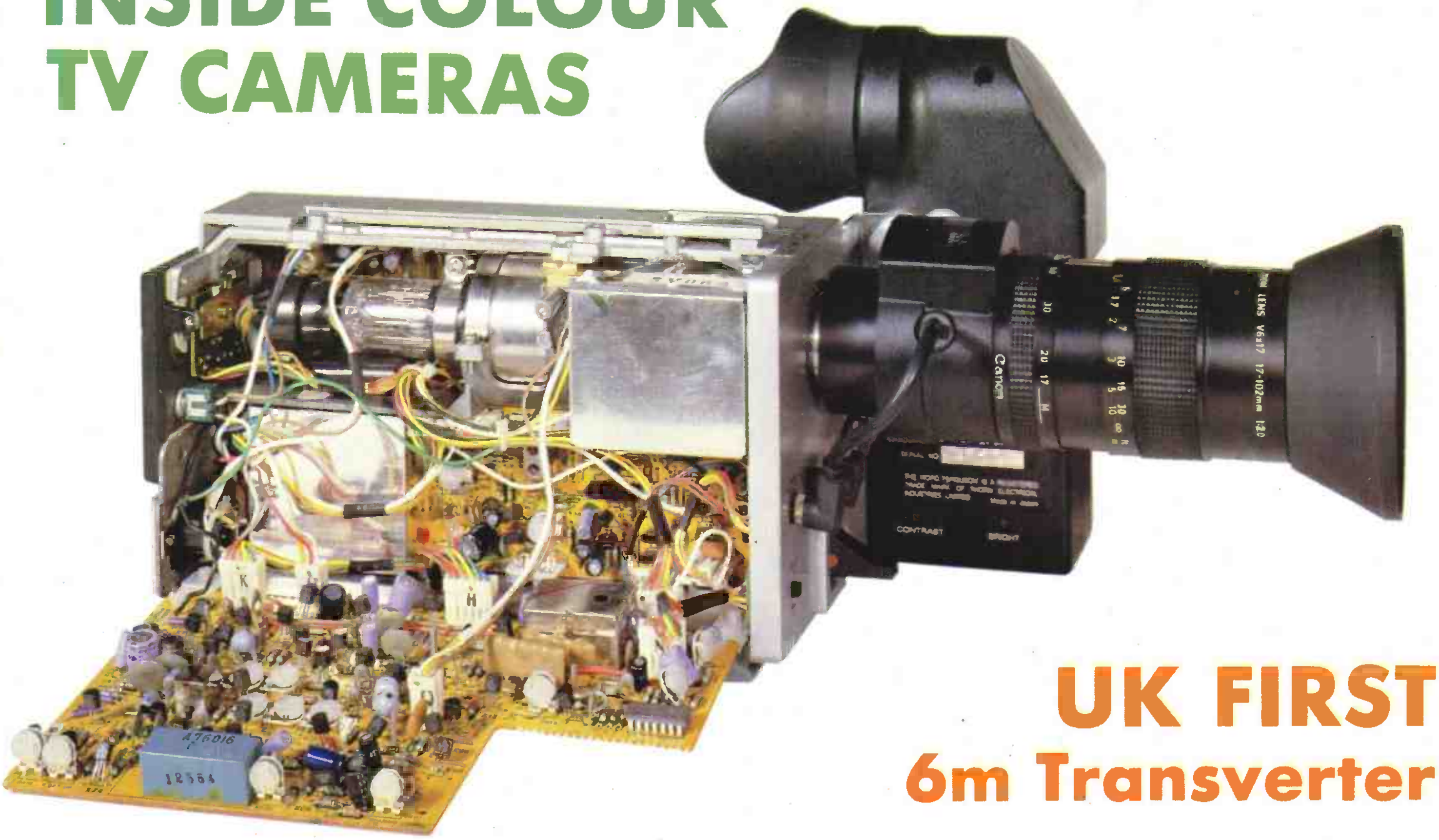
AUSTRALIA	
CANADA	$2.95c
EIRE	£1.26.5
NEW ZEALAND	$2 20c
HOLLAND	F7.15

RADIO & ELECTRONICS WORLD

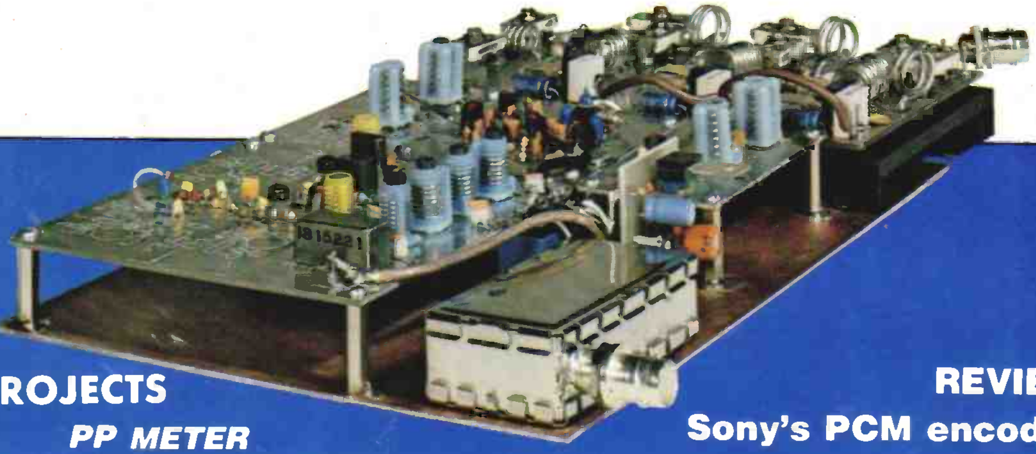
85p

RADIO & ELECTRONICS WORLD
DECEMBER 1982

INSIDE COLOUR TV CAMERAS



UK FIRST
6m Transverter



SPECIAL OFFER
Auto ranging digital multimeter

PROJECTS
PP METER
NI-CAD CHARGER

REVIEW
Sony's PCM encoder

D71699

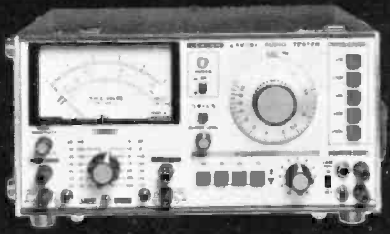
LEADER

instruments set the pace

TV & FM Test

- Colour Bar Pattern Generators
- Sweep and Marker Generator
- CRT Tester
- Field Level Checker
- Signal Level Meter
- High Voltage Metered Probe
- Signal Generators

Audio Test

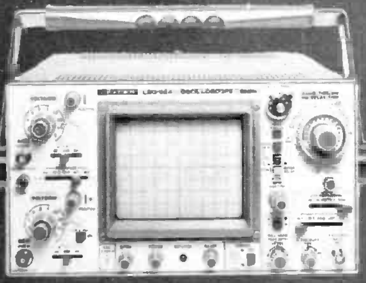


- Generators
- Attenuators
- System Analyser
- Audio Tester
- Distortion Meter
- Equaliser Amp
- Wow and Flutter Meter
- Frequency Response Recorders
- Millivoltmeters
- Log Amplifier
- Speaker Analyser

When you select an instrument from the Leader range, you get more than just sound engineering. That's guaranteed – by rigorous quality assurance at manufacture, and a one year warranty.
A broad range that covers most areas of test, measurement and calibration, with advanced features and high specification as standard. Prices that are lower than you'd expect are the bonus. Probes, covers, hoods and pouches are all available to enhance the application potential and ensure that Leader instruments set the pace for others to follow.

thandar
ELECTRONICS LIMITED

Oscilloscopes



- 4 to 50mHz
- Single, Dual and Quad trace
- Delayed sweep
- Wide bandwidth
- High sensitivity
- High accuracy
- Battery operated

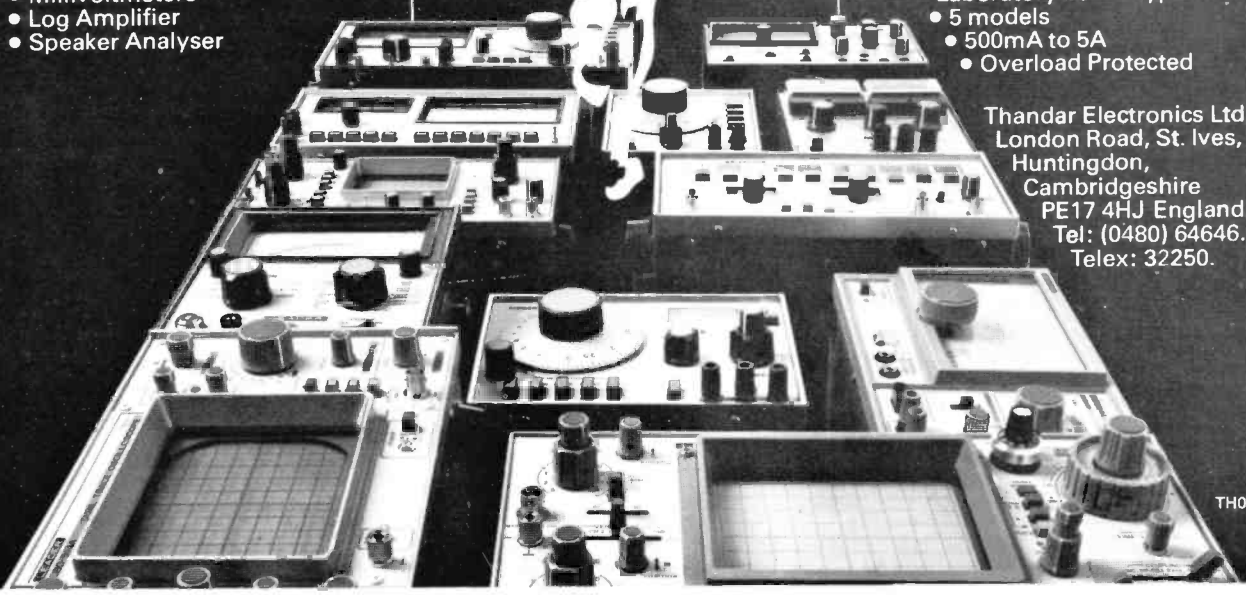
General Test

- LCR Bridge
- Semiconductor Curve Tracer
- Transistor Testers
- Logic Probe

Power Supplies

- Laboratory bench type
- 5 models
- 500mA to 5A
- Overload Protected

Thandar Electronics Ltd,
London Road, St. Ives,
Huntingdon,
Cambridgeshire
PE17 4HJ England.
Tel: (0480) 64646.
Telex: 32250.



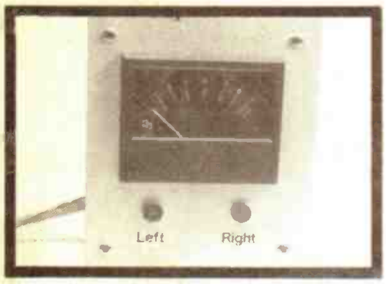
TH02

221 for further details

R&EW

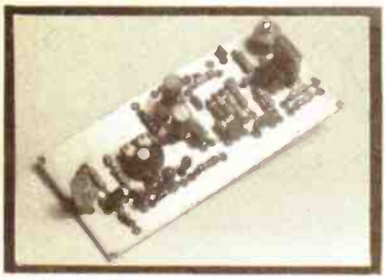
Contents

DECEMBER1982
Volume 2 No. 3



Projects

6M Transverter — A UK first 10
TX10 Direct Video — High quality Video 25
R&EW Transceiver — The CW Generator 41
NI-CAD Charger — Sophisticated Design 53
High Quality PPM — A good mover 73



Features

Comment — Leading questions 5
Piezo Buzzers — Sounds interesting 16
Data Brief: MSL9362RS — RC Encoder 21
Circuit Blocks — Quadrature Oscillator 38
Rewtel — Software for the BBC micro 44
Inside TV Cameras — Vidicons to Videos 48
Amateur Radio World — Arthur Gee reports 61
Z8 Assembler — More power to our TBDS 64
Data Brief: MSL9363RS — RC Decoder 79
Notes from the Past — Electronic greenfingers 81
Data File — Cmos logic explained 90
The Last Word — Buzby Burgers? 96

Reviews

Kyokuto FM - 2030 — With our unique circuit analysis 32
Sony PCM F1 — Digital audio 56
Hitachi 9500 — Second generation machine 70

News

New Products — In time for Christmas 6
Audio Brief — IBC report 30
Video News — Auto focus camera 36
Computing News — A few over the eight 78
DX TV — Who needs Channel 4? 82
Short Wave News — Frank's log 86
News Background — Poel's page 88

Information

Next month's R&EW — All is revealed 24
Project Packs and PCB Service — Makes life easy 63
R&EW Book Service — An expanding service 84
Advertisers' Index — Finders keepers 96

Our appologies to Tim Radford, the author of last month's 'What's wrong with the Spectrum' article whose name was omitted from the credits.

See page 35 for the latest R&EW reader offers.

Sinclair ZX Spectr

16K or 48K RAM... full-size moving-key keyboard... colour and sound... high-resolution graphics...

From only £125!

First, there was the world-beating Sinclair ZX80. The first personal computer for under £100.

Then, the ZX81. With up to 16K RAM available, and the ZX Printer. Giving more power and more flexibility. Together, they've sold over 500,000 so far, to make Sinclair world leaders in personal computing. And the ZX81 remains the ideal low-cost introduction to computing.

Now there's the ZX Spectrum! With up to 48K of RAM. A full-size moving-key keyboard. Vivid colour and sound. High-resolution graphics. And a low price that's unrivalled.

Professional power– personal computer price!

The ZX Spectrum incorporates all the proven features of the ZX81. But its new 16K BASIC ROM dramatically increases your computing power.

You have access to a range of 8 colours for foreground, background and border, together with a sound generator and high-resolution graphics.

You have the facility to support separate data files.

You have a choice of storage capacities (governed by the amount of RAM). 16K of RAM (which you can uprate later to 48K of RAM) or a massive 48K of RAM.

Yet the price of the Spectrum 16K is an amazing £125! Even the popular 48K version costs only £175!

You may decide to begin with the 16K version. If so, you can still return it later for an upgrade. The cost? Around £60.

Ready to use today, easy to expand tomorrow

Your ZX Spectrum comes with a mains adaptor and all the necessary leads to connect to most cassette recorders and TVs (colour or black and white).

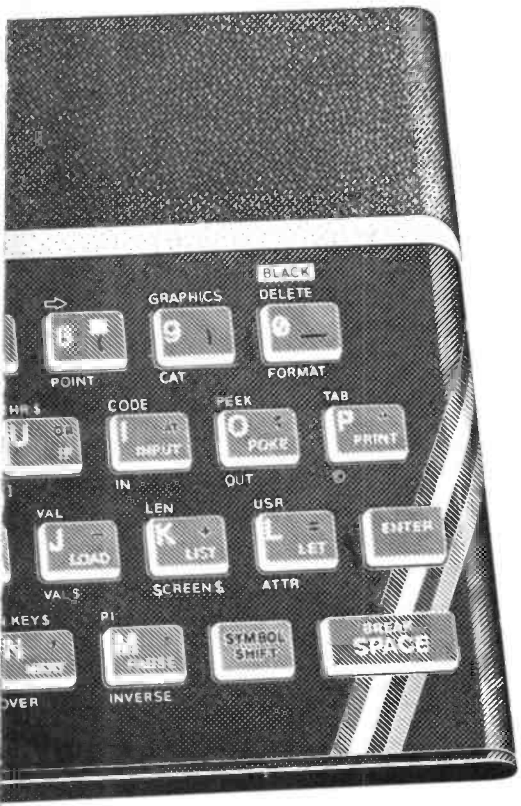
Employing Sinclair BASIC (now used in over 500,000 computers worldwide) the ZX Spectrum comes complete with two manuals which together represent a detailed course in BASIC programming. Whether you're a beginner or a competent programmer, you'll find them both of immense help. Depending on your computer experience, you'll quickly be moving into the colourful world of ZX Spectrum professional-level computing.

There's no need to stop there. The ZX Printer – available now – is fully compatible with the ZX Spectrum. And later this year there will be Microdrives for massive amounts of extra on-line storage, plus an RS232 / network interface board.

Key features of the Sinclair ZX Spectrum

- Full colour – 8 colours each for foreground, background and border, plus flashing and brightness-intensity control.
- Sound – BEEP command with variable pitch and duration.
- Massive RAM – 16K or 48K.
- Full-size moving-key keyboard – all keys at normal typewriter pitch, with repeat facility on each key.
- High-resolution – 256 dots horizontally x 192 vertically, each individually addressable for true high-resolution graphics.
- ASCII character set – with upper- and lower-case characters.
- Teletext-compatible – user software can generate 40 characters per line or other settings.
- High speed LOAD & SAVE – 16K in 100 seconds via cassette, with VERIFY & MERGE for programs and separate data files.
- Sinclair 16K extended BASIC – incorporating unique 'one-touch' keyword entry, syntax check, and report codes.

'um



RS232/network interface board

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

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

ZX Spectrum

Available only by mail order and only from

sinclair

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

The ZX Printer – available now

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

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

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

The ZX Microdrive – coming soon

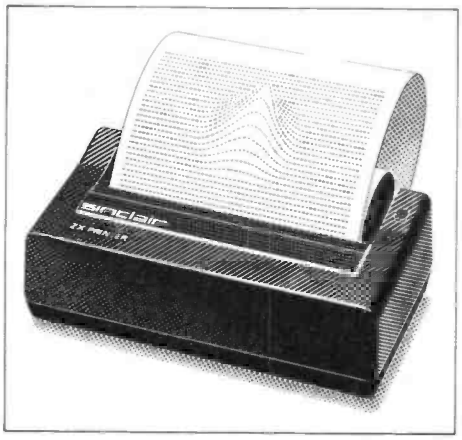
The new Microdrives, designed especially for the ZX Spectrum, are set to change the face of personal computing.

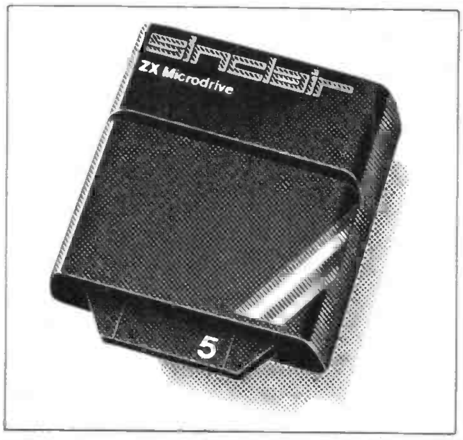
Each Microdrive is capable of holding up to 100K bytes using a single interchangeable microfloppy.

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

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

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





How to order your ZX Spectrum

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

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

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

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

Please tick if you require a VAT receipt ☐

*I enclose a cheque/postal order payable to Sinclair Research Ltd for £ ______

*Please charge to my Access/Barclaycard/Trustcard account no.

*Please delete/complete as applicable

Signature

PLEASE PRINT

Name: Mr/Mrs/Miss

Address

REW812

FREEPOST – no stamp needed. **Prices apply to UK only.** **Export prices on application.**

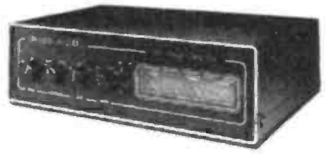
EAST LONDON HAM STORE

H. LEXTON LIMITED

191 FRANCIS ROAD LEYTON E.10
TEL 01-558 0854 TELEX 8953609 LEXTON G

EXCLUSIVE TO US

DRESSLER AMPLIFIERS



These are high power 240V linears using 4C x 150 or 4C x 250 or 4C x 350 Eimac Tubes NOT using the grounded Grid system .
Fully protected, no thermal damage to PA finals possible.

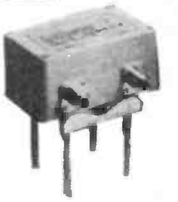
GAAS - FET DRESSLER PRE-AMPS

VV2	
VV2GAAS 150W	£40.00
VV200GAAS 750W	£69.00
VV2000GAAS 1KW	£79.00
VV2RPS S0259	Non switching £22.00
VV2RPS N Type	£24.00
VV7RPS S0259	£22.00
VV7RPS N Type	£24.00

DRESSLER AMPLIFIERS

D70 70cm 200wfm 400 PEP	£495.00
D200c 2mtr 125wfm 200w PEP	£285.00
D200 2mtr 300wfm 600w PEP	£495.00
D200S 2mtr 400wfm 1KW PEP	£600.00

GASFET MASTHEAD PREAMPS



Powered by the linear or with separate interface.
0.7 - 0.9dB signal to noise
0.2dB insertion loss
3SK97 GASFET

ICOM

IC740 HF 100W	P.O.A
IC720RHF 100W G/C	P.O.A.
IC730 HF 100W	£586.00
IC2KL Linear	£829.00
IC2KLPS P.S.U	£211.00
PS15 P.S.U.	£ 99.00
PS20 P.S.U	£130.00
AT500 A.T.U	£299.00
RX70 Receiver	
PS15 P.S.U	£ 99.00

ICOM

IC2E 2mtr fm portable	£159.00
IC4E 70cm fm portable	£ 99.00
IC25G 2mtr 25w fm	£235.00
IC290 2mtr 10w fm/ssb	£366.00
IC251 2mtr 10w fmkw/ssb/base	£495.00
IC451 70cm 10w fmkw/ssb/base	£630.00
IC490 70cm fm/ssb mobile	£445.00
ICSP3 Speaker	£ 29.00
ICSM5 Mic	£ 29.00
IC24G 10w FM Mobile	£169.00

ICOM

Accessories	
ICLC/1/2/3 case	£ 4.25
ICWM9 SP/Mic	£ 12.00
ICBP2 6V pack	£ 29.50
ICBP3 9V pack	£ 20.00
ICBP4 empty pack	£ 6.95
ICBP5 12V pack	£ 39.50
ICCP1 charging lead	£ 3.75
ICDC1 12V car pack	£ 9.75
LC8 leather case	£ 18.98
BC30 Base Charger	£ 45.00

TRIO/KENWOOD

TS930 General Coverage RX/TX	£995.00
TS830 100W HF	£650.00
TS530 100W HF	£475.00
TS130 100W HF	£495.00
TS130 25W 2mtr FM/SSB	£390.00
TS7850 40W 2mtr FM	£300.00
TS7800 25W 2mtr FM	£245.60
TR2500 2mtr Portable	£200.00
TR7730 2mtr FM	£245.00
AT230	£110.00
SP230	£ 34.00
DM801 GDO	£ 60.00
R600 Receiver AM/SSB	£190.00

YAESU

FT-one gen. coverage TX/RX	£295.00
FT102 150W 10mtr-160mtr	£690.00
FT707 100W 5-10mtr	P.O.A.
FP707 20A P.S.U.	P.O.A.
FC707 A.T.V.	P.O.A.
FT107M 9 band 100W	P.O.A.
FP107 P.S.U.	P.O.A.
FT101ZD 160-10mtr	
FT9020M 160-10mtr AM/FM	P.O.A.
SP901 Speaker	£ 30.00
FC902 A.T.U	£135.00
FL2100Z 1.2KW PEP linear	£425.00
FC102 Speaker	P.O.A.
FC102 A.T.U	P.O.A.
FV102 V.F.O.	P.O.A.

Morse Readers

MBA electronic morse/RTTY reader	£170.00
Microdot/morse/RTTY printer/ VDU/Key Board all one peice	£650.00

YAESU

FT290R with mods	FM/SSB	£245.00
FT480R 2mtr mobile	FM/SSB	£365.00
FT780R 70cm 7.6swift	Shift	£400.00
FT780R 70cm 1.6 swift	Shift	£440.00
FT208 2mtr portable	FM	£195.00
FT708 70cm portable	FM	£205.00
FT230 2mtr FM mobile		£220.00
FRG7700 receiver	AM/FM/SSB	£295.00
FRG7700 memory		£ 80.00

FRV7700A 118-150	£ 60.00
FRV7700B 50-60/118-150	£ 75.00
FRV7700C 140-170	£ 65.00
FRV7700D 70-80/118-150	£ 72.00
FRT7700 Aerial Tuner	£ 37.00
FRA7700 Active Antenna	£ 36.00
FF5 Filter	£ 9.95
MMB11 FT290 Car Mount	£ 22.00
NC11C Charger	£ 8.00
NC8 Base Charger	
FT208/208 108	£ 44.00

SCANNING RECEIVER

Scanning Receiver SX200N	£249.00

MORSE READERS

+ Tasco Telereader CW/RTTY	£250

DATONG

D70 Morse Tutor	£ 56.35
PC1 Gen. cov converter	£137.00
FL1 Agile filter	£ 79.35
FL2 Active filter	£ 89.70
ASP Auto clipper	£ 82.80
D75 Manual clipper	£ 56.35
RFC Speach clipper	£ 29.90
AD270 Indoor active ant	£ 47.15
AD370 Outdoor active ant	£ 64.40
RFA Wide band AMP	£ 33.92

DIAWA

RM940 Mic	Infrared	£ 45.00
CN620A	1KW SWR	£ 52.81
CN1001	Auto A.T.V.	£156.00
CN2002	2KW Auto A.T.V.	£228.00
CN518	2.5KW A.T.V.	£175.00
AF406 Active Filter		
AF606 P.L.L. Active Filter		£ 56.00
DK210 Electronic Keyer		£ 41.00

WELTZ

SP200 1.8-160MMZ 20-200-1KW	£ 59.00
SP300 1.8-500MMZ 20-200-1KW	£ 79.00
SP400 130-500MMZ 5-20-150	£ 59.00
SP250 1.6-60MMZ 20-200-2K	£ 43.00
SP15 1.08-160MMZ 5-20-200	£ 29.95
CT150 150/400W Dummy Load	£ 31.00
AC38 3.5. 30MMZ A.T.U	£ 59.00
SP10X 108-150MMZ 20-20n	£ 19.95

DURING DECEMBER OUR PREMISES WILL BE OPEN SUNDAY FOR DEMONSTRATIONS ONLY

MORSE KEYS

Morse keys Swedish brass key	£ 44.00
Himound HK706	£ 11.00
Himound MK706	£ 20.00
Himound HK7022	£ 22.50
Kenpro squeeze key 100 electronic key	£ 57.00

Power Supplies

The Lexton

7ampMax 12amp	£ 49.95
20ampMax 22amp	£ 79.95

Fully protected against overvolts & over current S/C protected.

Trade enquiries Invited and own name can be provided

SONY

ICF2001 receiver	£140.00

Microwave modules

MML 144/30 1-3w drive	£ 9.95
MML 144/100 L.S. 1-3w drive	£159.95
MML 144/100 S10Wdrive	£139.95
MMC 435/600 ATV converter	£ 27.90
MM2001 RTTY receiver	£189.00
MM4000 RTTY tranceiver	£269.00
MM1000KB key board + transceiver	£299.00
MMT28/144	£109.95
MMD050 frequency counter	£ 75.00

TONO

2M - 50W Linear amp. 1-3Win -	£ 62
2M - 70W Linear amp. 10Win	£ 90
2M - 100W Linear amp. 10Win -	£115
θ 500 - CW/RTTY Terminal -	£260

ROTATORS

Kenpro KR 250	£ 44.95
Hirshmann HR 250	£ 50.00
Kenpro KR400RC	
Kenpro elevation rotator	
CDE Ham IV	£189.00

TONNA

144 4ELE £12.00 432/440 21 ELE	£19.00
144 9ELE £16.00 432/435 21 ELE A.T.V.	£27.00
144 9ELE crossed 30.0 144/435 9 19ELE	£31.00
144 9ELE portable 30.0144 19ELEX	£30.00
144 16ELE £33.00 1296 23ELE	£27.00
144 13ELE portable £29.00 Phasing Harnes	
430/440 19ELE crossed telescopic masts	
435 19ELE	£19.00

TET

HB33T	£189.00	HB35C	P.O.A.
HB34T	£202.00	SQ22144	£ 55.00
HB35T	P.O.A.	SQ22OX144X4	£ 90.00
		SO007 70cm	P.O.A.

JAYBEAM

TB3 HF 3 band	£181.70	5XY2M	£24.70
VR3 band vertical	£ 46.00	8XY2M	£31.00
C52M colinear	£ 47.72	10XY2M	£40.80
5Y2M 5ELEYAGI	£ 12.00	Q4/2M	£25.80
8Y2M 8ELEYAGI	£ 15.50	Q6/2M	£33.90
10Y2M10ELEYAGI	£ 33.00	Q8/2M	£39.00
PBM1010EPARABEAM	£39.50	MBM548/70cm	£31.00
PBM1414EPARABEAM	£48.00	MBM88/70cm	£42.50
		8XY 70cm	£36.80
		12XY 70cm	£46.00

HOXIN

GP5 2mtr colinear 6.4DB	£33.00
DX1 discone TX-TX	£34.00
HF5DX 80-40-20-15-10 mtr Vertical	£84.00

ALL ACCESSORIES AVAILABLE – PLUGS SKTS CO-AX 2MTR COLINEAR £31.50, 70CM COLINEAR £31.50

Access

PRICES INCLUDE VAT AT THE PRESENT RATE OF 15%
OPEN MON–FRIDAY 9:00–5.30. SATURDAY 10:00–3:00. INSTANT HP FACILITY AVAILABLE
EASY ACCESS M2–M11–M1 NORTH CIRCULAR ROAD–EASY PARKING

BARCLAYCARD
VISA

Editorial Offices
117a High Street, Brentwood,
Essex CM14 4SG

Editorial (0277) 213819

Managing Editor
William Poel

Editor
Gary Evans

Assistant Editor
Paul Coster

Computing Editor
Jonathan C Burchell

Technical Consultants:
Projects
Keith Collins
Jake Oliver

Communications
Graham Leighton
Roger Ray

Editorial Secretaries
Kim Mitchell
Janet Capon

Production (0277) 213819

Production Editor
Jack Burrows

Art/Production Manager
Patrick Haylock

Art Editor
Sally Bennett

Layout
Helen White
Martin Sheehan

Advertising (0277) 213819

Advertisement Manager
John White

Subscription 01-868 4854

Subscription Manager
Owen Rundle
45 Yeading Avenue, Rayners Lane,
Harrow, Middx HA2 9RL

Subscription Rate
UK £13.00 p.a.
O/Seas £13.50 p.a.

Printers
LSG Printers, Lincoln

Photosetting by
Delafield Reprographic Service

Distributors 01-274 8611
SM Distribution Ltd

Overseas Agents
Holland Electronics **071-144988**
Postbus 377, 2300 A J LEIDEN

U.S. PROJECT PACK AGENTS
Box 411, Greenville, New Hampshire,
NH030408, U.S.A.

Back Issues: £1 each inclusive of postage from Subscription Dept, or send reply paid card with cheque or PO.

Publishers Broadercasting Limited

Comment

Not a moment too soon

The interim report of the Independent Review of the Radio Spectrum (30-900MHz) was issued on September 23rd 1982. This must be one of speediest and most efficient pieces of work by any such body, and we are full of admiration for the way in which it was conducted so expeditiously.

The conclusions are not too surprising, being a recognition of the increasing pressure on the space available by both broadcast and commercial mobile radio, and the need to terminate 405 line VHF television ASAP. The word 'revised' occurs with alarming frequency, and it must be anticipated that makers of crystals and crystal filters will be rubbing their hands with glee before too long, if some of the more far reaching recommendations are followed through.

There was no mention of our request for NBFM broadcasting facilities, and we shall be taking this point up with the Chairman, Dr Merriman (whose letters of qualification include the rather apt 'CB, OBE, FEng.'), since the concern of PW and the RSGB regarding the question of 6 metres is given quite an airing.

Surprise, surprise

Well, section 9.13 says the most intriguing bit: 'There is one bid we would commend to the attention of the Home Office: the radio amateurs' request for an allocation in the 50-54MHz range, a frequency which in use by amateurs in the Americas *(we're surprised they resisted calling them the "Colonies"....)*. We believe that radio amateurs play a part in increasing the understanding of radio and are worthy of encouragement. We therefore *recommend that, if the detailed planning of Band 1 can be so arranged, radio amateurs be given an appropriate allocation in the 50-54MHz band."*

The rest of the report contains the usual stuff about being basically in favour of Good Things, and generally not in favour of Bad Things - and you'll have to pay £3.80 to HMSO if that bothers you.

The report pointedly fails to contain any reference to CB or cordless telephones, which begs the question just where did these gentlemen cast for their 'inputs'? It is well known that the mobile radio manufacturers' and users' groups have a substantial lobby facility, along with the broadcasters. Let's hope that the further deliberations of the committee will not miss this rather important aspect at the second pass.

PS:Ahem, guess who brings you the first 6m transverter?

Feel the Quality

In common with other magazines in our field, increasing costs incurred in the production of **R&EW** have meant that we have been forced to increase our cover price to 85p with this issue. On a purely cost per editorial page, and taking into account this increase in price, **R&EW** does, however, offer the best value for money amongst the electronic magazines ranked along your newsagents shelves every month.

Our generous allowance of editorial pages means that we are able to cover all aspects of electronic endeavour from communications (represented in this issue by Graham Leighton's 6m Transverter) through general electronics, audio, video test gear to computing. Thus one magazine, **R&EW** of course, gives you in one package, the same coverage given by perhaps five or six more, vertically structured, magazines. These would set you back about a fiver - **R&EW** at 85p does make exceedingly good sense.

NEW PRODUCTS

Space Savers From Hitachi

To herald the launch of a newly styled colour TV range, Hitachi are releasing the first model of the new series, the 20" CPT 2071.

Instead of the conventional layout of controls and speakers alongside the picture tube, the speakers on this new model, and others in the range, are positioned on the sides of the cabinet. All the operating controls are grouped neatly under the TV screen, for ease of operation, which results in the cabinet being square in shape and taking up far less space.

The CPT 2071 has been designed to offer a wide range of facilities. It is equipped with a multi-function infra red remote keypad; controlling channel selection, brightness, colour, volume, on/off and speaker muting. In addition, there is a button which will cancel the remote control adjustment of volume, brightness and colour and restore the settings to those originally set on the receiver.

In order to facilitate daytime viewing in bright light, the new receiver has a tinted glass filter-panel, across the face of the screen, which gives improved picture clarity.

An extensive range of input and output sockets are provided with the CPT 2071, including headphone socket, VTR connection socket, external speaker terminal, audio line-out terminal (enabling connection to be made to hi fi equipment), and a DIN audio recording socket for recording television sound.

The CPT 2071 will sell for around £380.

Combined A & D Plotters

For the very first time, you can obtain digital and analogue functions combined in a single recorder. Known as the RY Series, these unique recorders are marketed by Rikadenki Mitsui Electronics (UK) Limited and were demonstrated for the first time in the UK at Lab 82. They can be seen again at Testmex, Wembley Conference Centre, October 26 - 28; where, to highlight their advantages, units will be linked to a NEC Personal Computer specially programmed for demonstration.

Made in A3 and A4 sizes, the RY Series units are high speed plotters, with rates of up to 1,200mm/s in analogue mode and 400mm/s in digital mode. Both sizes are available as single or multi-range recorders. There are 19 simple alpha-character commands to input a wide selection of functions. These include 'T' to select plotting speed and 'C' to draw a circle and arc of a circle. Other features include: 80-byte buffer memory, ASCII character format and a standard Centronics printer interface.

Rikadenki Mitsui Electronics (U.K.) Ltd.,
Oakcroft Road, Chessington,
SURREY, KT9 1SA.

Low Power DC Fan

A new 3" DC axial fan, with extremely low power consumption, has just been introduced by Papst Motors. Known as the 8112G, it consumes only 2.6 watts - about five times less than an AC fan of similar performance. The 8112G is one of a complete range of DC fans currently being introduced by Papst. They employ sleeve bearings, rather than the more traditional ball bearings, which are of a sintered self lubricating design and combine long life and low manufacturing cost.

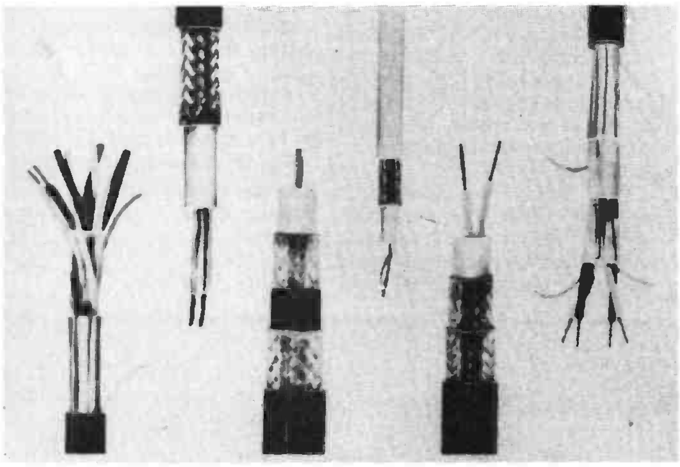
A significant feature of the 8112G is that spurious electromagnetic radiation is extremely low, which is particularly important when the fan is employed in medical equipment, disc drives, display units and instrumentation systems.

The 8112G will move up to 60 cubic metres of free air per hour, when supplied by 12V DC. The supply voltage can be varied between 8 and 16V with resultant proportional variations in airflow. The maximum noise generated by the fan varies from 26dB(A), with an 8V supply, to only 50dB(A) operating at its maximum speed from 16V.

The drive is provided by a compact brushless DC motor manufactured by Papst. The steel fan blades are directly welded to the external rotor and dynamically balanced to minimise vibration/noise and ensure maximum life. The 8112G is rated for use at temperatures up to 65° without fear of compromising performance, with a life expectancy in excess of 20,000 hours (at this temperature). Accessories available for use with the fan include metal or plastic finger guards complying with BS3456.

Papst Motors Ltd.,
Parnell Court,
East Portway,
Andover,
HANTS, SP10 3LX.

● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ●



Cabled For Data

Alpha Wire Limited has announced a new, comprehensive range of data transmission cables designed to meet the needs of the computer industry. The large selection is intended to assist design engineers; with such diverse applications as communications interface, data entry and display, local network cabling, computer peripheral connections and original equipment design.

Alpha offers six basic cables: co-axial, twin-axial, Alpha-Byte low-loss, individually screened multi-pair, overall screened multi-pair and IEEE 488 interface bus cables and assemblies. Large stocks of the complete range are kept, assuring prompt delivery whenever needed.

Alpha-Byte is a newly developed set of cables with cellular polypropylene insulation. The unique cellular construction enables cable pairs to exhibit a lower dielectric constant, resulting in reduced signal loss, lower distortion and increased transmission speeds; plus substantially reduced cable weight.

The new Lo-Tox (FEP Teflon) co-axial cables are ideally suited for low-loss signal transmission in harsh environments.

A broad selection of individually screened and overall screened multi-pair data cables are also offered as part of the complete Alpha range. Individually screened multi-pair cables are designed for computer and computer peripheral equipment connections, where high levels of noise interference are anticipated. Overall screened multi-pair cables are designed for heavy duty control as well as for data transmission purposes. Insulated with polyethylene, polypropylene or PVC, both types of cable are ideal for outdoor installation as well as for in-house networks. In addition, many optional armouring materials are available for abrasion and mechanical protection, where required.

More information regarding Aplha's data transmission cables, can be found in the new DC-1 data catalogue. This is available from:

Alpha Wire Limited,
Alpha House,
Central Way,
North Feltham Trading Estate,
Feltham,
MIDDLESEX.

AUDIO ELECTRONICS

ALL PRICES INCLUDE VAT

TEST EQUIPMENT CENTRES ALL MODELS ON DISPLAY OPEN SIX DAYS A WEEK

RETAIL • MAIL ORDER • EXPORT • INDUSTRIAL • EDUCATIONAL

TRIO 20 MHZ DUAL TRACE SCOPES 2 YEAR GUARANTEE
140mm Tube: DC to 20MHZ: 5mV sensitivity: CH2 Invert
CS1820 Delayed sweep: 0.2 μsec to 0.5 sec
Sweep: Modes CH1. CH2. DUAL and ADD.
List Price £539.00 inc. VAT.
SAVE £119
Our Price **£420.00** inc. VAT (UK c/p £4.00)
CS1566A NOR. AUTO. VIDEO: 0.5 μsec Sweep:
Modes CH1. CH2. ALT. CHOP and ADD:
List Price £368.00 inc. VAT
SAVE £69
Our Price **£299.00** inc. VAT (UK c/p £4.00)
Optional probes – see below.

100 KHZ TO 30 MHZ
6 Band Trio RF Generator. int/ext. mod.
variable o/p to 100mV. AM int 400 HZ mod.
Special Price £59.95 inc. VAT (UK c/p £2)
SAVE £10+
AG202A matching
20 HZ to 200 KHZ.
Audio Generator £78 inc. VAT (c/p £2)

LOW COST DIGITAL MULTIMETERS
3½ digit LCD Hand Held DMM's:
(SW = Slide switch: PB = Push Button:
RS = Rotary) (Models * with carry case)
UK c/p 65p all models
***KD25C** 13 Range 0.2A DC 2 megohm (SW) £26.50
***KD30C** 26 Range 1A AC/DC 200 megohm (RS) £37.50
***KD55C** 28 Range 10A AC/DC 200 megohm (RS) £41.50
***601** 26 Range 2A AC/DC 20 megohm (PB) £36.50
188m 16 Range 10A DC (no AC) 2 megohm
Plus HFE (transistor) Tester (RS) £43.50
189m 30 Range 10A AC/DC 20 megohm
Plus HFE Tester (RS) £69.95

FREQUENCY COUNTERS
(All models battery operated) (UK C/P £1)
PFM 200A Pocket 8 digit LED
200 MHZ 10mV (THANDAR) £67.50
Max 50 50 MHZ 6 digit
LED Pocket (GSC) £56.35
Max 550 6 digit
LED Pocket (GSC) £97.75
8110A 8 digit LED 2 range 100 MHZ
Bench (SABTRONICS) £77.00
8610A 8 digit LED 3 range 600 MHZ
Bench (SABTRONICS) £94.00
Max 100 5HZ-100MHZ.
8 digit Bench LED (GSC) £97.75
8610B 9 digit LED 3 range 600 MHZ
Bench (SABTRONICS) £113.85
8000B 9 digit LED 3 range 1000 MHZ
Bench (SABTRONICS) £178.00
TF040 8 digit LCD 40 MHZ (THANDAR) £126.50
TF200 8 digit LCD 2 range 200 MHZ
(THANDAR) £166.75
Thandar prescalers for any counter up to 200 MHZ.
TP600 600 MHZ £43.13
TP1000 with P/S 1 GHZ £73.00
OPTIONS
TF series carry case £6.84
AC adaptors (TF Series) £5.69
'8' series AC adaptors £5.69
All models probe kits £7.95

ANALOGUE MULTIMETERS GENERAL RANGE
Low cost reliable meters (All supplied with batts/leads) (UK C/P 55p)
BANANA 15 range pocket 20K/Volt
plus cont. buzzer £20.64
ET102 14 range 2K/Volt Pocket £5.95
ST5 11 range pocket 4K/Volt £6.50
NH56R 22 range pocket 20K/Volt £10.95
YN360TR 19 range plus Hfe test 20K/Volt £2.95
KRT5001 16 range 10 amp DC range
double 50K/Volt £16.50
ST303TR 21 range plus Hfe Test 20K/Volt £16.95
AT1020 18 range Deluxe 2KV and Hfe Tester £17.50
TMK500 23 range plus 12A DC
plus cont. buzzer 30K/Volt £23.95
168M 36 range large scale 10A
AC/DC 50K/Volt £28.50
360TR 23 range large scale 10A
AC/DC Hfe test 50 meg. ohm. 1KV
AC/DC 100K/Volt £36.95
Choose from UK's largest range

GENERATORS
R-C. Pulse. RF Function.
Audio (UK c/p £1)
All models 220/240V AC
AUDIO 4 band Sine /SQ output
TE22D Max distortion 1% 20HZ/200KHZ £59.95
LAG27 Max distortion 0.5-1%
(LEADER) 10HZ-1MHZ £86.25
LAG120A 5 band 10HZ-1MHZ.
Sine/SQ 0.05-0.8% dist. £146.00
LAG125 As LAG120A but 0.02%
dist. (LEADER) £273.00
AG203 10HZ-1MHZ 5 band 0.1% Sine/SQ
(TRIO) £129.95
RF (All with Int/Ext mod. variable output)
TE200 100KHZ-100MRZ 6 band
(300MHZ harm) £49.95
LS617 100KHZ-150MHZ (450MHZ-harm)
LEADER £71.30
FUNCTION (all sine/SQ/Triangle/TTL etc.)
5020A 1HZ-200KHZ (SABTRONICS) £90.00
TG100 1HZ-100KHZ (THANDAR) £90.85
TG102 0.2HZ-2MHZ (THANDAR) £166.75
PULSE
TG105 5HZ-5MHZ Various outputs
(THANDAR) £97.75
4001 Ultra-variable 0.5HZ-15MHZ (GSC) £113.85

OSCILLOSCOPE PROBE KITS
(UK C/P 50p per 1 to 3) BNC plug X1 £7.95
X10 £9.45
X1-X10 £10.50
X100 £16.95

DIRECT READ HV PROBE £18.40
(UK C/P 65p) 0/40 KV: 20K/Volt

OSCILLOSCOPES
(C/P Dual trace £4.00: SC110 £1.00: Single Trace £3.00)
HM307 Single trace 10MHZ 5mV: 0.5 micro
sec. Plus built in component tester
6 x 7cm display (HAMEG) £158.70
Optional case £18.40
3030 Single trace 15MHZ. 5mV: 0.5 micro
sec. Plus built in component tester. 95mm
tube. Trig. to 20MHZ (CROTECH) £172.50
HM203/3 Dual 20MHZ: Trig to 30MHZ
5mV:0.5 micro secs. 8 x 10cm display
(HAMEG) £253.00
HM203/4. As above but 2mV - Algebraic
add (HAMEG) £276.00
3131 Dual trace 15MHZ trig. to 35MHZ
5mV:0.5 micro sec. 130mm tube plus
component tester £276.00
HM204 New model with component tester
Dual 20MHZ delayed sweep: trig to 40MHZ.
5mV 0.1 micro sec 8 x 10cm display (HAMEG) £419.75
(Optional case £21.85)
SC110A New model 10MHZ battery portable.
10mV 0.1 μsec 2" trace.
All facilities (THANDAR) £171.00
(Options: Carry case £6.84
AC adaptor £5.69
Nicads £8.63)
SAFGAN – UK made dual trace
Safgan all models 5mV sens. 0.5 micro sec
6.4 x 8cm display.
DT410 Dual 10MHZ £205.85
DT415 Dual 15MHZ £217.35
DT420 Dual 20MHZ £228.85

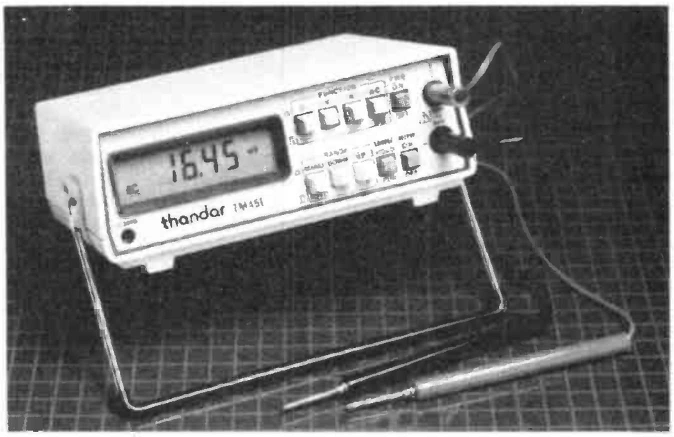
ALL PRICES INCLUDE VAT

AUDIO ELECTRONICS Cubegate Limited
301 EDGWARE ROAD. LONDON W2 1BN. TEL: 01-724 3564
ALSO AT HENRYS RADIO.
404/406 EDGWARE ROAD. LONDON W2

VISA
Order by Post with CHEQUES/ACCESS VISA or Telephone your order. Allow up to 10 days for delivery (unless advised)

155 for further details

NEW PRODUCTS



Samples From The Range

The new TM451 is a 4 ½ digit LCD multimeter and the latest edition to the range of test gear from Thandar Electronics.

It is a bench/portable instrument with basic accuracy of 0.03% and full autoranging or manual operation as standard. There are 21 ranges, in five modes, plus diode check and measurement storage on the display.

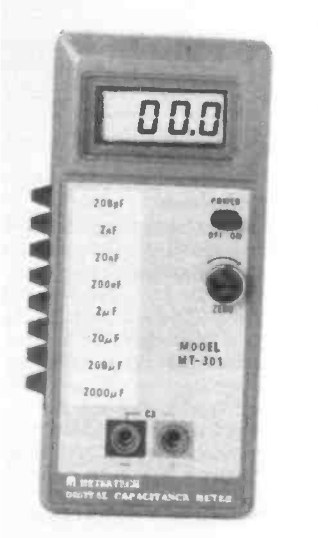
The meter incorporates a continuity tester and over-range warning beeper, with different audible tones for ohm measurement and input over-range. Full input overload protection is also provided.

The TM451 is powered by a standard PP3 battery giving good operational life (due to the CMOS LSI-based design), but can be driven from the mains supply through an adaptor.

Supplied complete with probes and battery, the instrument is priced at £171.35 including VAT.

For further details contact:

Thandar Electronics Ltd.,
London Road,
St. Ives,
Huntingdon,
CAMBS PE17 4HJ.



Hand-Held Capacitance Meter

The Metertech Model MT 301 is a low-cost hand-held digital capacitance meter. Battery operated, with a bold 0.5" 3 ½ digit liquid crystal display, it permits a wide measurement range from 0.1 pF to 2000 uF across 8 ranges. Push-button controls allow fast and easy operation, whilst small size, robust contruction and long battery life make the MT 301 truly portable. It is supplied complete with battery, alligator test clips, spare fuse and instruction manual for £69. A deluxe protective case is available as an optional extra at £6.

For further details contact:

Centemp Instrument Co.,
62, Curtis Road,
Hounslow,
MIDDLESEX.

● ● ● ● ● ● ● ● ● ●

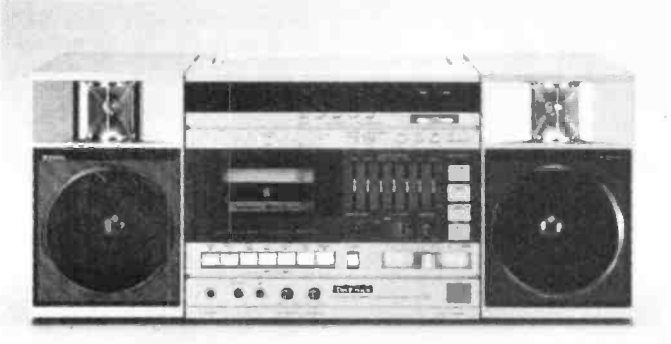
Portable Hi-Fi

For the first time ever, Technics has made hi-fi portable with the introduction of its new system, the SA-CO5L. Retailing at under £245.00, the SA-CO5L combines Technics renowned sound quality with true light-weight portability. Finished in silver, the system weighs less than 9kg and comprises a central unit, with built-in graphic equaliser, an FM/AM tuner and a cassette deck with Dolby B noise reduction. Soft touch controls, as well as one-button recording and direct mode switching, indicate a strong emphasis on simple design and ease of operation.

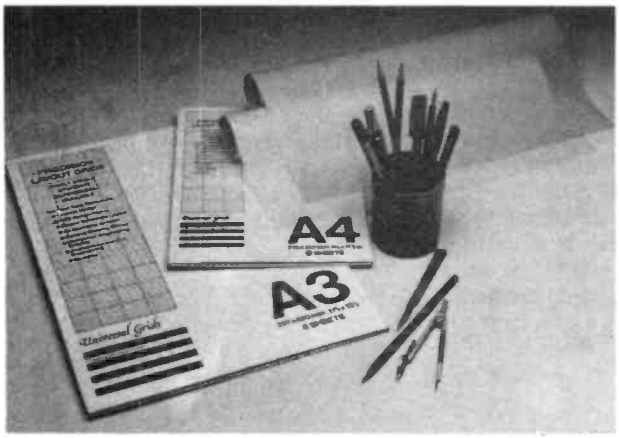
Compact dimensions make the SA-CO5L easily portable with matched speakers adjoining each side of the console unit. For home listening, they can be detached and used with wired connections for a wider stereo image. There is a power-pack for AC mains operation and an additional DC battery pack for music on the move.

Specifications AMPLIFIER: continuous power (both channels, 1kHz into 4R at 5% THD) - 2x15W(AC) and 2x20W(15VDC); input sensitivity and impedance - phono 2.5mV/47k, aux 150mV/22k, mic 1.5mV/10k; frequency response - phono RIAA standard curve ± 1dB, aux/mic -3dB(20Hz-20kHz). TUNER(FM): sensitivity - 1.8uV/75R; THD(mono) - 0.2%; S/N ratio(mono) - 75dB(IHF); frequency response - 20Hz-15kHz, +0.5 and -1.5dB; selectivity - 60dB; stereo separation(1kHz) -40dB. TUNER (AM): sensitivity - 30uV; selectivity - 27dB. CASSETTE DECK: wow and flutter - 0.05% (WRMS) ±0.14% (DIN); frequency response - metal tape 20-17000Hz, CrO_2 tape 20-16000Hz, normal tape 20-15000Hz; S/N ratio - Dolby NR in, 65dB (above 5kHz), Dolby NR out, 55dB (signal in = max record level). SPEAKERS: input power - 60W (music), 30W (DIN); impedance - 4R; output level - 88dB B/W (1m); frequency range-68-50000Hz (-16dB); crossover frequency - 8kHz.

National Panasonic (UK) Ltd.,
300-318 Bath Road,
Slough,
BERKS SL1 6JB.



● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ●



PCB Layout Grids

Universal Grids is the name of a brand new product that has been perfected to meet all designers needs. It is an extremely strong, versatile and stable base material, manufactured from 75 micron (0.003") doublematt polyester film, printed with a grid of Imperial or Metric 'fade-out' blue rulings.

Working to produce PCB patterns directly on the film eliminates any angular error and saves processing time. Accuracy is maintained even when working on a light box, or under a camera!

Technical pens, markers, rolling writers, dry transfer, all perform equally well on Universal Grids, giving great versatility as well as increased economy and accuracy through savings in valuable time and materials.

Universal Grids are available in four sizes - A1,A2,A3 and A4 - and in Imperial, Metric or plain. Prices for Imperial/Metric grids are: A1 £3.91 per sheet; A2 £2.04 per sheet; A3 £5.29 per pack of 5 sheets; and A4 £4.42 per pack of 8 sheets.

Universal Grids Ltd.,
P.O. Box 3,
Liskeard,
CORNWALL,
PL14 6YZ.

CAMBRIDGE LEARNING
SELF-INSTRUCTION COURSES

★NEW!★

DIGITAL DESIGN
A self-instruction course from Cambridge Learning

DIGITAL COMPUTER DESIGN £8.50

Our latest, up-to-date course on the design of digital computers, both from their individual logic elements and from integrated circuits.

Digital Computer Design is the best way for you to understand how simple computers are. You are first shown the way in which simple logic circuits operate and then, through a series of exercises, arrive at a design for a working machine.

GSC SUPERKIT £19.90

The original Cambridge Learning Superkit, a practical digital electronics kit for beginners, now re-written for the popular GSC EXP300 breadboard. The kit comes complete with an instruction manual, components, and breadboard to teach you all the basics of digital electronics.

DIGITAL COMPUTER LOGIC & ELECTRONICS £6.00

The theory course to support the practical Superkit, this 4-volume set covers basic computer logic; logical circuit elements; the design of circuits to carry out logical functions: flipflops and registers. No prior mathematical knowledge other than arithmetic is assumed.

GUARANTEE No risk to you. If you are not completely satisfied, your money will be refunded upon return of the item in good condition within 28 days of receipt.

CAMBRIDGE LEARNING LIMITED, UNIT 150, RIVERMILL SITE, FREEPOST, ST IVES, CAMBS, PE17 4BR, ENGLAND.
TELEPHONE: ST IVES (0480) 67446. VAT No 313026022

All prices include worldwide postage (airmail is extra - please ask for prepayment invoice). Giro A/c No 2789159. Please allow 28 days for delivery in UK.

......SUPERKIT(S) @ £19.90
......DIGITAL COMPUTER DESIGN(S) @ £8.50
......DIGITAL COMPUTER LOGIC AND ELECTRONICS @ £6.00

I enclose a *cheque/PO payable to Cambridge Learning Ltd for £......... (*delete where applicable)

Please charge my:
*Access / American Express / Barclaycard / Diners Club Eurocard / Visa / Mastercharge / Trustcard

Expiry Date........... Credit Card No ....

Signature...

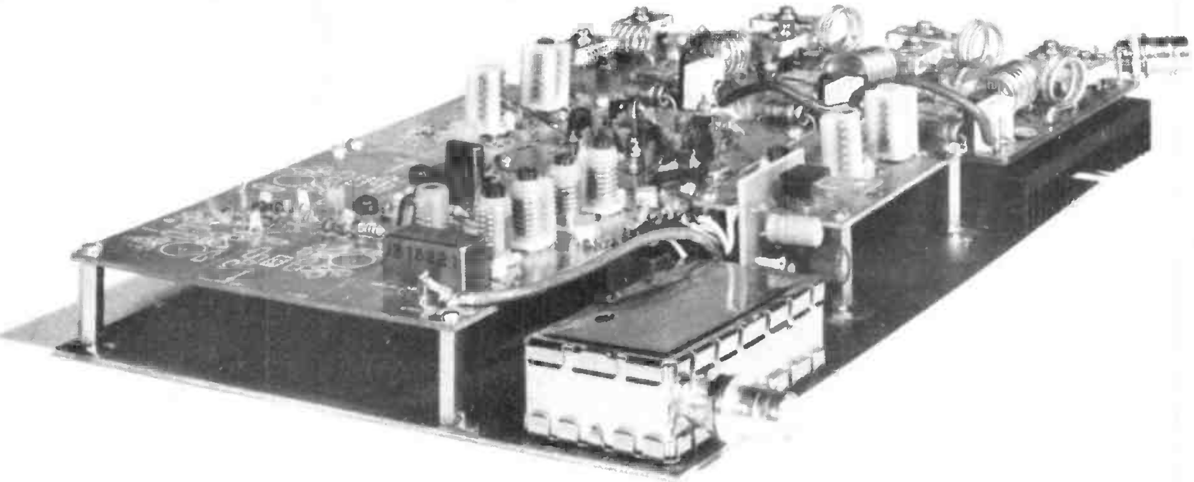
Telephone orders from card holders accepted on 0480 67446

Overseas customers (including Eire) should send a bank draft in sterling drawn on a London bank, or quote credit card number.

Name...

Address...
....
....

Cambridge Learning Limited, Unit 150, Rivermill Site, FREEPOST, St Ives, Huntingdon, Cambs, PE17 4BR, England. (Registered in England No 1328762).



6 METRE BAND TRANSVERTER

A transmit/receive converter, designed by Graham Leighton, for frequencies in the range 50- 54MHz.

The 6 metre band has been used by amateurs in IARU regions 2 and 3 for many years. In most countries the frequency range is 50 to 54MHz. The RSGB/Home Office have announced that a limited number of experimental licences will be available in the UK. These will permit the use of 50 to 52MHz outside television hours. So, we are presenting a transceiver converter, based on modules previously published in **R&EW**, which will form the basis of a 6m station using a 144MHz tranceiver as the IF stage. Soon we hope to bring you a follow-up article describing a single board 144MHz to 50 or 28MHz transverter.

The heart of the system is a slightly modified multiband up- converter (*Ref. 1*). During the design of this unit, the possiblity of using it as part of a transmit converter was investigated. The hope was that it would be useable for the 10, 6 and 4 metre bands. The wideband amplifier, described in this issue, was designed with this in mind. In practice, however, the filtering needed for the 4m version became too complex and was difficult to set up.

THE DESIGN

The block diagram (*Fig. 1*) shows how the various boards have been combined to produce the transverter. The multiband up-converter uses a double-balanced diode mixer and a low pass filter which, since both are bi- directional, makes it suitable for use on transmit and receive. The low pass filter, used in the converter, has a cut-off frequency of about 65MHz (see *Fig. 2*). This may be reduced to about 58MHz by adjusting the coils. In order to keep the spurious output level as low as possible, the drive to the mixer (on transmit) must be limited to about -13dBm maximum. At this level the output from the mixer board is about -20dBm. The spurious output is low (-60dB below the wanted signal) but under overdrive conditions there is a spurious output at approximately ± 6MHz which is caused by the following mixing products:-

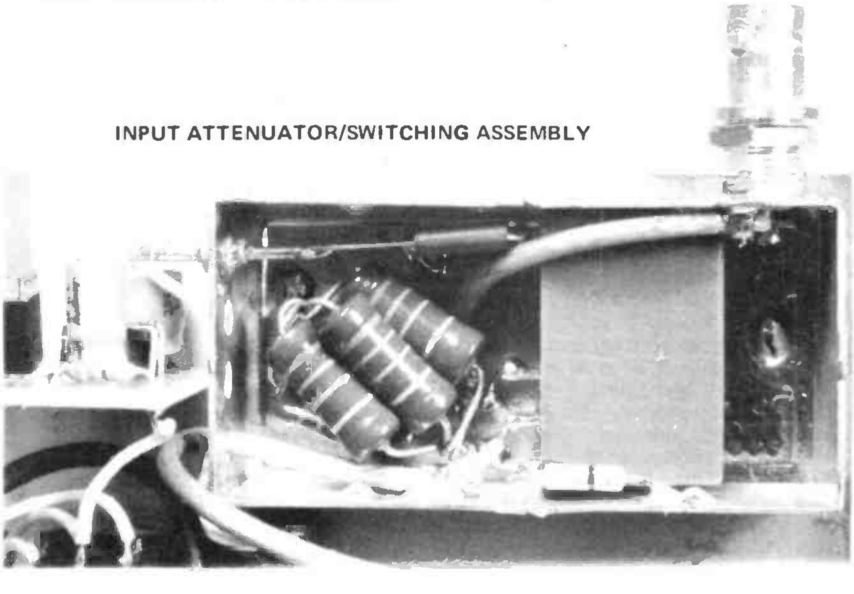
$$50-\pm (50 \times 2) - 94 \text{ MHz}$$

so, don't get too enthusiastic with the drive power.

The mixer board is followed by a wideband amplifier which brings the level up to about +21dBm. This stage does generate some harmonics. These, together with any other unwanted out-of- band signals, are reduced by the bandpass filter. This filter is based on the design used in the 6 metre preamp (*Ref. 2*).

A power amplifier may be included at

INPUT ATTENUATOR/SWITCHING ASSEMBLY



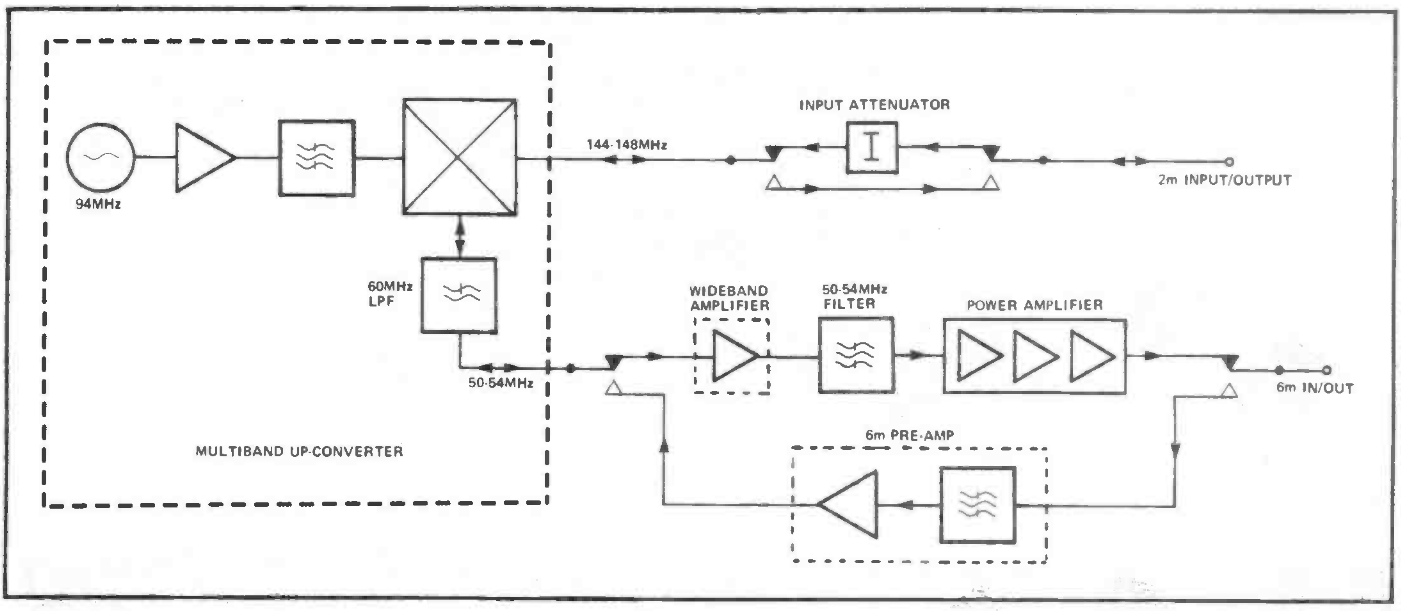


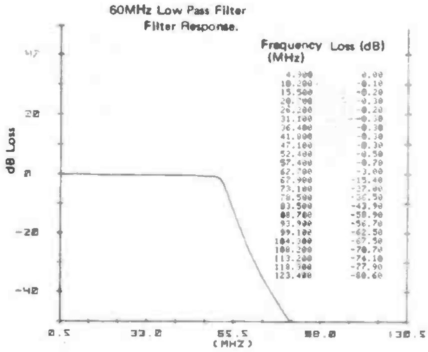
Figure 1: Block Diagram of 6M Transverter

this stage. The design we used works well, but is an experimental prototype. The gain of about 36dB, at 40 watts output, makes the 'system gain' far too high. Therefore a 10dB attenuator, between the filter and the power amplifier, is needed if the PA is not to be overdriven.

The input switching is carried out by a double pole relay which is housed in a screened enclosure together with the load resistors. *Figure 3* shows the circuit of this arrangement. The input attenuator relies on the coupling between the two parts of the relay to provide about 45dB of attenuation.

On receive, the signal is routed to the mixer board via a preamplifier (the design for the preamp was published in September **R&EW**, *Ref. 2*). A noise figure of 2.0dB was measured on the prototype of this amplifier, so the overall sensitivity should be quite adequate.

RL2, which switches the 50MHz side of the mixer board, is also used to switch the supply between the transmit and receive amplifiers.



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
41.000	-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 low pass filter response

CONSTRUCTION

The pre-amplifier and transmit amplifier (*Ref. 3*) can now be built and tested. The mixer board (multiband up-converter) is built according to the article, except that the 60MHz filter is used instead of the 75MHz version. *Figure 4* shows the circuit of the 50MHz bandpass filter which is based on the one used in the pre-amp. This can be conveniently built on a pre-amp PCB if desired.

The input attenuator and switching network, (Shown in the photograph), requires an input drive level of about 1 watt. If a higher drive power is to be used then a more elaborate system may be required.

As can be seen from the photographs, all the boards are mounted on an earth plane. This method is the most convenient for this type of modular design. Each board is fitted with tapped pillars which are then soldered to a piece of copper laminate board. Connect up all the individual boards, using screened cable for all RF

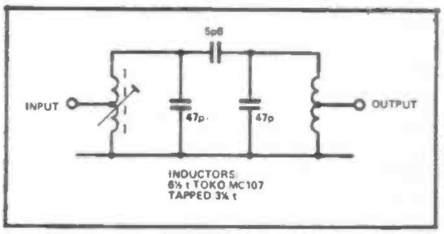


Figure 4: 50MHz filter circuit

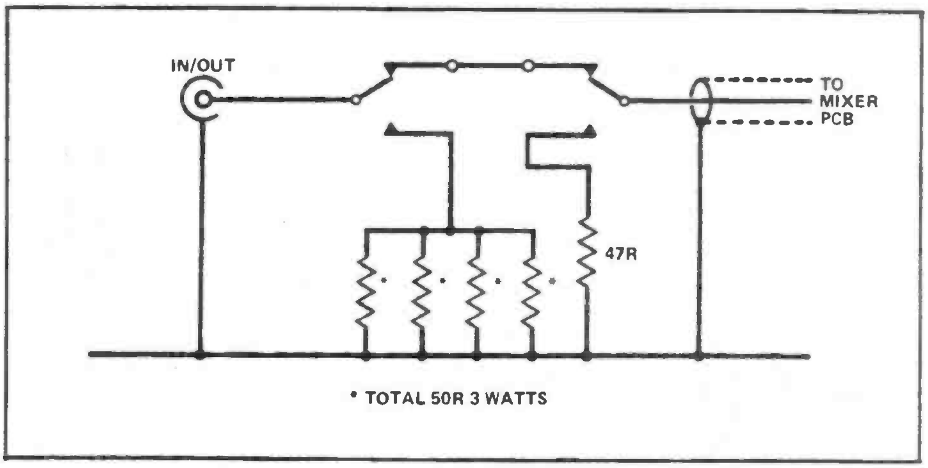


Figure 3: Input switching circuit

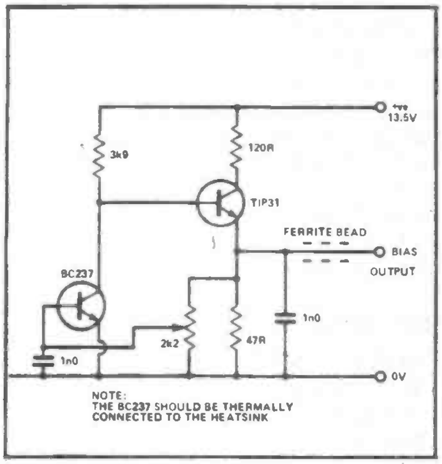
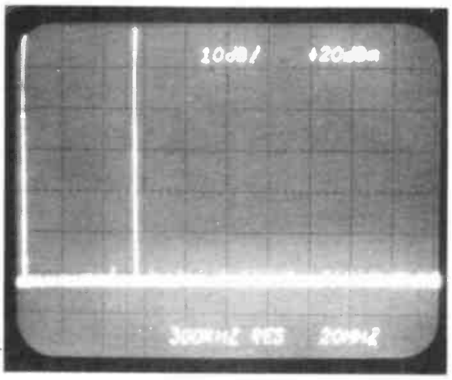


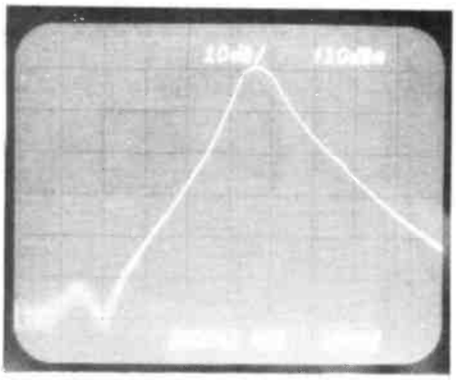
Figure 5: Power transistor bias circuit

connections. Once this has been done the low power transverter should be ready for use. The only part which may need further adjustment is the bandpass filter. In the absence of other test gear the filter may be adjusted for maximum power output.

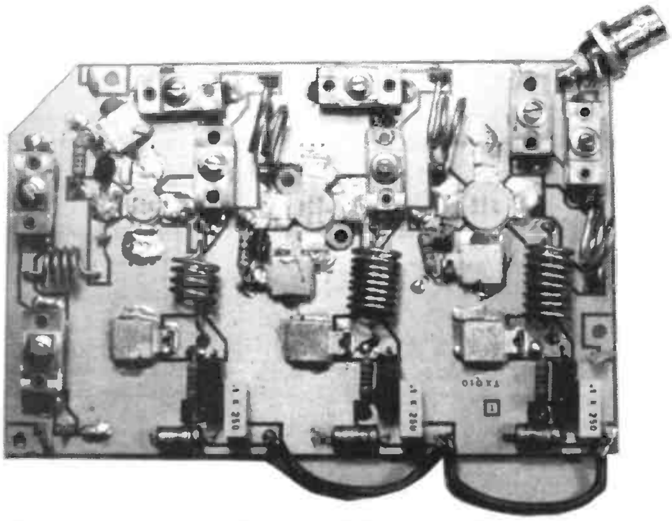
Make sure that neither a high RF power level nor a DC voltage is applied to the mixer, or irrepairable damage may result!



Low power transverter output spectrum



50MHz bandpass filter response



POWER AMPLIFIER

The three stage 40 watt amplifier has been included in this article to give you a starting point. As already mentioned, a refined version will appear in a later issue of **R&EW**.

In the power amplifier, each stage is operated in class AB, the bias being controlled by an individual active network. This bias network (*Fig. 5*) provides a stable low impedance output which is fed to the base of the RF power transistor. A BC237, when thermally connected to the heatsink compensates for any temperature rise. The RF matching has been kept as simple as possible whilst allowing a wide in the prototype, low VHF band transistors were used. HF SSB parts should also be suitable-some experimentation may be necessary. Make certain that you follow the usual assembly precautions when fitting the RF power transistors (see *Ref. 4*). Ensure adequate heatsinking - the photo shows the heatsink that we used - our one had to be cooled using a fan.

When setting the bias, do so one stage at a time. In each case, set the variable resistor to the end of its travel (connected to the TIP31 emitter). Adjust the bias current to the following levels: 1st stage 25mA; 2nd stage 75mA; 3rd stage 150mA or as requried by the devices actually used.

When tuning the amplifier, increase the drive level slowly whilst tuning each stage. Monitoring the current drawn by each stage is helpful during the tuning process, as is checking for oscillations by listening on a nearby receiver.

A low pass filter should follow the amplifier to reduce the level of harmonic output.

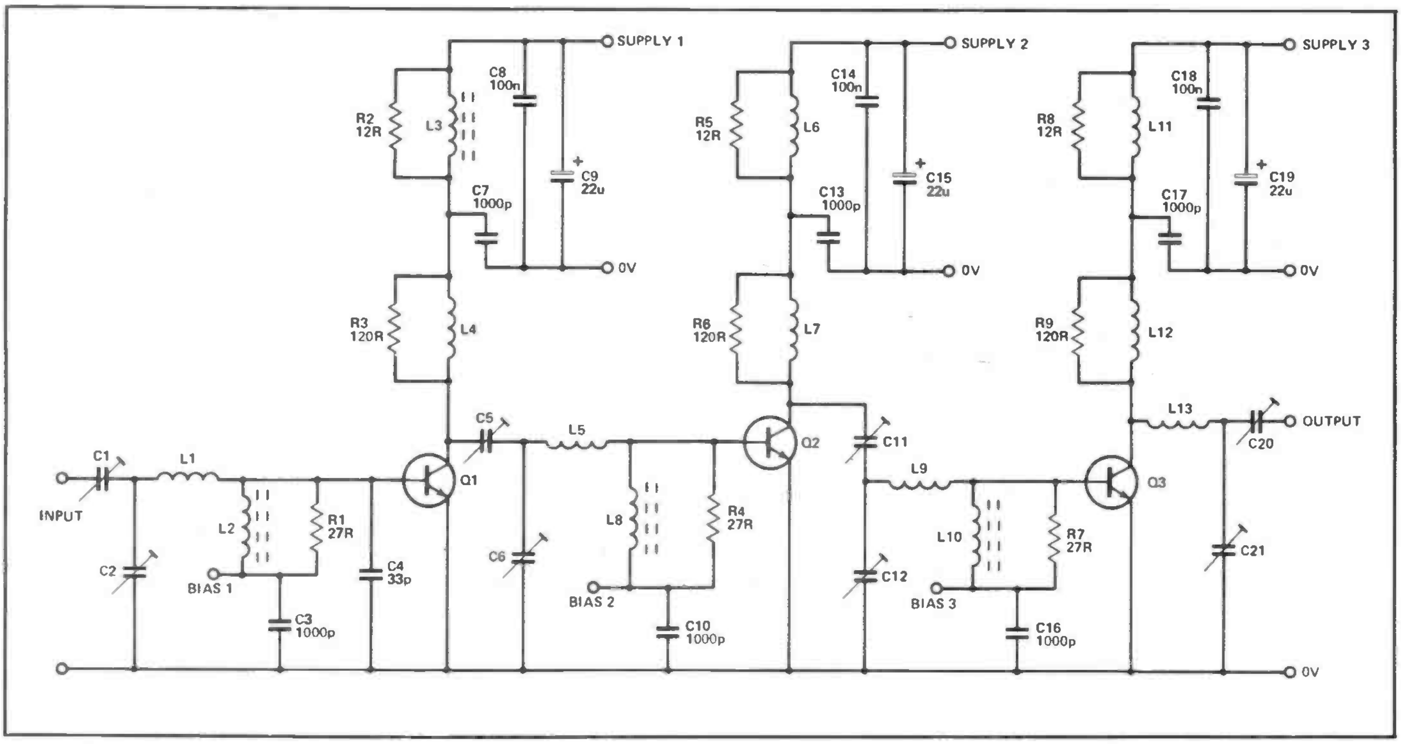
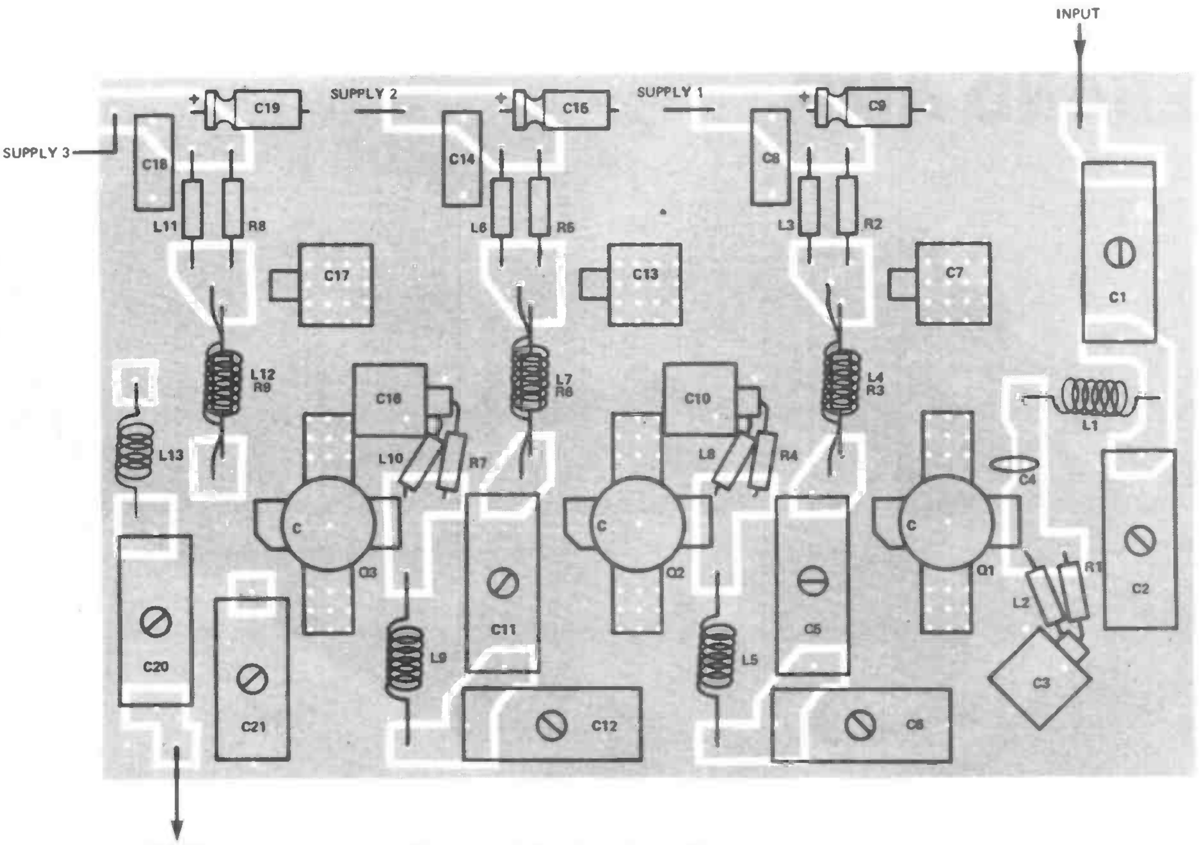
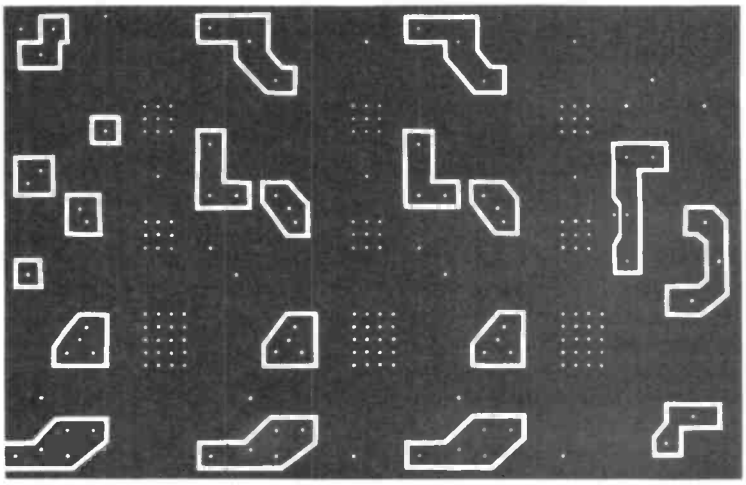


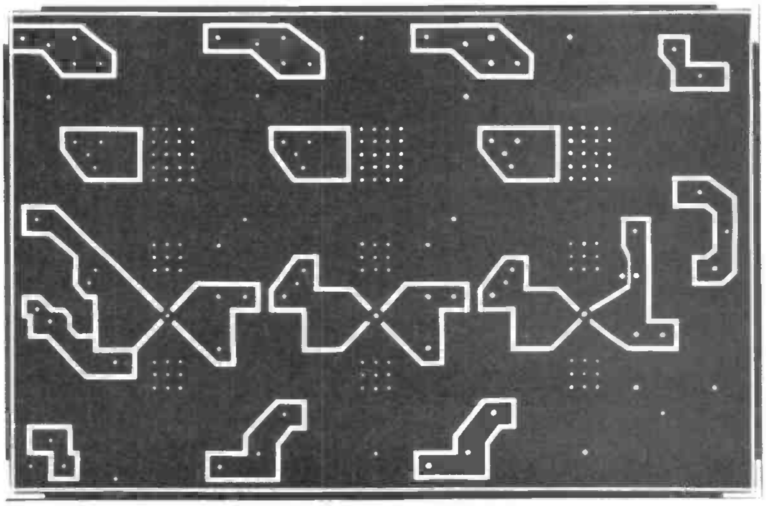
Figure 6: Power amplifier circuit



Component Overlay - Actual Size.



PCB Foil Patterns shown at 70% of actual size.



COMPONENTS LIST (low power transverter)

Mixer Board - Multiband Up-converter fitted with 60MHz LPF and 94MHz oscillator.
6 Metre preamp board
Wideband amplifier board
Bandpass Filter - as modified pre-amp board shown in circuit diagram.

Miscellaneous

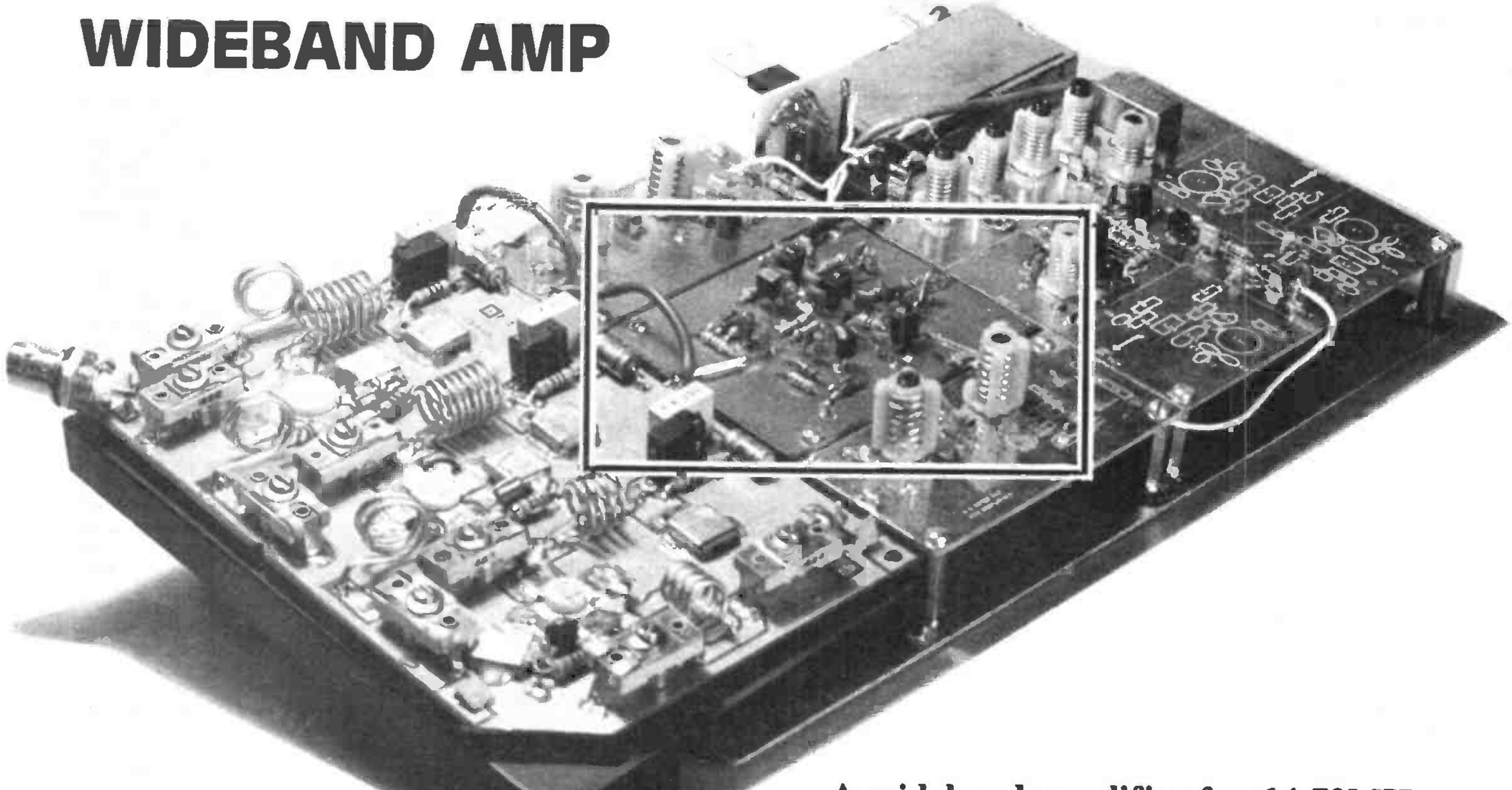
Screening box, 3 off OMI relays, BNC sockets, Load resistors, LM317 regulator etc.

References

1) Multiband Up-Converter R&EW August 1982.
2) 10/6/4M Pre-amp R&EW September 1982.
3) Wideband Amplifier R&EW December 1982.
4) 2M Power Amplifier Ray, R. R&EW June 1982.
5) TRW RF Semiconductors Data Book (European Edition).

Your Reactions......	Circle No.
Excellent - will make one	45
Interesting - might make one	46
Seen Better	47
Comments	48

WIDEBAND AMP



The wideband amplifier shown with the other modules that combine to make the 6m Transverter

A wideband amplifier for 14-70MHz

Graham Leighton

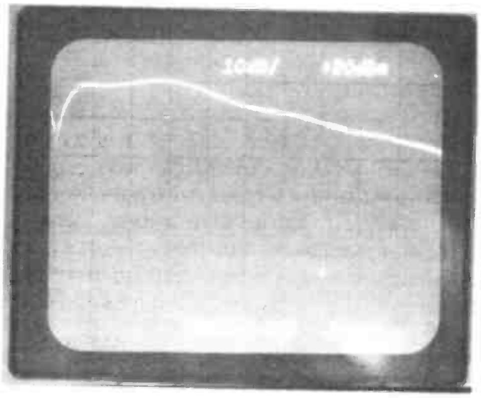
THE DESIGN described here was intended to form part of a transmit system for 14 to 70MHz based around a double balanced diode mixer (eg MCL SBL-1). The output level from such mixers of about -20dBm (if spurious products are to be avoided) necessitates a high gain linear amplifier block - such as that described here. The 1dB compression point after the amplifier is about +24dBm (250mW). Originally,a single transistor output stage was used, and this gave +12dBm output at the 1dB compression point.

Both stages are run in class A, this being the best mode to achieve good linearity. Active bias has been used to provide good d.c. stability. The feedback was tailored for the most level response over the required range.

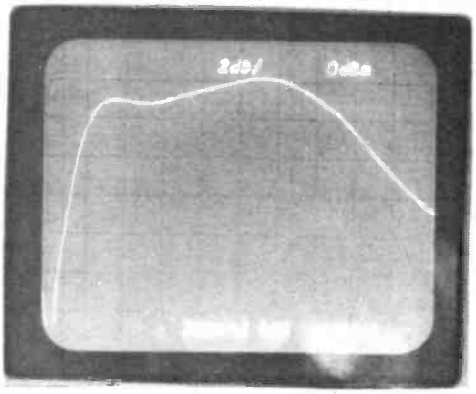
CONSTRUCTION

As usual with circuits of this type, a double sided pcb has been used, with the top side of the board as an earth plane. All components requiring an earth connection are soldered *directly to the top* of the pcb. Apart from the winding of the transformers the construction is straightforward and should present no problems.

Transformer Winding:
T1: Wind 2 turns through a core to form the primary, and three turns for the secondary.
T2: Wind two turns on the core. Fold back and twist together about 6mm of wire to form the centre tap, then wind a further two turns. The result is a centre tapped four



Response of wideband amplifier over 0-100MHz rangé (vertical 2dB/div)

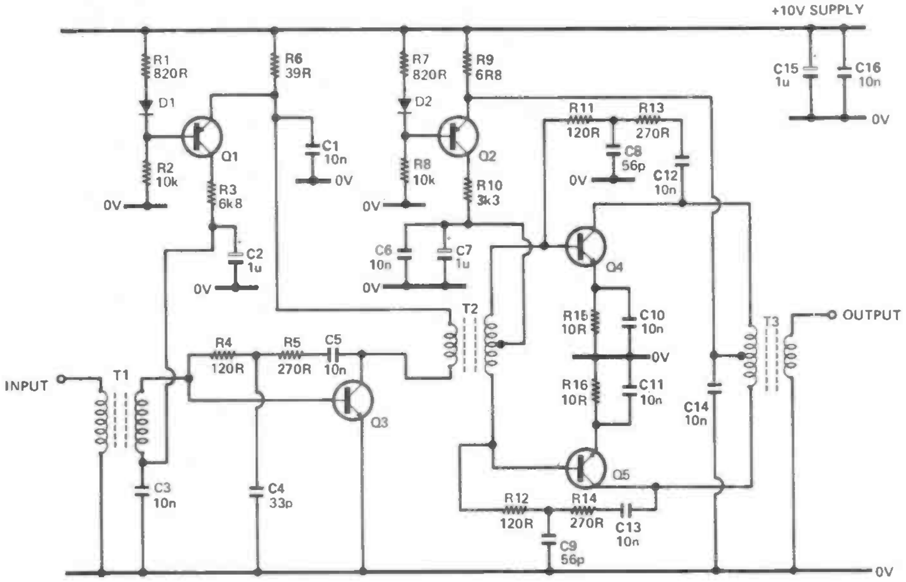


Response of the wideband amplifier over 0-200MHz range (vertical 10dB/div)

PARTS LIST

Resistors	
R1,7	820R
R2,8	10k
R3	6k8
R4,11,12	120R
R5,13,14	270R
R6	39R
R9	6R8
R10	3k3
R15,16	10R
Capacitors	
C1,3,5,6,10,11,12,13,14,16	10n ceramic
C2,7,15	1u Tant
C4	33p Ceramic
C8,9	56p Ceramic
Semiconductors	
Q1,2	BC307
Q3,4,5	ZTX327
D1,2	1N4148

Miscellaneous
3 off fair rite core Z8-43002402
1 off PCB enammelled copper wire



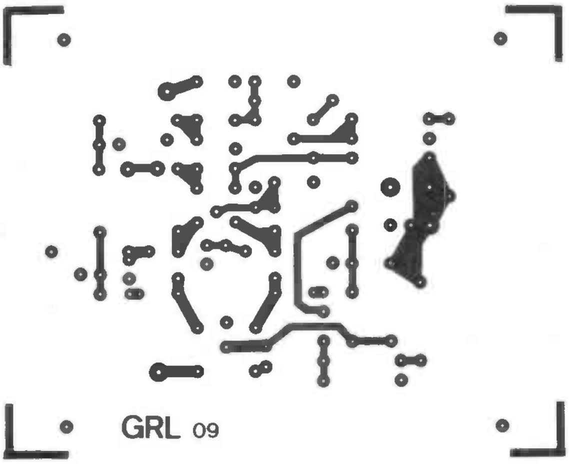
Q1 & Q2 = BC307
Q3,Q4 & Q5 = ZTX327
D1 & D2 = 1N4148

Circuit diagram of the amplifier

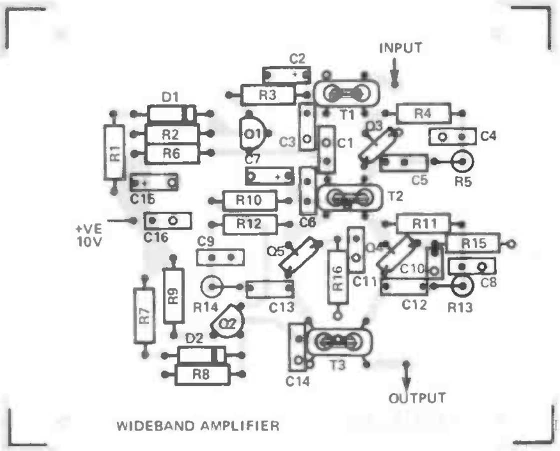
CIRCUIT DESCRIPTION

The input to Q3 is approximately matched to 50R by the transformer T1. R4, R5 and C4 form a feedback network which reduces the gain with increasing frequency. T2 provides the required matching and phase split between the two stages. A push-pull output stage was used to give a reasonable output level with good linearity, using relatively inexpensive devices. Once again, an RC feedback network has been used to set the gain. Additional LF roll-off is achieved by the capacitors across R15 and R16, and the reduction in efficiency of the transformers. T3 re-combines the output from Q's 4&5, and matches their output to 50R.

Class A bias has been used to minimise distortion. The power consumption is not significant at the low output levels involved. An active bias network such as that used here, gives very good dc stability. The diodes D1,D2 are included to give some degree of temperature compensation.... R15 and R16 reduce the effect of any differences between Q4, Q5 and their associated circuitry.



PCB Foil Pattern - Track Side.



Component Overlay.

turn secondary. Wind another four turns on the core to provide the primary winding.

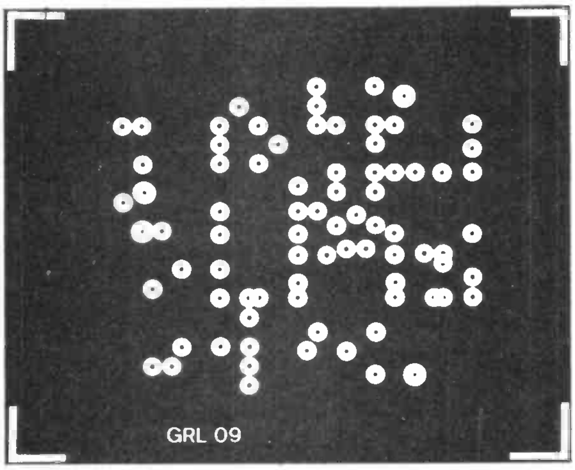
T3: In a similar manner to the winding of T2, wind T3 with a 6 turn centre tapped primary and a two turn secondary.

Once the transformers have been soldered in place, the amplifier may be tested.

TESTING

Since there is no alignment involved, the testing consists only of checking the operation of the amplifier. Connect a 10 volt current limited power supply and an RF power meter (which could simply be a 50 ohm resistor and RF probe for a multimeter or 'scope). Using either a signal generator or a converter, check that the gain is about 40dB, and the output is reasonably constant over the frequency range. The output power at the 1dB compression point should be about 250 mW.

■ R & EW

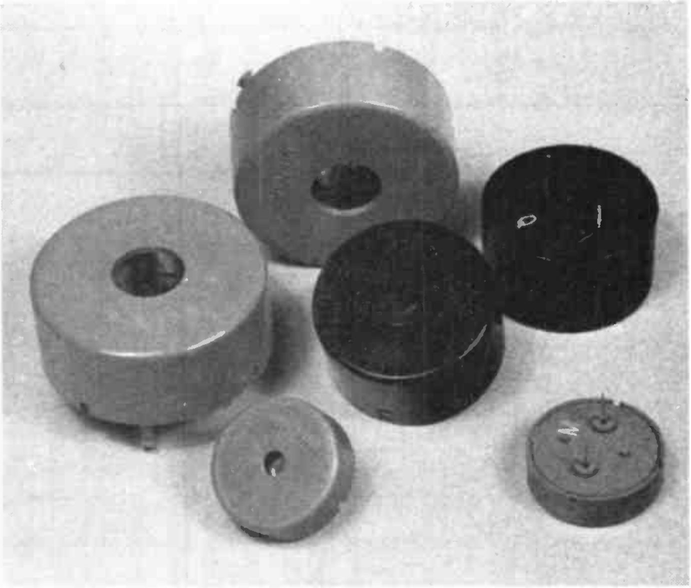


PCB Foil Pattern - Top.

Your Reactions

	Circle No.		Circle No.
Excellent - will make one	21	Comments	23
Interesting - might make one	22	Seen Better	24

PIEZO-BUZZERS



Chris Parsons explains the operation, construction and application of these useful devices.

PIEZO-BUZZERS fall into a category of devices called transducers. These come in widely differing types, since the category encompasses anything which converts a physical quantity, such as heat or light, into an electrical one - and vice versa. Now usually, this conversion process will generate electrical signals which can be processed - converted to digital form - and stored for analysis by computer. However, in the case of piezo-buzzers, the conversion is from electrical to mechanical: they operate by *producing* vibration (ie sonic waves) in response to an electrical input. In fact, AC *and* DC input voltages will cause the piezo-electric ceramic to distort (ie expand or contract), but only AC gives rise to the repetitive vibrations which characterise a sound wave - albeit at a frequency above that of the audible range for humans (>20kHz). These are the ultrasonic piezo transducers, familiar in burglar alarms, which require certain modifications to function at audio frequencies. This is one of the topics we will discuss.

SUPPORTING VIBRATIONS

The natural resonant frequency of piezo-ceramics is much higher than that of the upper limit for human audition. So, to obtain an *audible* output, a metal plate has to be attached to the ceramic element (*Fig. 1*). This produces a reduction in frequency to something around a few kilohertz; the resonant frequency being proportional to the thickness, over the square-of-the-radius of the element (assuming a consolidated plate and ceramic). The metal plate vibrates in a vertical direction - since it cannot follow the expansion/contraction vibration you find with resonating ceramics - and it is this vertical motion which produces the sound waves. As the ceramic is stimulated into oscillation, near the resonant frequency, it contorts and vibrates against the plate. This, in turn, moves up and down causing alternate bands of compression and rarefaction in the air (sound waves); which is why we can hear the buzzer.

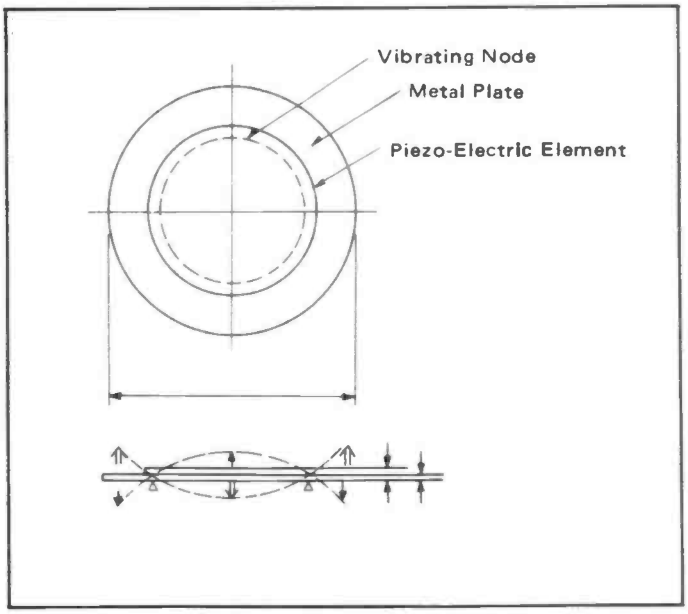
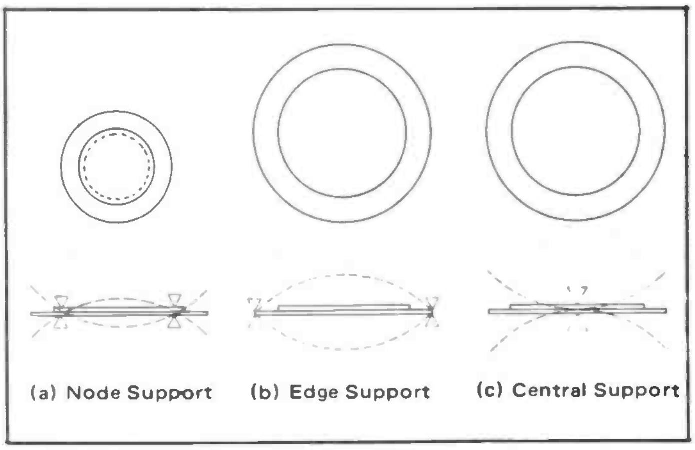


Figure 1: Position of metal plate on a piezo-ceramic

Piezo-electric buzzers can operate in three modes of vibration, dependent on the position of an integral support to hold the element inside the case. These three modes, shown in *Fig. 2*, are: node support, edge support and centre support. The first represents vibration in a free state (the vibration is not affected by the support) and the broken line in the diagram shows a circle of null vibration called a node. Where this node is supported, suppression of vibration is very small and a stable resonant frequency is obtained. At this frequency the sound pressure level is 40dB higher than at frequencies which are more than 1kHz either side (*Fig. 3*). The diameter of the node, consistent with this type of vibration, is theoretically 0.55 times the diameter of the sound element. However, practical elements may vary from this ratio by as much as 12%.

The second mode of vibration results when the element is supported around its edge. Here, since the *whole* element is moving up and down, the support also vibrates causing the resonant frequency to change. *Fig. 4* shows the spread of resonances, throughout a range of frequencies, due to the interaction between the support and the element. So, since there is not a *single* resonant peak, with high output level, an external drive (source of frequency) is best used.



(a) Node Support (b) Edge Support (c) Central Support

Figure 2: The three vibration modes for plate and ceramic element.

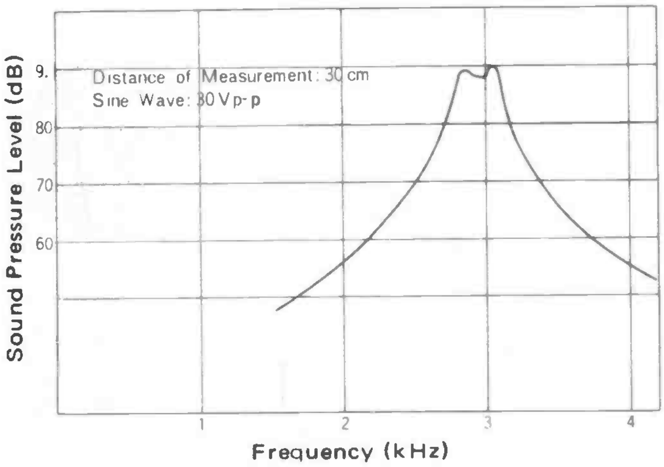


Figure 3: The output rises dramatically at the resonant frequency (mode support, 30Vp-p input at 30cm).

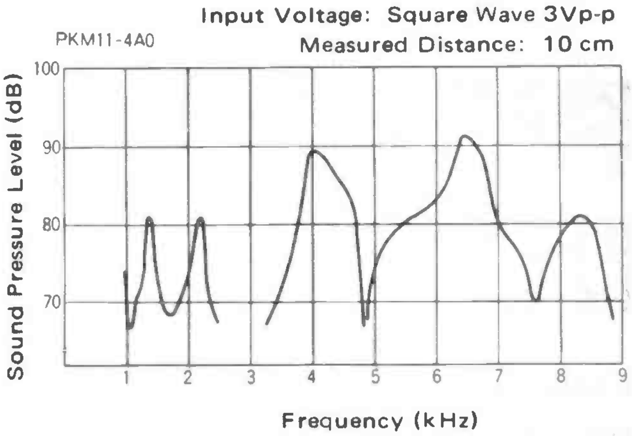


Figure 4: Range of resonant frequencies with edge support (3Vp-p @ 10cm).

The third mode, centre support, is similar to the second in the way it suppresses a certain amount of vibration and requires an external signal source. However, the resonator is not easy to design and the device is mainly used for alarm systems where a customised design is needed.

THE CASE FOR LOUDNESS

The shape of the case, in which the piezo-ceramic and metal plate are supported, plays a significant role in the overall level of sound available from the buzzer. If the piezo- electric element is stimulated in free air (ie without a case) the output will be fairly low. This is due to several factors, but lack of directivity and power are two of the main ones. So, to combat this a resonating case is used to house the piezo-ceramic and metal-plate.

The case is designed to resonate at a specific frequency, which can be found from fo = 55 s/lW (the letters refer to dimensions shown in *Fig. 5*). This frequency is chosen to match the resonant point of the ceramic and plate; which amplifies the sound pressure level at resonance.

If the case design is constrained by other considerations - for instance, limited space inside a watch - it is possible to boost the output using a coil and switching transistor (*Fig. 6*). The technique is to create a high instantaneous voltage to drive the transducer. When Q1 is switched on or off by a square wave input (with rise or fall time t), a back EMF proportional to L/t is generated in coil L1. This can provide a peak-to-peak voltage several times greater than the line voltage and a comparable increase in sound output. Also, by inserting a capacitor between +V and the collector of Q1, any surge currents will be absorbed at the expense of some loss of sharpness in the sound quality.

THE DRIVE TO OSCILLATE

There are two methods for driving these transducers; self-drive and external drive. The primary factor which determines the oscillation driver is the type of support used. As mentioned earlier, there are three ways of supporting the piezo-ceramic and metal plate - one produces a single resonant peak (node support) and is easy to set into oscillation, and the other two have a range of resonances (edge and centre support) so must be driven by an external source. The suitability of any buzzer for a particular application therefore depends on the construction of the case and the way the element is supported. With node support, self-drive oscillation is most appropriate and the usual circuits (e.g. Colpitt or Hartley oscillators) may be used. An alternative is shown in *Fig. 7*, where a feedback electrode is used to simplify the oscillator circuit. However, this method relies solely on the resonant frequency of the sound plate, that is, only one frequency is available (the only way to alter the frequency is to change the size and shape of the plate).

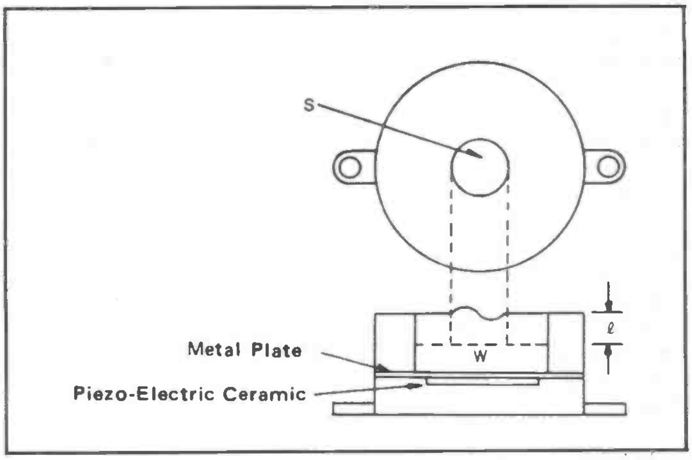


Figure 5: Important dimensions for the design of a resonating case.

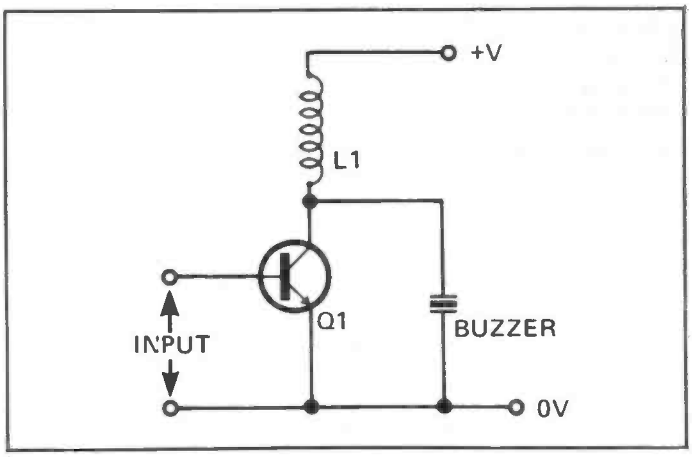


Figure 6: Using a transistor and boosting coil to increase the output voltage.

The other support-types (edge and centre) require external driving circuits and are commonly found in watches and calculators. However, there are a wide range of application circuits in which *these* piezo-transducers can be used. Some examples are shown in *Figs 8, 9 and 10*. The first circuit is a simple multivibrator with external drive transistor to boost the available peak voltage, as described earlier. The second (*Fig. 9*) is designed to produce a telephone ringing tone, with centre frequency provided by IC1c,d. Finally, *Fig. 10* is configured to produce the sound made by a cricket. All these circuits can be provided with protection against ▶

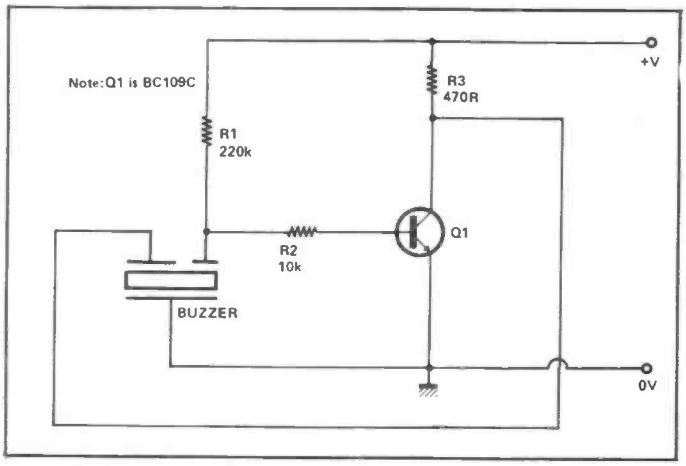


Figure 7: A feedback electrode can be used in a simple oscillator.

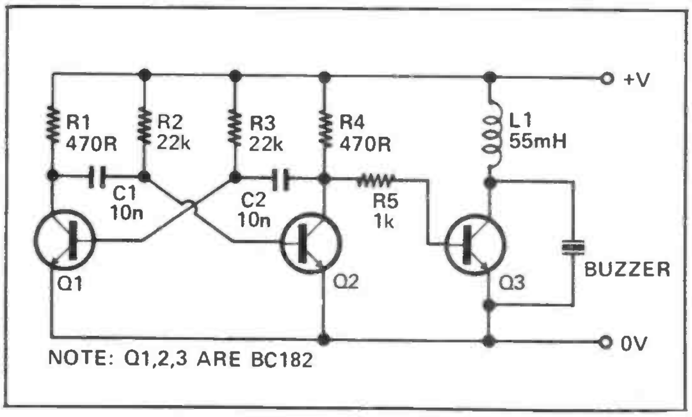


Figure 8: Multivibrator circuit with boosting stage.

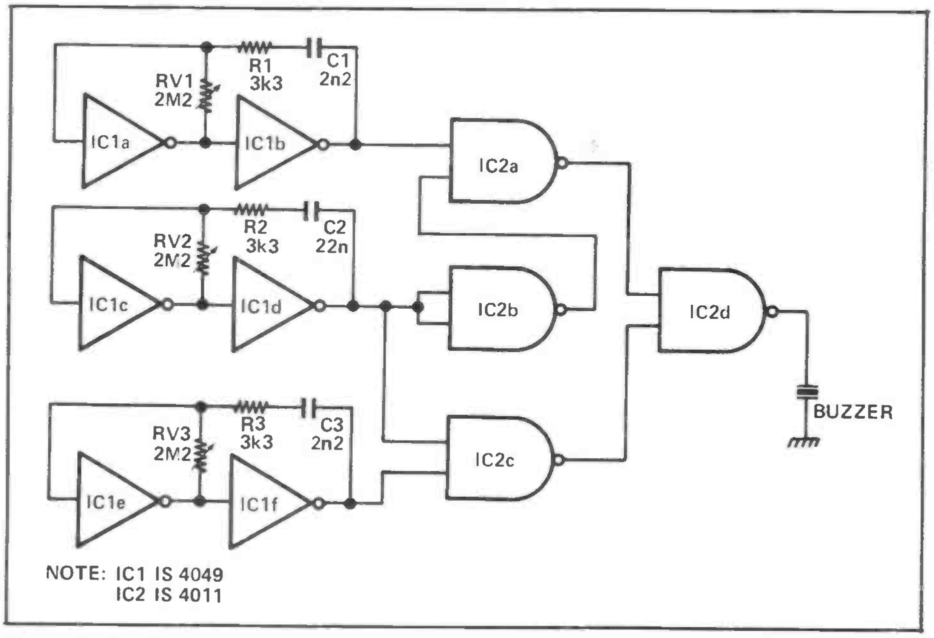


Figure 9: Circuit to produce telephone ringing tone.

voltage overload, by placing two zener diodes (cathode to cathode) across the terminals of the buzzer.

Piezo-buzzers best suited for external drive do not have a single resonant peak, but two or more within a frequency band of around 10kHz. The response characteristic is shown in *Fig. 11* (for a buzzer designed to produce most sound at 2048Hz and 4096Hz) and it is clear that around the resonant peaks, an increase of 20Vp-p input will produce a 20dB increase in sound pressure level. This compares favourably with the efficiency of the node support types, but here the external drive circuits can add further power and frequency variation. In fact, the number of audio circuits in which external drive transducers can be used is quite large. It is just a case of making any special mods and then 'plugging in' and 'switching on'.

■R&EW

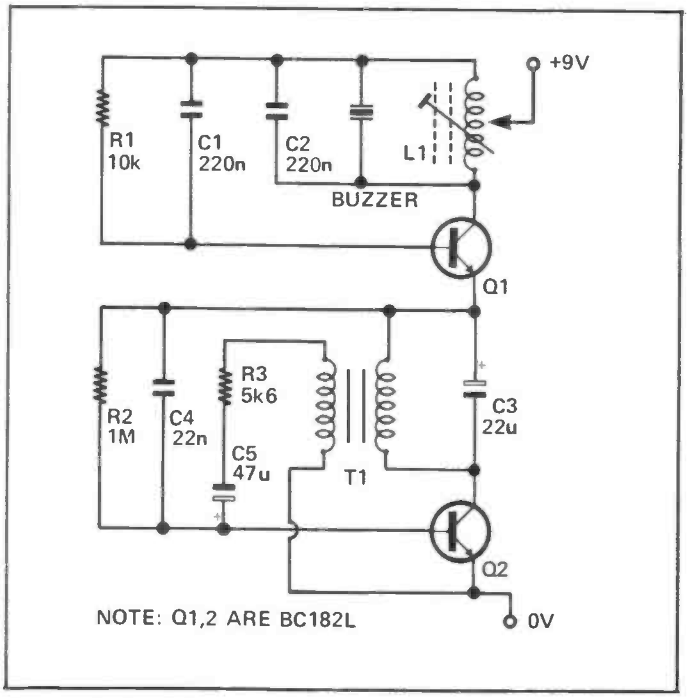


Figure 10: Circuit for sythesising the sound made by a cricket.

Your Reactions

	Circle No.		Circle No.
Immediately Interesting	1	Not Interested in this Topic	3
Possible Application	2	Bad Feature/Space Waster	4

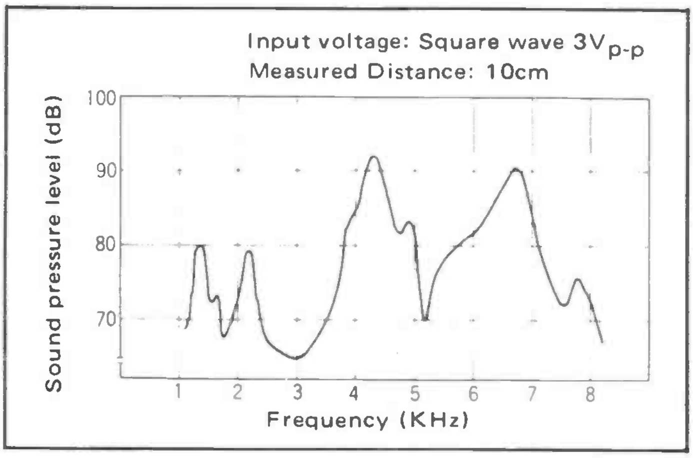
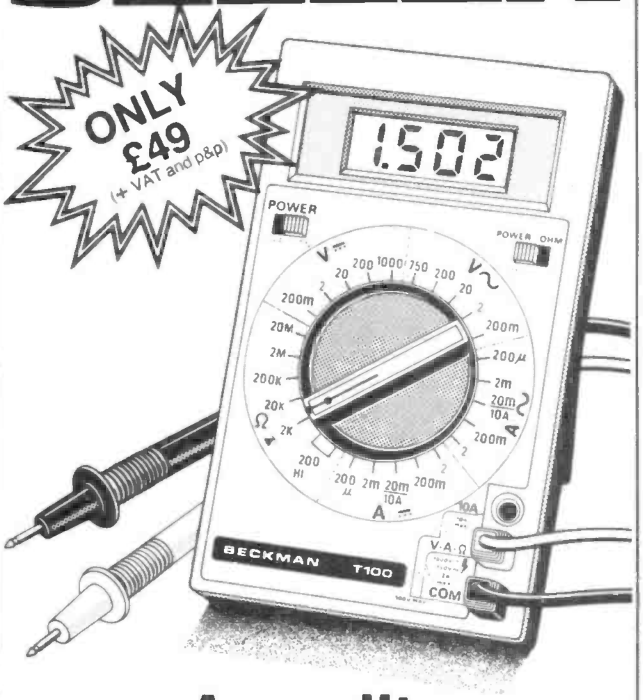


Figure 11: Response characteristics of an external- drive buzzer (Murata PKM11-4AO).


OUTPUT
10 MHZ
1 MHZ
SUPPLY
OFF
EXT
INT
INHIBIT
METER
RX
LOCK
SUPPLY
FREQUENCY STANDARD SD-12
BURNS


ONLY £49
(+ VAT and p&p)
1.502
POWER
POWER OHM
BECKMAN T100
V-A-Ω
COM
10A

R&EW PANEL SIGNS

Giving that professional look to the front panel of your latest creation can be a bit of a problem.

Dry rub down lettering can be used for control markings and scales but unless used with skill the results can be less than flattering.

The R&EW label system solves the problem by providing a set of symbols and scales that are printed on the reverse side of a thin, clear plastic sheet.

Identify the word/symbol you require, cut around it, peel the backing paper off and stick it in place on your project.

The results are perfect every time.

Three different sets of panel markings are available, black wording, white wording and a set of scales.

VOLUME **SUELCH** **RF GAIN**

The wording sets contain over 1000 words covering 300 terms – the dial set contains one large horizontal tuning scale, frequencies and 12 control panels.

Any one will cost you only £1.50, but buy two and we'll give you the third one free thats just

£3.00

for the complete set of R&EW Panel Markings.

All prices include VAT and post and packing.

Send your order to:

R&EW PANEL SIGNS
117A High Street
Brentwood
Essex CM14 4SG

OUT NOW

AUTUMN '82 WR&E

- MORE PAGES
- MORE COMPONENTS
- MORE TOOLS
- MORE TEST GEAR
- MORE DISCOUNT VOUCHERS (3x£1)
- MORE BOOKS

Now 128 pages of components, modules, sub assemblies from the leading exponent of components.

AT YOUR NEWSAGENT OR DIRECT

- MORE COILS
- MORE FILTERS
- MORE HARDWARE
- MORE SEMICONDUCTORS
- MORE INFO
- MORE INNOVATION WITH A TELEPHONE ACCESSIBLE COMPUTER ORDERING FACILITY

AMBIT INTERNATIONAL
BRENTWOOD ESSEX CM14 4SG

Telephone (0277)230909
Telex 995194 AMBITG
REWTEL
data RS232/300 baud
(0277)230959

R&EW Data Brief

MSL9362RS

The MSL9362RS is an encoder chip, primarily designed for use in radio control systems. It is contained in a 14 pin DIL package, incorporating an oscillator. When running at the same frequency as the oscillator (built into the decoder chip MSL9363RS-Data Brief 2) they produce a very effective method of coding signals.

The oscillator frequency determines the length of one frame of signals. In each frame there are 4 signals and a sychronous period. These 4 signals, defined as the period between the pulses, can be operated in two modes:

1) 4 proportional channels
2) 2 proportional channels + 2 logical channels (ON/OFF)

The proportional signals are controlled by a potentiometers and the logical commands by switches, selecting high or low resistor values.

The sychronous period has to be long enough for separate frames to be identified by the decoder.

Where many radio control channels are being used, interference between channels can be easily avoided by selecting different oscillator frequencies. With high oscillator frequencies, fast reaction times are obtainable - with a loss in sensitivity to the controls.

The oscillator frequency is fixed by the values of a resistor (Ro) and capacitor (Co), fed by the stable voltage source (Vref) and connected to OSC1 and OSC2. Vref (3.8V) is obtained from the voltage regulator in the chip. This permits wide variations in power supply (6 to 13V) and is ideal for battery operation. Vref is also used to supply the control potentiometers so that the channel inputs remain stable.

Other controlling components include a trimmer, giving a voltage to Vcomp that sets the neutral position of the control potentiometers. Similarly the trimmer in the C,R and R' circuitry, that sets the pulse repeat time, is the sensitivity control for the signals.

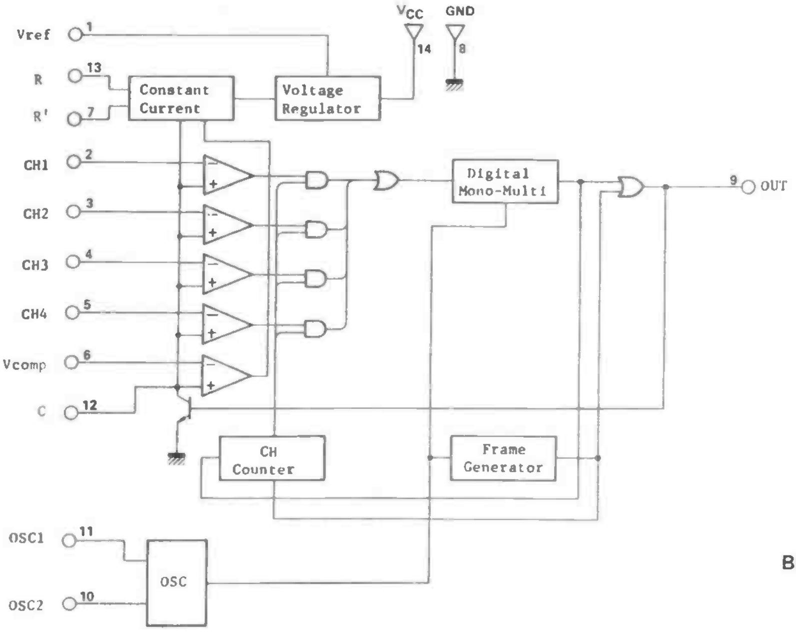
PARAMETER		CONDITIONS	MIN	TYP	MAX	UNIT
Input Voltage	V_{IN}	— *1	0	—	V_{ref}	V
Input Current	I_{IL}	V_{CC}=13V, V_{IN}=0 *1	—	-1	-3	μA
Output Voltage	V_{ref}	V_{cc}=7∿13V, I_{ref}=5mA *2	—	3.8	—	V
Output Current	I_{ref}	V_{cc}=7∿13V, V_{ref}=3.8V	5	—	—	mA
Logical "0" Output Voltage	V_{OL}	V_{cc}=7∿13V, Io=15mA *3	—	0.25	0.4	V
Logical "0" Output Current	I_{OL}	V_{cc}=7∿13V, Vo=0.4V *3	15	—	—	mA
Output Leakage Current	I_{LO}	V_{cc}=13V, Vo=5V	—	—	10	μA
Supply Current	I_{CC}	V_{cc}=9V, V_{ref}=Open	—	6.5	8.5	mA

Electrical Characteristics (Ta = —10 +60° C, TYP : Ta = 25° C).

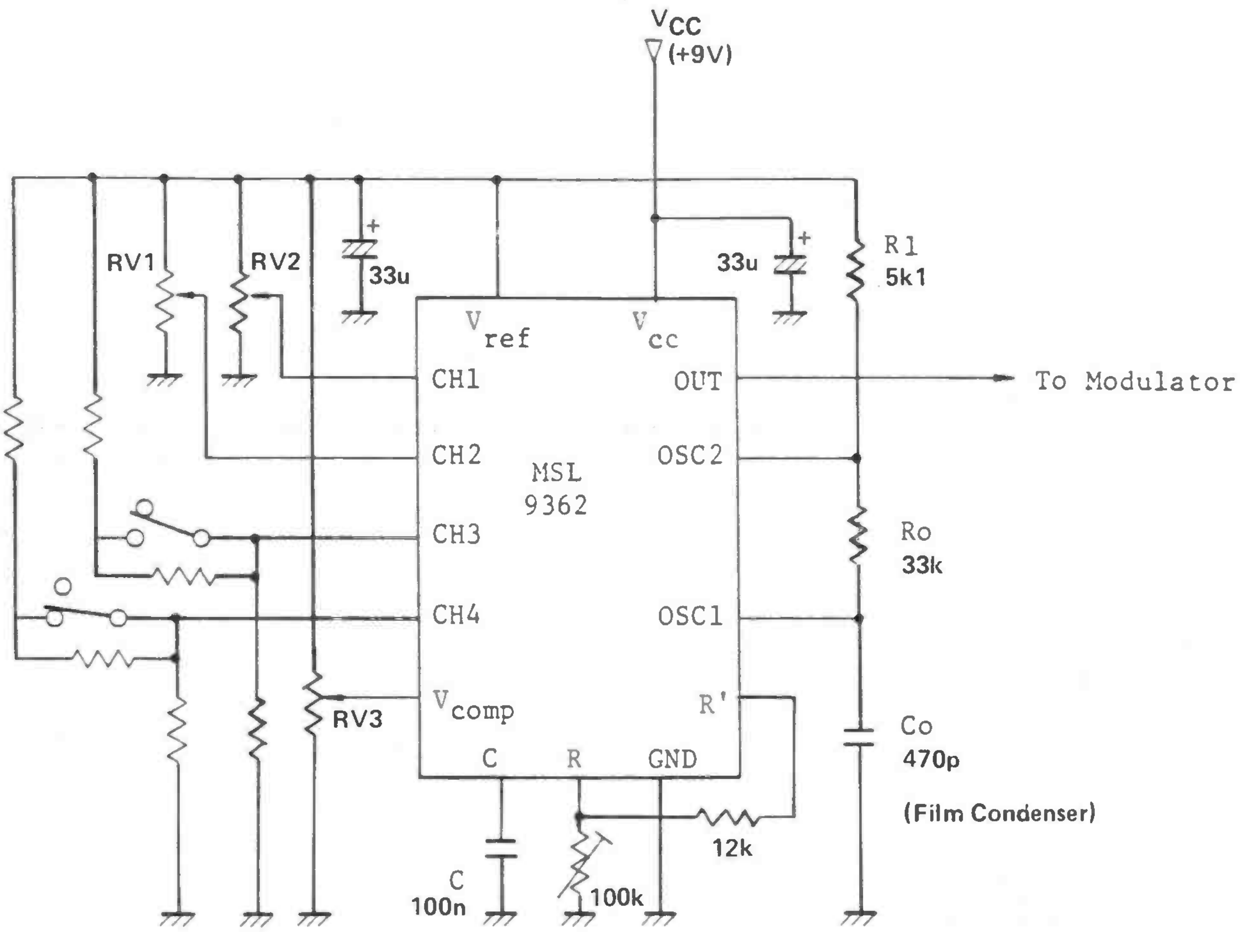
***1 : CH1 CH4**
***2 : V_{ref}**
***3 : OUT**

PARAMETER		CONDITIONS	RATINGS	UNIT
Supply Voltage	V_{cc}	Ta = 25°C	15	V
Input Voltage	Vin	Ta = 25°C *1	10	V
Output Current	I_{OUT}	Ta = 25'C *2	30	mA
	I_{ref}	Ta = 25°C *3	-30	mA
Power Dissipation	P_D	Ta = 25°C	200	mW
Storage Temperature	T_{stg}	—	-55 ∿ +150	°C

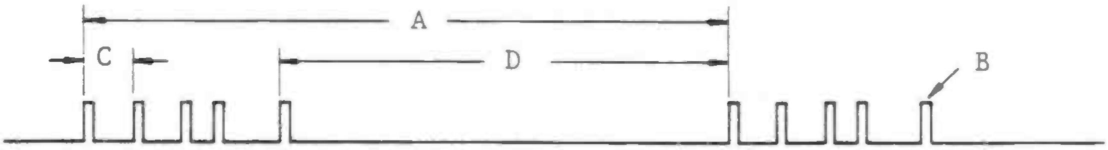
Absolute Maximum Ratings *1 : CH1 CH4 *2 : OUT *3 : V_{ref}



Block Diagram.



APPLICATION EXAMPLE
2 Channels Proportional + 2 Channels ON/OFF



OSC Freq. f(KHz)	Frame A (ms)	Pulse Width B (us)	Pulse Repeat C (ms)	Synchronous period D (ms)
80	16	200	<3	>4
60	20	250	<4	>4
53·3	24	300	<4	>4

OUTPUT WAVE FORM A:B = 80:1

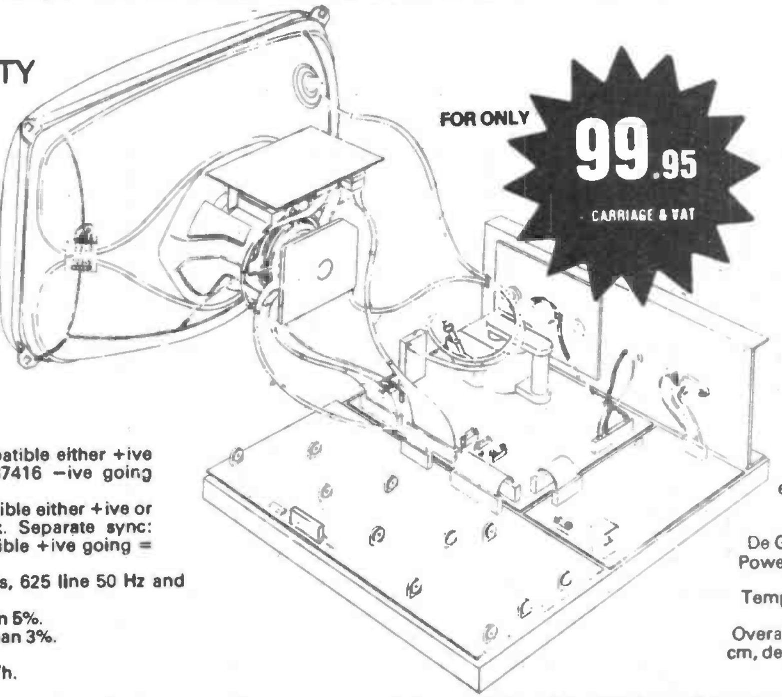
LOOK SENSATIONAL SCOOP OFFER

OPUS SUPPLIES BRING YOU AN RGB COLOUR MONITOR YOU CAN AFFORD

LOOK A COLOUR MONITOR FOR LESS THAN A TUBE

LIMITED QUANTITY AVAILABLE FOR USE WITH B.B.C., MICRO, APPLE, etc

Specification: The VMC 22 Colour Monitor is designed to meet the high reliability and performance standards associated with the games, data and computer colour graphics industries.
Input levels: Video-TTL compatible either +ive or −ive going for RGB (IC37416 −ive going 7417 +ive going).
Composite Sync: TTL compatible either +ive or −ive going set by PCB link. Separate sync: (Frame and line) TTL compatible +ive going = video response 10 MHz.
Deflection: Scanning systems, 625 line 50 Hz and 525 line 60 Hz.
Scan linearity: Errors less than 5%.
Scan geometry: Errors less than 3%.
High voltage: 25KV.
X radiation: Less than 0.5MR/h.



FOR ONLY 99.95 CARRIAGE & VAT

FREE ISOLATING TRANSFORMERS WHILST STOCKS LAST

A fabulous 22 inch colour monitor.
Featuring: Mullard 22 inch 110° C.C.R.T.
Controls: Brightness, RGB video amp bias, height, width, vertical hold, horizontal hold, linearity, east-west correction, phase, focus, H.T. adjust, beam cut-off switch, convergence controls.
De Gaussing; Automatic on switch on.
Power requirements: 155 VAC, 44-60Hz 120VA (isolated suplly).
Temperature: Storage −10°C to +70°C. Operating 0°C to 50°C.
Overall sizes: Height 40.3 cm, width 51.0 cm, depth 39.5 cm (inc. tube neck P.C.B.).
Weight 19 kgms.

After months of negotiation we have finally secured the computer user's dream. We have bought the complete manufacturer's production of these superb British made R.G.B. Colour Monitors and can offer them to you at this unrepeatable price. This offer, available to readers of 'R & EW' also includes a *FREE* isolating transformer. So with a little of your time and our buying power – you can save pounds. For shipping purposes the C.R.T. and scan coil assembly are separate from the chassis. The lugs of the C.R.T. allow it to be mounted in a standard 22" colour TV cabinet or a unit of your own design. The unit is assembled by plugging the wires from the chassis to the tube, soldering the input connector, power connector and isolating transformer. The monitor has been fully tested and adjusted prior to packing thus simplifying assembly. A comprehensive instruction sheet will be supplied with each unit.

OPUS A computer supplies company have established an enviable reputation for reliable service and value for money – so pick up your telephone and discuss your supplies requirement with us.

STOP PRESS

JUST ARRIVED FROM JAPAN:

NEC DOT MATRIX 100 c.p.s. PRINTER

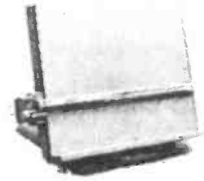
OUTSELLS OKI & EPSON IN USA

CALL FOR PRICE & DELIVERY

LOCKABLE DISC FILING BOXES:
To hold 40 Minis £16.00
80 Minis £21.00
To hold 40 8'' Discs £21.00
80 8'' Discs £28.00

DISC MAILERS:
Mini 60p
8'' 90p

DESK TOP LECTERN – ADJUSTABLE WITH MOVABLE CURSOR



ONLY £19.95

HOW TO ORDER

ATHANA FLOPPY DISCS

MINIS WITH FREE PLASTIC LIBRARY CASE & HUB RINGS

S/S S/D	£17.95 for 10
S/S D/D	£19.95 for 10
D/S D/D	£23.50 for 10
S/S 77 Track	£26.50 for 10
S/S 96 Track	£28.50 for 10
8'' DISCS	
S/S S/D	£15.50 for 10
S/S D/D	£24.50 for 10
D/S D/D	£25.50 for 10

HARD SECTORED AND ALL OTHER DISCS AVAILABLE

RAM BARGAINS

PART	1 off	25-99	100
4116-200ns	.80	.75	.68
4116-250ns	.75	.70	.55
2114-300ns	.85	.80	.75
2114-450ns	.80	.75	.70
2114-L-200ns	.95	.87	.83
4516-100ns			
BBC RAM	3.10	2.95	2.80
4164-200ns	4.80	4.60	4.20
6116-150ns	4.20	3.95	3.50
2716-5v-450ns	2.40	2.15	2.00
2716 Triple Rail	6.00	–	–
2732-450ns	3.95	3.75	3.25
2532-450ns	3.95	3.75	3.25
8080A	1.90	1.70	–
8212	1.40	1.30	–
25-WAY D SOLDER CONNECTORS			
25P		£1.30 each	
25S		£1.50 each	

OTHER OEVICES AVAILABLE PLEASE RING FOR QUOTE

OPUS DESKS

MANUFACTURED BY OPUS IN U.K.
AVAILABLE FROM OUR CENTRAL WAREHOUSE

For business or home use – each Desk is supplied with castors – two of which have lockable brakes

★ 5 MODELS AVAILABLE – CHOOSE WITHIN YOUR BUDGET ★

★ CREAM & BROWN CO-ORDINATING PANELS ★

★ DRAWER FOR DISC STORAGE ★

★ MOBILE ★

★ AMPLE SPACE FOR HARDWARE AND PERIPHERALS ★

★ THROUGH SHELF FOR DISC DRIVES, PAPER FEED, FILES ★

SEND S.A.E. FOR YOUR FREE COLOUR BROCHURE

See us at the Northern Computer Show, Belle Vue, Manchester Stand 426, 25th-27th November.

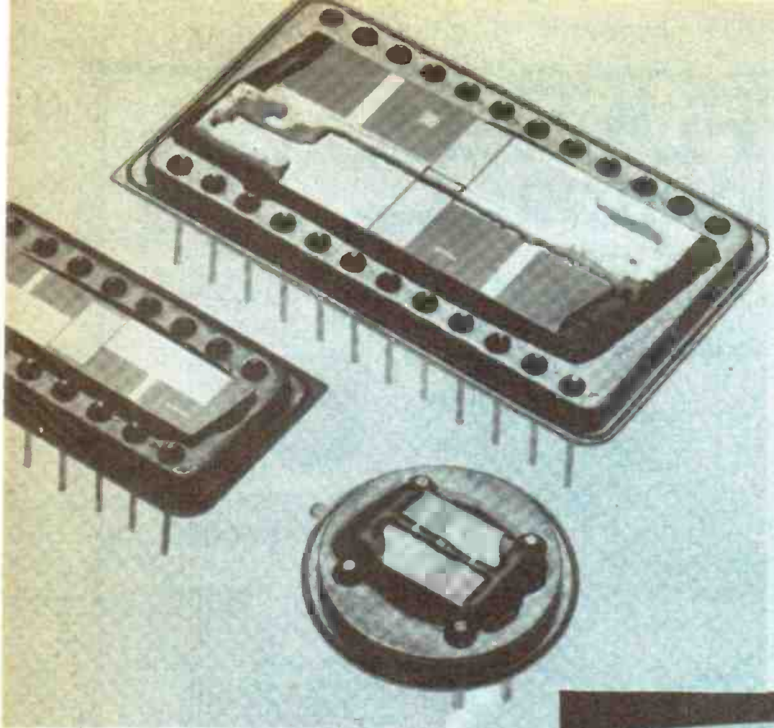
RGB Leads available for BBC Micro - Ring for price.

Carriage should be added to prices at the following rates: Monitor £10; Discs 85p; Rams 50p; Filing Boxes/Lecturns £2; Desks £10. Please add carriage as applicable and then VAT at 15% to total and send Cheque/P.Order payable to "Opus Supplies" to Dept. W.W., Opus Supplies, 10 Beckenham Grove, Shortlands, Kent BR2 0JU. Telephone order Hotline: 01-464 5040 (24-hour service) or 01-464 1598. Access and Barclaycard accepted. If you are not completely satisfied return the goods within 14 days and your money will be refunded.

BARCLAYCARD VISA

TRADE ACCOUNTS OPERATED – GOVT. AND EDUCATIONAL ORDERS WELCOMED

159 for further details



IF YOU LIKED JAWS YOU'LL LOVE SAWS

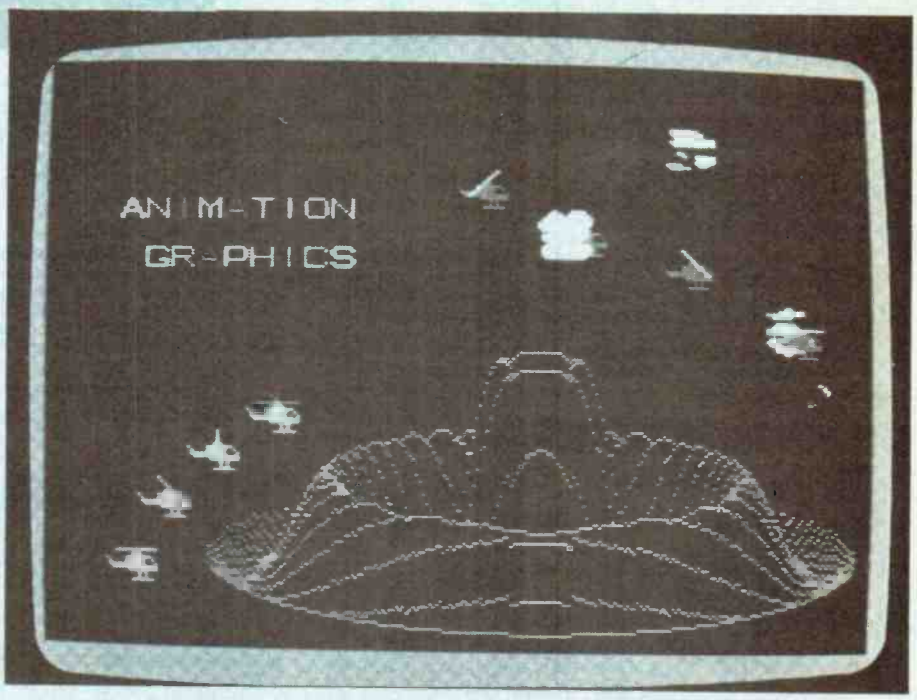
Ian Campbell's articles on PLL Frequency Synthesis and Power Mosfets proved very popular with our readers. Next month he turns his attention to SAW Devices. These Surface Acoustic Wave filters feature small size, high stability when compared to LC tuned circuits, optimum phase design and high reliability.

The theory behind SAW Devices, plus plenty of examples showing their practical applications will feature in next months **R&EW.**

MINIMUM CHIP Z8 SYSTEM

Our full featured Z8 system published last February has proved very popular. A number of readers have asked for a 'stripped down' design omitting features such as the EPROM programmer and utility routines.

Next month Jonathan Burchell presents just such a design featuring the Z8 - an EPROM and not a lot else.



NASCOM ANIMATION GRAPHICS BOARD

The Animation Graphics Board provides colour graphics, stereo sound, CMOS battery backed up ram, real time clock, 8 channel A-D and a vectored interrupt counter timer chip all on a single board approx. 8" x 12" with Nas-bus edge connector. Although intended for the Nascom range of computers, there is no reason why the board could not be used with any Z80 system, or indeed with a little external logic the board could be mapped as memory for the 6800 family of microprocessors. The whole board is mapped as I/O ports and although containing 16K bites of dynamic screen memory does not encroach on the system memory map. The board is fully buffered and provides a de-coded I/O port signal for feeding back to the Nascom CPU board.

Take me to your NEWSAGENT

Newsagents often run out of copies of R&EW simply because it is the best value for money electronics magazine around.

To make sure you don't miss a single issue, why not fill out the coupon and your newsagent will reserve a copy of every month's magazine ready for you to pick up at your leisure.

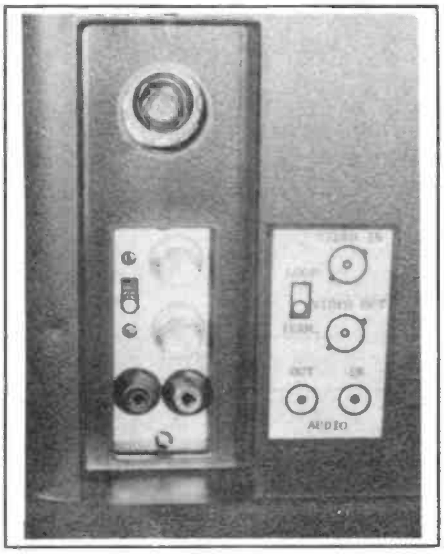
Fill out the coupon NOW and drop it in when you pick up your morning paper.

NEWSAGENT:
Please reserve me a copy of the
JANUARY 1983
RADIO & ELECTRONICS WORLD
and every succeeding issue until
further notice.
Name: ....
Address: ....
....
....

DIRECT VIDEO INTERFACE

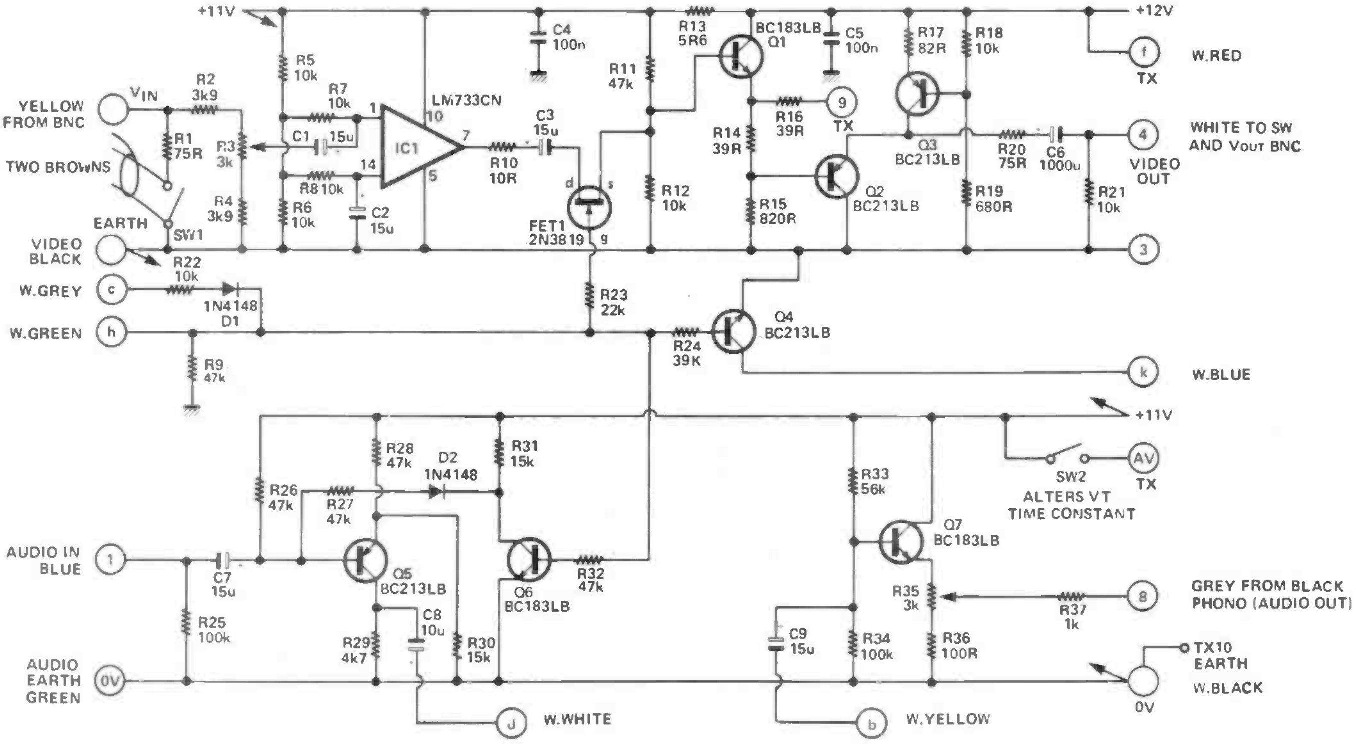
In this month's conversion, Paul Pitts outlines the modifications for composite video from the Thorn TX10 receiver.

LARGE SCREEN MONITOR



THE FIRST THING to recognise, when designing any TV interface, is there are two signal paths to consider; audio and video. With the TX10 convertor, this is apparent from the circuit diagram (*Fig. 1*). The upper portion processes the video signals and the lower is for audio. Switching between monitor and RX is via Q4 and FET1 (video), and Q6 (audio). On the tuner, this is achieved by pressing one of the extreme right hand buttons marked AV. In RX mode, the video output carries off-air pictures (1V peak-to- peak into 75R) and the audio carries off-air sound (standard level into 1k) that adjusts to zero - this permits connection to some VHS machines which require inputs of 20-30dB down from the usual level. Depressing the AV switch, mutes the RX IF stage (via the AGC line) and causes FET1 to close the video path from IC1 to the video output stage. Transistor Q1 cuts out any signal path from the vision detector (remember the IF is muted), which prevents Q2 seeing two inputs at once - it's either 'video in' or 'detector out'. Depending on the position of SW1, the 1Vp-p video signal sees an input impedance of either 10k or 75R. This is amplified by IC1, which has a gain of 3, and then output to the drain of FET1 (described earlier). Control of the video level is provided by R3 (± 3dB). Switch SW2 is included in the circuit to allow for different sync pulse timing - this is kept in the AV position.

SW1 is next to the BNC sockets on the prototype. It is wired in such a way as to loop through the BNC's (when not terminated) as well as terminating the input with R1 when required. This is so that when sets are



NOTE: A100n CAPACITOR (C10) IS PLACED BETWEEN PADS B AND D OF THE AUDIO AMPLIFIER IC.

Figure 1: Circuit diagram for the complete interface.

▶

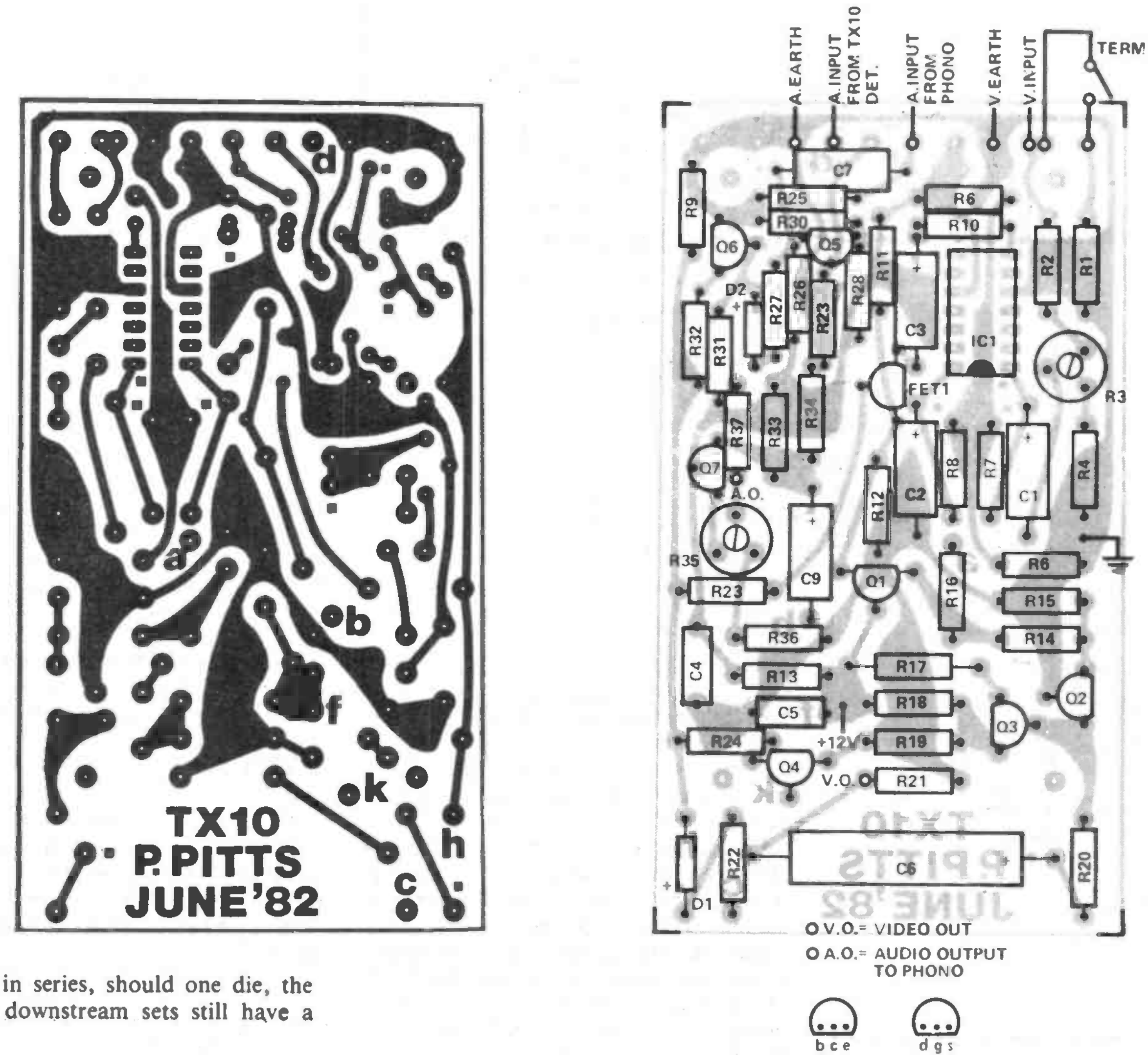


Figure 2: (a) The foil pattern, and (b) component overlay for the TX10 modifications board.

connected in series, should one die, the remaining downstream sets still have a picture.

CONSTRUCTION

You will have noticed the sockets on the panel are isolated. Also the PC board earth is wired back to the TX10 chassis at the point shown, ie pin 10 of plug 4. The reason this seemingly roundabout route is used is to prevent a shallow striation appearing on mid-grey scenes on some kits. I traced these two pulse currents from the sets' PSU, causing small voltages to be set up in the metallic chassis. Hence the actual point chosen for the earth contact is *important*. I hasten to add that DC- wise there is negligible resistance between exposed metalwork or BNC/phone plugs and the 13 amp plug earth. So, make sure you change the existing 2-core mains lead for a 3-core. The green/yellow conductor must be taken to the set's metallic chassis at the point shown and in the manner outlined - a 'self tapper' does not satisfy some ruling bodies.

I chose to remove the on/off switch and button assembly and solder the blue and brown conductors to the points used by Thorn (at the switch); remembering to thread the wires through the plastic shield they use. The cord grip can be re-used even though the cable is thicker. You may, on seeing the cable, feel it's a bit light, but remember these sets only consume about 90 watts!

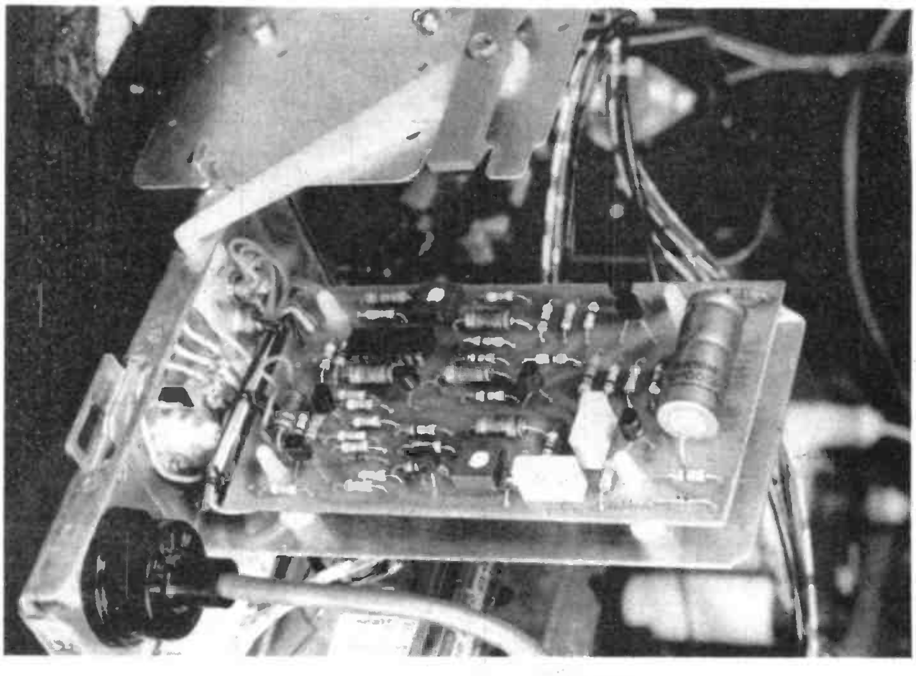


Photo 2: Internal view of the prototype board fitted into the TX10 chassis. This clearly shows the PCB pillars and neat layout — essential to prevent fouling any of the wiring inside the TV.

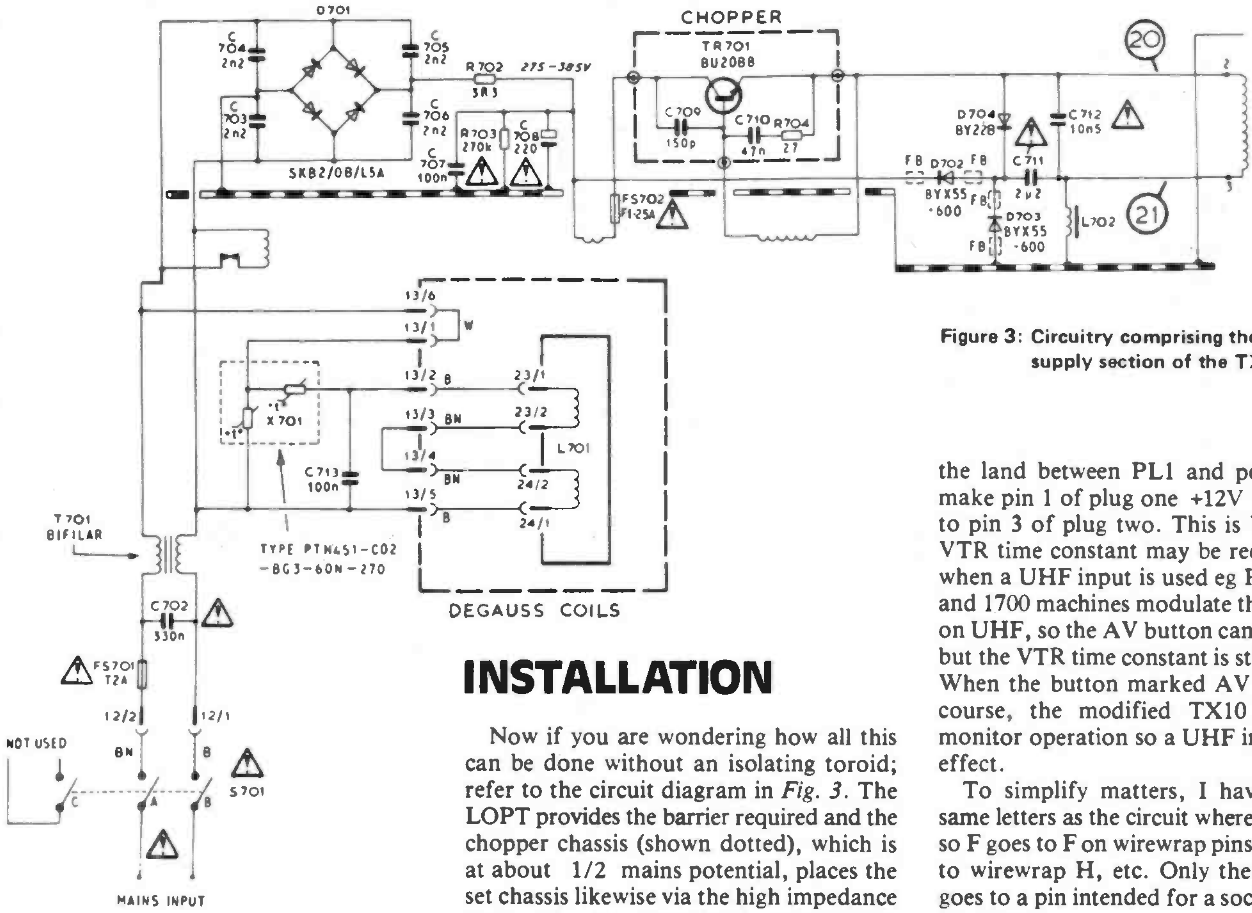


Figure 3: Circuitry comprising the power supply section of the TX10.

INSTALLATION

Now if you are wondering how all this can be done without an isolating toroid; refer to the circuit diagram in *Fig. 3*. The LOPT provides the barrier required and the chopper chassis (shown dotted), which is at about 1/2 mains potential, places the set chassis likewise via the high impedance path of the combined component R701/C701. Hence the exposed metalwork of the set may be earthed without detriment or risk. Don't forget C10, a 100 nf, which just fits on the copper side of the TX10 audio chip between pins B and D. This is for audio continuity during certain modes.

Cut the copper (for about 1/16") at the point shown on the signal board to sever the land between PL1 and point H and make pin 1 of plug one +12V by taking it to pin 3 of plug two. This is because the VTR time constant may be required even when a UHF input is used eg Philips 1500 and 1700 machines modulate their pictures on UHF, so the AV button cannot be used but the VTR time constant is still required. When the button marked AV *is* used, of course, the modified TX10 reverts to monitor operation so a UHF input has no effect.

To simplify matters, I have used the same letters as the circuit where applicable, so F goes to F on wirewrap pins and H goes to wirewrap H, etc. Only the black wire goes to a pin intended for a socket, i.e. pin 10 of PL4.

■ R & EW

Your Reactions......	Circle No.
Excellent - will make one	13
Interesting - might make one	14
Seen Better	15
Comments	16

PARTS LIST

Resistors	
R1,20	75R
R2,4	3k9
R3,35	3k cermet pot
R5,6,7,8,12,18,21,22	10k
R9,11,26,27,28,29,32	47k
R10	10R
R13	5R6
R14	39R
R15	820R
R16	39R
R17	82R
R19	680R
R23	22k
R24	39k
R25,34	100k
R30,31	15k
R33	56k
R36	100R
R37	1k
Capacitors	
C1,2,3,7,9	15u 16V elec.
C4,5,6,10	100n poly.
C8	10u 16V elec.
Semiconductors	
Q1,6,7,	BC183LB
Q2,3,4,5	BC213LB
FET 1	2N3819
IC1	LM733CN
D1,2	1N4148

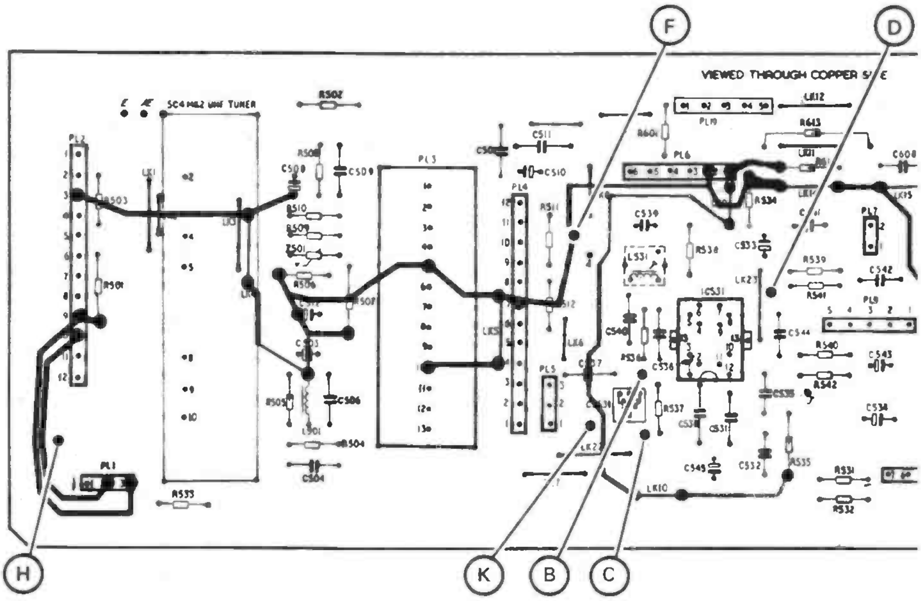
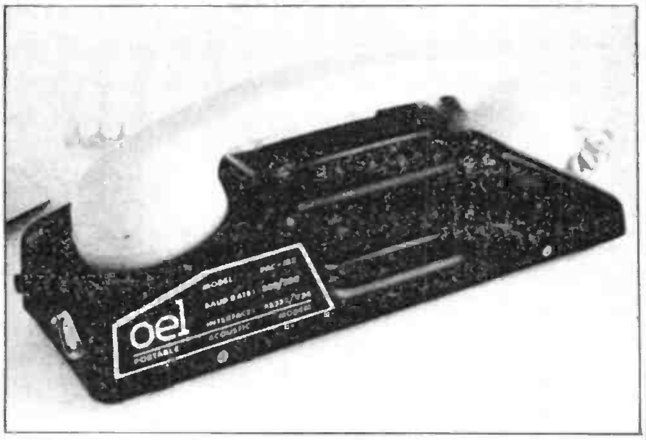


Figure 4: Connection details for wiring the monitor board to the television's signal board.



PORTABLE ACOUSTIC COUPLERS

Typical Applications

- Networking computers
- Linking to electronic mail system (Euronet)
- Converting microcomputer to Viewdata (Prestel) receiver

Key Features

⊛ Snap-fit acoustic link between standard telephone handset and terminal equipment ● Low cost ● Slimline design ● Lightweight and compact ● Specially designed acoustic chambers need no rubber seals

PAC-M1: This acoustic modem provides a link between telephone line and Serial Data socket of a microcomputer, thus allowing conversion into a Prestel receiver and facilities for transfer of telesoftware programmes. £135 + VAT, P&P.

PAC-M2: Specifically for fully interactive data communication at 300/300 Baud rate, this acoustic modem is designed for networking computers and for electronic mail system. It operates in an originate mode to the CCITT V21 standard and connects Serial Data via an RS232 socket. £135 + VAT, P&P.

PAC-1: Provides an acoustic link between standard telephone handset and all types of Prestel and private Viewdata terminals, TV sets and adaptors. Powered by a single PP3 battery, this acoustic coupler allows Viewdata equipment to be used in office or home without a fixed BT socket. £85 + VAT, P&P.

Technical Approval

All products meet the British Telecom Technical Guide for acoustic coupling.

Software Available for:

PET Series, Apple, BBC Micro and many others.

O.E.Limited, Industrial Estate,
Appleby-in-Westmorland,
Cumbria CA16 6HX.
Tel. (0930) 51909. Telex 64157.

PLEASE SEND MORE DETAILS OF THE PORTABLE ACOUSTIC COUPLERS. PAC-1 ☐ PAC-M1 ☐ PAC-M2 ☐ (tick as required)

NAME ....

COMPANY ....

ADDRESS ....

....

TEL. .... (Ref. REW 12/82)

WOOD & DOUGLAS

NEW PRODUCT TPUP2 Converter £19.60 in kit form AVAILABLE NOW

Looking for a winter project? Read on .....

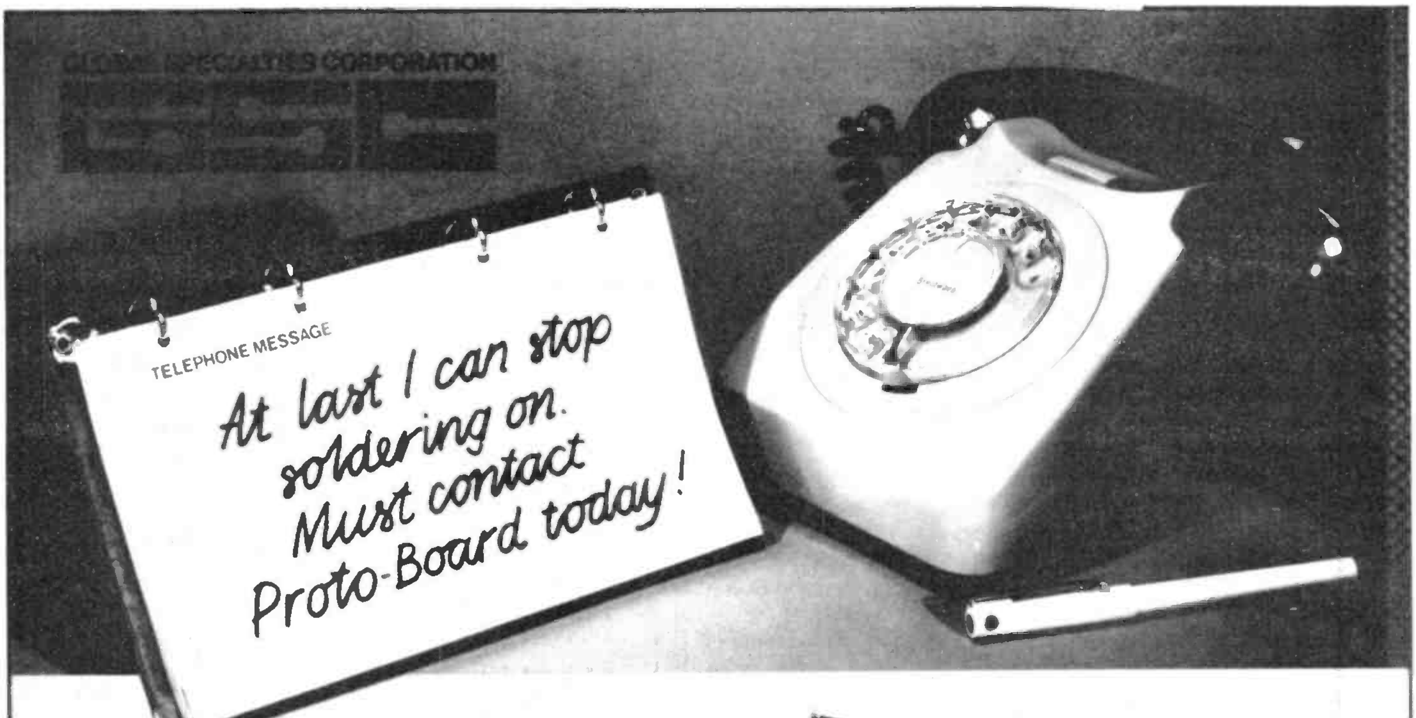
PROJECT	CODE	ASSEMB'D	KIT
6M Equipment			
Converter (2M or 10M i.f.)	6RX2	27.60	19.95
FM Transmitter	6FM2T	P.O.A.	
FM Receiver	6FM2R		
Video Equipment			
Converter (ch 36 o/p)	TVUP2	26.95	19.60
3W Transmitter (boxed)	ATV-1	87.00	-
3W Transceiver (boxed)	ATV-2	119.00	-
4M EQUIPMENT			
FM Transmitter (1·5W)	4FM2T	34.75	21.20
FM Receiver	4FM2R	61.05	42.15
Mosfet Pre-Amp	4PA4	10.95	7.95
Mosfet Pre-Amp (RF Switched)	4PA4/5	18.95	14.40
70cms EQUIPMENT			
Transceiver Kits and Accessories		£	£
FM Transmitter (0·5W)	70FM05T4	38.10	23.10
FM Receiver	70FM05R5	68.25	48.25
6 channel Transmit Adapter	70MC06T	19.85	11.95
6 channel Receive Adapter	70MC06R	27.15	19.95
Synthesiser (2 pcbs)	70SY25B	84.95	60.25
Synthesiser Transmit Amplifier	A-X3U-06F	27.60	17.40
Synthesiser Modulator	MOD 1	8.10	4.75
Bandpass Filter	BPF 433	6.10	3.25
PIN RF Switch	PSI 433	9.10	7.75
Converter (2M or 10M i.f.)	70RX2/2	27.10	20.10
FM Package 1 (Crystal Controlled)	70PAC1	135.00	100.00
FM Package 2 (Synthesised)	70PAC2	163.00	128.00
TV Modulator (for 70FM05T4)	TVM1	8.10	5.30
Power Amplifiers (FM/CW use)			
50mW to 500mW	70FM1	12.05	6.85
500mW to 3W	70FM3	19.65	13.25
500mW to 10W	70FM10	30.70	22.10
3W to 10W	70FM3/10	19.75	14.20
Combined Power Amp/Pre-Amp (10W)	70PA/FM10	48.70	34.65
Pre-Amplifiers			
Bipolar Miniature (13dB gain)	70PA2	7.90	5.95
MOSFET Miniature (14dB gain)	70PA3	8.25	6.80
RF Switched (25W max)	70PA2/S	21.10	14.75
2M EQUIPMENT			
Transceiver Kits and Accessories			
FM Transmitter (1·5W)	144FM2T	36.40	22.25
FM Receiver	144FM2R	64.35	45.76
Synthesiser (2pcbs)	144SY25B	78.25	59.95
Synthesiser Transmit Amplifier	SY2T	26.85	19.40
Bandpass Filter	BPF 144	6.10	3.25
PIN RF Switch	PS1 144	9.10	7.75
Synthesised FM Package (1·5W)	144PAC	138.00	105.00
Power Amplifiers			
1·5W to 10W (FM) (No Changeover)	144FM10A	18.95	13.95
1·5W to 10W (FM) (Auto-Changeover)	144FM10B	33.35	25.95
1·5W to 10W (SSB/FM) (O/P Changeover)	144LIN10A	26.80	19.87
1·5W to 10W (SSB/FM) (Auto Changeover)	144LIN10B	36.60	26.95
Pre-Amplifiers			
Low Noise, Miniature	144PA3	8.10	6.95
Low Noise, Improved Performance	144PA4	10.95	7.95
Low Noise, RF Switched	144PA4/S	18.95	14.40
SYNTHESISER ACCESSORIES			
Display Decoder/Driver	DISP1/2	22.60	16.10
GENERAL ACCESSORIES			
Toneburst	TB2	8.20	3.85
Piptone	PT2	6.90	3.95
Kaytone	PTK1	8.20	5.95
Regulator	REG1	8.80	4.25
Solid State Supply Switch	SSR1	5.80	3.60
Microphone Pre-Amplifier	MPA1	5.40	2.95
Reflectometer	SWR1	6.35	5.35
CW Filter	CWF1	6.40	4.75
MICROWAVE PROJECTS			
Microwave Drive Source	MD05T	29.50	20.40
Bandpass Filter	BPF 384	5.10	3.25

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.

Kits are available from the following agents:-

Amateur Radio Exchange, 373 Uxbridge Road, ACTON. 01-992-5765
J. Birkett, 25 The Strait, LINCOLN. 0522 20767.
Darwen Electronics, 13 Thorncliffe Drive, DARWEN, Lancs. 0254 771 497.
Wood & Douglas (Scandia) HB, Box 16024, 200 25 MALMO, SWEDEN. 040 94 89 55.

9 HILLCREST, TADLEY
BASINGSTOKE, HANTS RG26 6JB



At last the message has come through, all you old solderers can throw away the soldering irons and the perforated circuit boards. NOW you can use PROTO-BOARDS from GSC. Despite daily breakthroughs in components and packaging, designing and testing new circuit concepts is often a lot more manual work than creative work. Not surprising, if you are using old-fashioned perforated boards and time-consuming soldering. With PROTO-BOARDS any component can be plugged in, tested, removed, and used again. Circuits can often be designed from component pinouts and the circuit diagram does not need to be drawn until after the circuit is working properly. PROTO-BOARD designing is very much like careful single-sided printed circuit design in terms of the effects of parasitics and in terms of operation at high frequency or low levels. Well-planned grounds and judicious use of shielded cable can permit operation through VHF frequencies. So, you old solderers, stop soldering on! Send off for our FREE 40 page catalogue; we have a PROTO-BOARD to fit any size budget.

PROTO BOARDS
Models PB 203, PB 203A and PB 203AK offer a large breadboarding area and a built in regulated power supply housed in a rugged metal cabinet. Models PB6 to PB105 offer various breadboarding areas screw mounted onto sturdy back plates with non-slip, non-scratch vinyl feet. Red and black binding posts are included, the red being electrically insulated from the back plate, the black being electrically connected for ground.

PB 203
Includes 5VDC, 1 amp power supply, available at binding posts; two binding posts (V1, V2) remain uncommitted. The perfect board for TTL and other 5 volt logic designs.

PB 230A
Every development engineer should have one of these, includes 5VDC, 1 amp power supply. Also includes separate + 5.5 to 18 VDC and - 5.5 to 18 VDC power supplies, each capable of supplying 500 mA at 15 VDC. Power supplies are factory preset to +/- 15 VDC but can be independently adjusted.

PB 203AK
Identical to PB 203A but in kit form.

PB 6
A kit form breadboard with 4 binding posts, 630 contact points and includes non-slip rubber feet.

PB 100
Another kit form breadboard with 760 contact points.

PB 101
A robust laboratory breadboard accepts up to 10 IC's, 940 contact points.

PB 102
A fully assembled breadboard with 1240 contact points.

PB 103
With 2250 contact points this board is perfect for prototyping and custom circuit applications.

PB 104
A total IC capacity of 32 with 3060 contact points makes this the ultimate electronics development engineers breadboard.

PB 105
The newest Protoboard, 4560 contact points, 48 IC capacity.

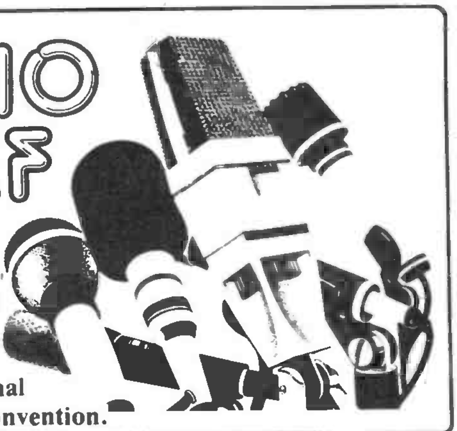
G.S.C. (UK) LIMITED
UNIT 1, SHIRE HILL INDUSTRIAL ESTATE
SAFFRON WALDEN, ESSEX CB11 3AQ
Telephone: Saffron Walden (0799) 21682
Telex: 817477

GLOBAL SPECIALTIES CORPORATION
GSC

163 for further details

AUDIO BRIEF

David Strange reports on the more interesting of the two recent gatherings at Brighton - the International Broadcasting Convention.



The International Broadcasting Convention, IBC, is an annual event that takes place alternately in Brighton and Montreux. This year it was the turn of Brighton to play host, and the convention was held at the Metropole Centre.

The first thing that came across was the emphasis on satellite broadcasting. Along the sea-front amassed an impressive array of various communication-dishes, all pointing to the sky. The BBC, IBA and outside-broadcast manufacturers, were very keen to show everyone their latest OB vans - so these were also lined up nose-to-tail along the sea-front.

Inside the exhibition, every conceivable electronic trick relating to video was on offer. And if you didn't want to make a picture change shape or colour and spiral off the screen, then you were at liberty to play with the latest TV camera - that is, if you could find the *latest* from amongst thousands on offer!

NEW LONDON COMMUNICATIONS CENTRE

On the serious side (although, to look at the model it is difficult to take it seriously), news emerged of a communications centre being built at Hammersmith, London.

Apparently, London is the busiest news centre in the world, with more than 60 international bureaus using local facilities to relay reports from America, The Far East and The Middle East. The giant American networks collect stories from half the world, to be edited in London before being satellited back to the US. Apart from the Americans, who spend £5 million annually maintaining their UK operations, other TV news teams must, at the moment, compete with one another for essential technical services. This usually works on a first come, first served basis. So during times of crisis, such as during the recent Falklands campaign, the situation becomes totally chaotic and the demand for facilities far exceeds supply.

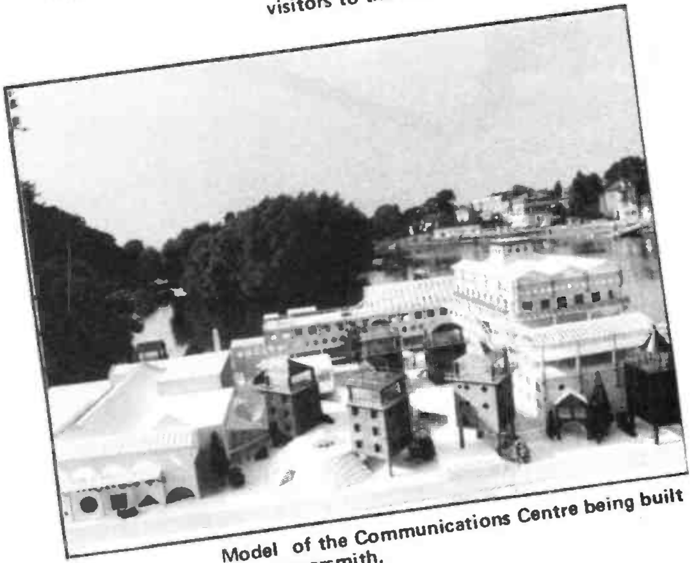
The London Communications Centre is being built at an estimated cost of £40 million. The massive complex, with its studios, post production areas and computer-linked offices, has been designed primarily for the international news agencies. It should be operational during 1984, working 24 hours a day, 365 days a year. The Centre will have its own ground station, using the Atlantic satellites and, when launched, the medium distance satellites which will cover the UK and Europe.

TV companies will be able to rent a number of units within the complex. Each of these units will have access to an impressive range of links, standards conversion, telecine, studios, editing suites and theatres - the Centre being manned by 250 personnel.

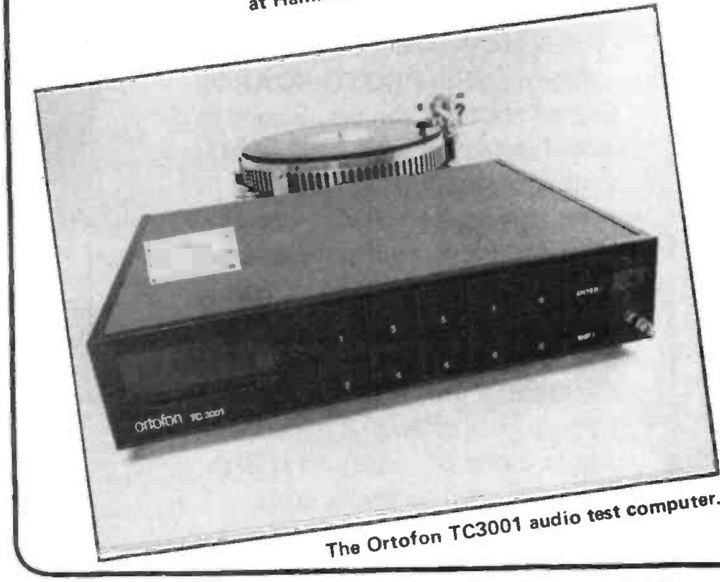
AUDIO TEST COMPUTER

Unsure of whether your Hi-Fi is performing as well as when you first installed it? Ortofon have the answer with their TC3001 Test Computer - that is, provided you can afford the £3K price tag! The TC 3001 probably *is* a bit on the expensive side for home use, so Ortofon - who manufacture ½ million cartridges a year - are aiming at the professional user of disc equipment. For instance, a radio station will be able to check the performance of a disc system, on the day of installation, and later determine any fall off in performance as wear takes place.

The sign along Brighton seafront welcoming visitors to the conference.



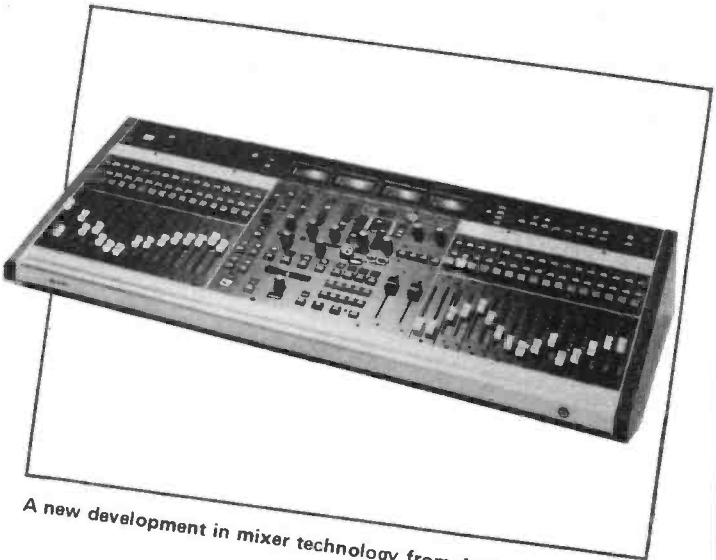
Model of the Communications Centre being built at Hammersmith.



The Ortofon TC3001 audio test computer.

The computer is able to test any record deck and cartridge combination, and connects to either the cartridge output directly, or the preamplifier output. The user is prompted, by instructions from an alpha-numeric display, through the various tests; which start with putting the pick-up onto a weighing balance connected to the computer. This having been done, various tracks of a test record are selected and played according to the displayed instructions.

Once all the appropriate tracks have been played, the computer,



A new development in mixer technology from Audix.

Inside the BBC's mobile radio station.

Outside broadcast units with their transmitting dishes.

having stored the results, can print test parameters onto a sheet for future reference. A complete check-out of a disc reproduction system takes about 2 minutes to complete. The tests are made in accordance with IEC recommendations, but since only software changes are required, Ortofon can make the instrument measure to any reasonable specification a customer may require (Incidently, when I was given a demonstration of the TC3001 it did not tell me to clean the test record - you can't leave everything to the machine!)

The tests carried out by the TC3001 are: output (ref 1kHz), tracking ability, phase and frequency response for L and R (20Hz to 20kHz), resonance, speed and signal-to-noise ratio.

AUDIX ASSIGNABLE TECHNOLOGY DESK

Audix Ltd. the well known audio mixer manufacturers, have been taking a side-ways look at mixing desks. At the IBC, they were demonstrating something called an Assignable Technology Desk.

Mixers of recent manufacture have been what is known a 'in line' types - that is, each input channel has been a module containing the main fader, routing switches, prefade listening, equalisation and gain function controls as well as the electronics. All this has meant that desks have become broader and broader for engineers to reach across. Consequently, smaller and smaller controls have to be used to get all the functions in - triple concentrics and *worse* are becoming commonplace.

The fresh approach taken by Audix results in a smaller and less cluttered desk. All the controls, for each channel, apart from the fader, prefade listen and postfade listen, have been replaced by one push-button. However, when the button is pressed (electronically speaking) all the controls are reset, since the channel becomes assigned to a set that is centrally situated. Then, this set are used just like they belonged to that channel *alone*; but once panned, equalised, routed, etc, the channel is de-assigned to make way for the next. Finally, the settings for each channel are stored away in a memory... and talking about memory, an additional 10 different channel settings and group settings can be memorised for recall at any time.

The new mixing desk is a significant step forward by Audix and should be readily accepted by engineers because, unlike some systems, none of the creative control is taken away. The central area is a fair size and control functions are given more graphical representation, with bargraph and alphanumeric displays, than is usual on standard mixers. Operationally too there has got to be an advantage in always going to the same place to carry out certain tasks.

One last, interesting note about the mixer before we leave it, is that the audio signals never come anywhere near the desk itself, they are all processed by digital elements (in a rack), driven from the desk.

MOBILE STUDIO FOR BBC RADIO

As I said at the beginning, outside broadcast vehicles were lined up along the sea-front for inspection, but for the sound engineer the BBC's Mobile Studio 3 'MS3' has got to be the most interesting.

The MS3 houses a talks area, control room and radio links' stowage area, and first went into service in April of this year for commentary on the London Marathon - this was done from the roof of the vehicle!

Designed primarily for coverage of sports and current affairs events, the MS3 had been in use in Brighton during the week precedeing the IBC, to cover the TUC conference. Within the van, the 30 channel Glen Sound mixing desk can handle up to 24 outside sources, each with individual talkback and cleanfeed facilities - it is also fully stereo capable. There is room in the control room for 2 record decks and 4 stereo tape recorders, with monitoring done by BBC designed LS3/7 loudspeakers. (The television monitors in the photograph are there to aid certain commentaries, not for the benefit of bored sound engineers!).

Outside, a 10 metre pneumatic support can be erected to carry a range of aerials to receive off-air signals for monitoring and cue purposes, or for the transmission of locally generated material for insertion into the network.

Finally, for the transport buffs amongst you, the vehicle is 11 metres long and 2.5 metres wide. It has dual steerable front axles and is based on a Ford R1114 coach chassis.

■ R & EW

Your Reactions	Circle No.		Circle No.
Immediately Interesting	69	Not Interested in this Topic	71
Possible Application	70	Bad Feature/Space Waster	72

KYOKUTO FM-2030

William Poel canters round the circuit of the KDK FM2030, to see what's on offer from this lesser known source of Amateur technology from The Far East...

THE KDK FM2030 got off to a less than auspicious start when it failed the soak test. After a few hours on the bench, it locked onto transmit - and stayed there. SMC advised us this was due to a trapped wire (we sent it back without daring to fiddle).

Ah well, the **R&EW** curse strikes again.

Despite this minor hiccup, the rig is presented quite tidily, being somewhat reminiscent of Trio styling. Quite why LED readouts are so popular with transceiver manufacturers is still a mystery. The fluorescent display system, of the newer Yaesu rigs, displays the benefits of that technology very plainly - so maybe they have created a long awaited trend towards readouts that can still be read in bright daylight.

EYES FRONT

The handbook is a rather meagre offering when put alongside the lavishly conceived preparations of messrs Trio and Icom. It nevertheless puts across a succinct and adequate explanation of the rig functions.

The description of the electronic alarm, that hoots if you attempt to over-range the unit, is described as "Eyes on the Road" for maximum driving safety. It seems nearly impossible to pick up any piece of Japanese technology without the wretched thing bleeping imperiously at you sooner or later.

The scanning and general functions represent (as they say) a third generation approach, which seems to make provision for everything imaginable, yet present an elegant package that isn't smothered in knobs and gratuitous lights. The use of the LED signal meter comes fairly close to the gratuitous, but then everyone uses one. As one amateur observed, it tells deaf users that they could hear a signal if they weren't deaf.

SMC's sales blurb on the transceiver neatly summarizes its functional quality, so we'll just take the lid off and peek inside.....

ANOTHER VHF TRANSCEIVER CIRCUIT?

At the not unsubstantial risk of describing and printing yet another 2m transceiver review, we

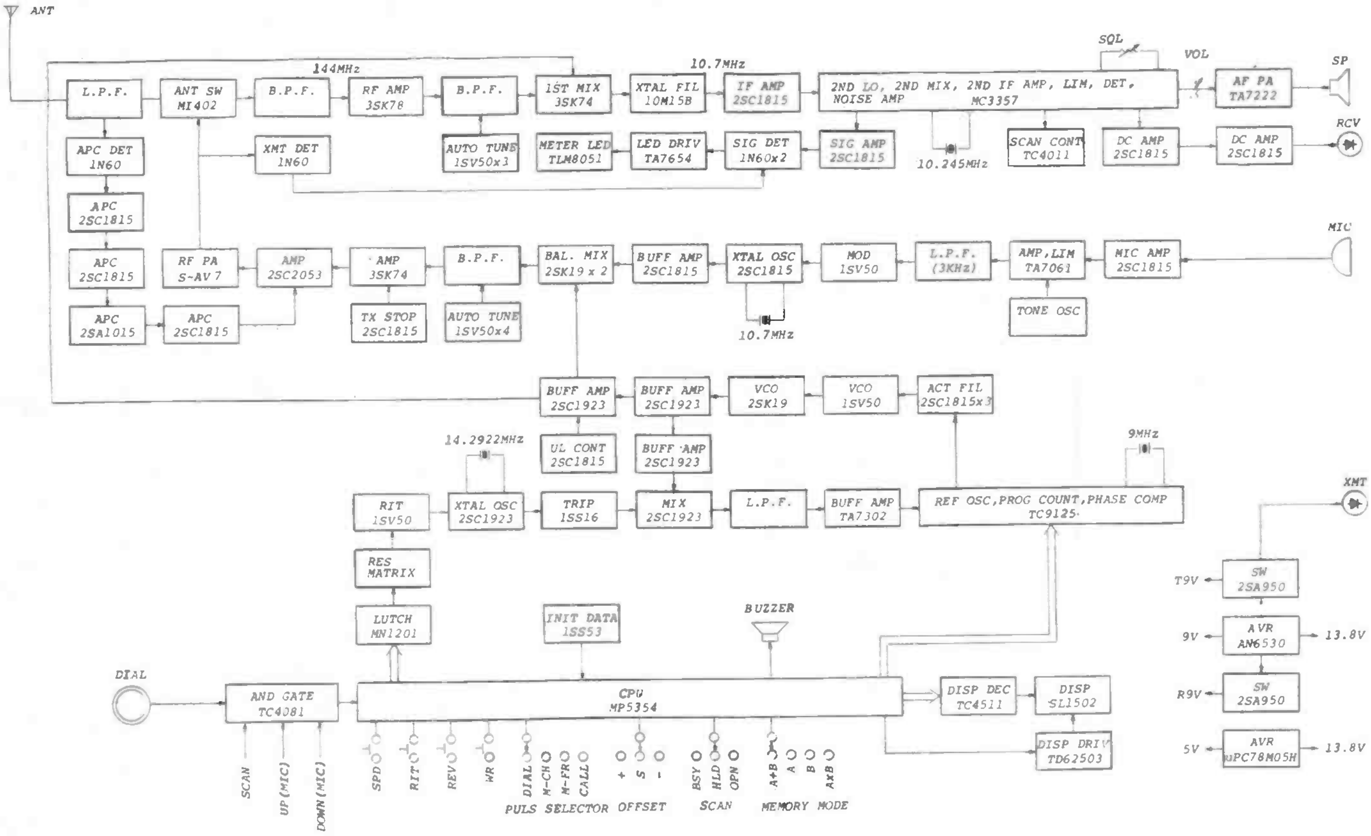


Figure 1: Block Diagram of the complete transceiver.

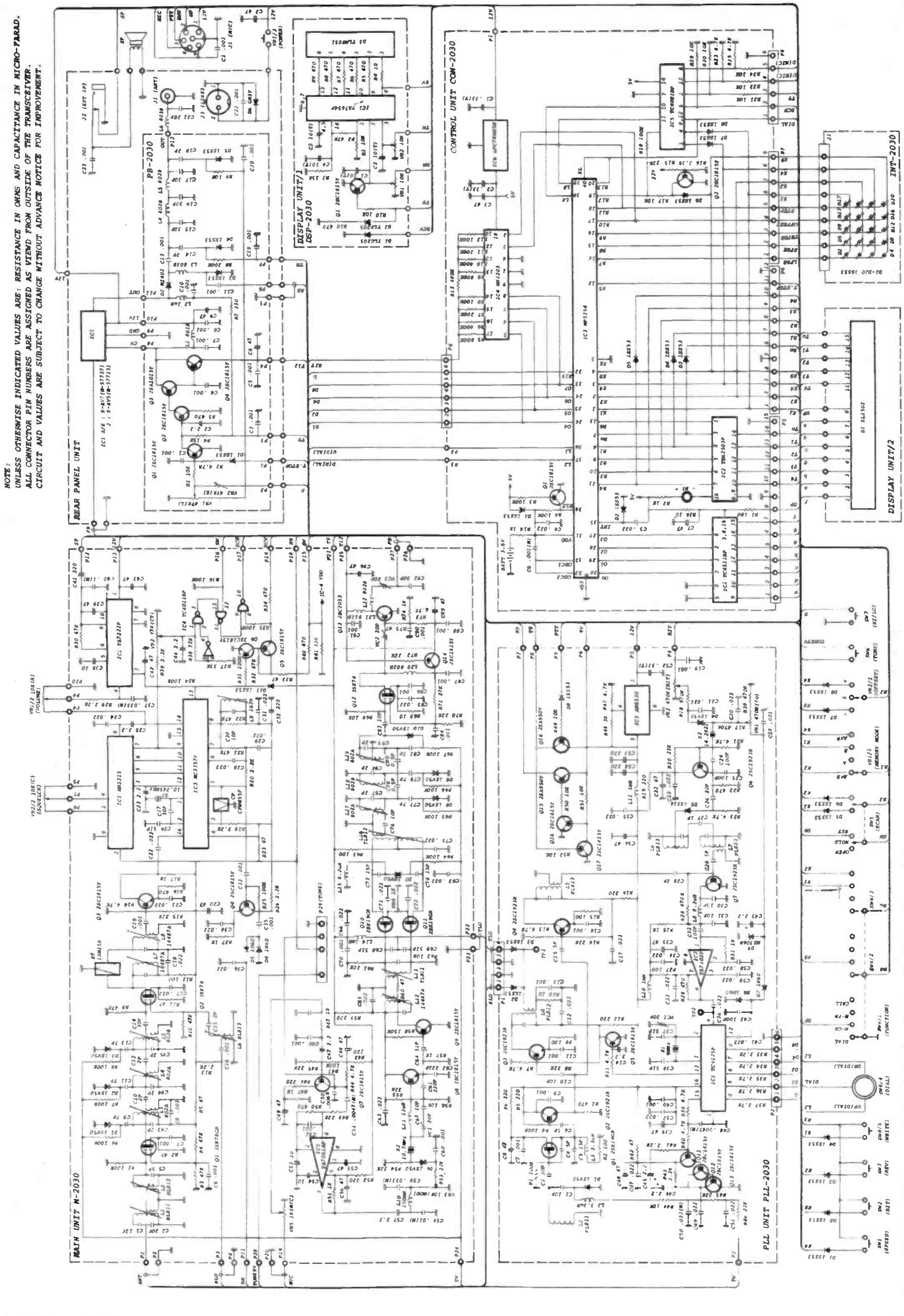

NOTE:
UNLESS OTHERWISE INDICATED VALUES ARE: RESISTANCE IN OHMS AND CAPACITANCE IN MICRO-FARAD.
ALL CONNECTOR PIN NUMBERS ARE ASSIGNED AS VIEWED FROM OUTSIDE OF THE TRANSCEIVER.
CIRCUIT AND VALUES ARE SUBJECT TO CHANGE WITHOUT ADVANCE NOTICE FOR IMPROVEMENT.

Figure 2: Circuit Diagram of the 2030, showing detail of the main modules.

must come clean and confess that there is virtually no innovative aspect of the circuit whatsoever. It's all good tried and tested stuff, and it works.

Refreshingly, the first IF uses a real 10.7MHz stage, not a marginal variant thereof; although the second filter at 12kHz bandwidth is arguably on the wide side. Well-behaved and conservatively deviated UK FMer's might find the 12.5kHz channelling option just a shade academic, unless the filter is swapped for an 8kHz version.

The block diagram of *Figure 1* gives the overview, but one or two interesting bits emerge when you move into the detailed circuit diagram of *Figure 2*. All the RF tuned circuits are track tuned using varicap diodes. Not just the receiver front end circuits, but the bandpass filter following the final mixer in the transmitter loop. Since KDK take the relatively direct route of mixing the receiver LO with the first IF offset (10.7MHz) to obtain the output frequency for the transmitter, it's understandable that there should be some concern for the purity of the signal at this point. Maybe not so much for the meagre UK span of 2MHz, but for the rather more demanding US range of 4MHz.

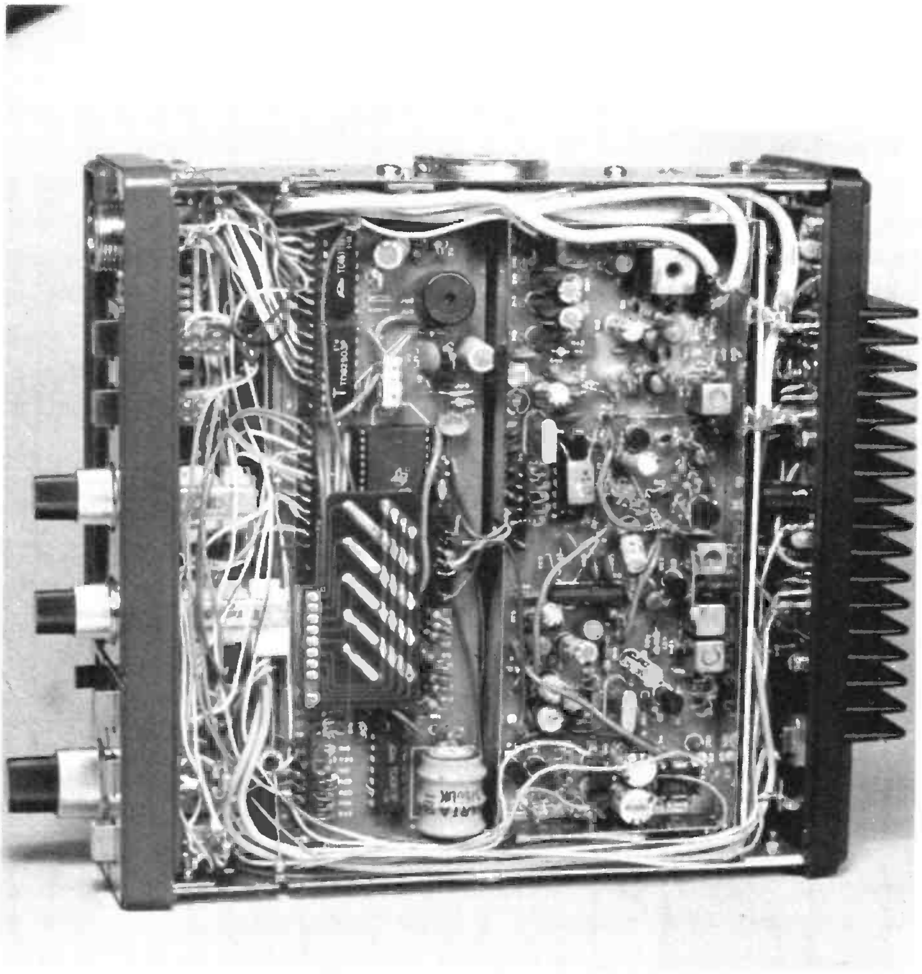
It's as well to remind UK readers that there are actually precious few regulations governing the outputs of amateur radio transmitters, other than requiring that they should not cause interference to other users. Uncle Sam's FCC ties it down a lot tighter, placing emission regulations on the equipment that are on a par with the MPT specs for mobile radio in this country. Even so, receiver and wide-ranging enviromental considerations are not nearly as important as simply keeping the harmonics and mixing products out of sight.

Incidently, one little gem you might like to distil from this circuit and file away for future reference is the modulator circuit.

SHAKE IT ALL ABOUT

As the more discerning readers of this magazine will know, it's not good form to wave the control voltage of synthesised VCO around in the attempt to FM modulate it. All sorts of funny things go on that give mathematicians paroxysms of the Fourier variety - but practically, the modulation level can vary rather frantically from one end of the band to the other (very few varicaps boost a linear slope on the bias/capacitance curve).

Once again, the 2MHz of the UK 2m band can actually be managed tolerably well in this fashion, but in order to satisfy world market requirements, most Jap rigs use a VCXO and mix-up process - since the VCXO modulation level is constant. The KDK rig achieves a +/-5kHz deviation level by wobbling a 10.7MHz crystal with a varicap. Cynics might suggest that you really shouldn't be able to get a linear swing of 10kHz from a 10.7MHz quartz crystal, and that L11 (12uH) is just a bit on the naughty side, since it somewhat loosens the grip of the crystal on the whole oscillator. Nevertheless, KDK get away with it, and you might like to bear this technique in mind as a short cut to turning our forthcoming 2m synthesised receiver (derived from Keith Mitchell's Airband Receiver) into an instant transceiver.


Internal shot of the 2m transceiver.

SYNTHESIS MADE EASY!

The need to provide fine tuning at VHF has tended to drive designers away from the elegant simplicity of the dual modulus prescalar and direct VCO approach (like the Airband RX), and into all sorts of contortions with R2R D/A to control VCXOs in roundabout loops. OK, the VCO runs at the same frequency at the end of the day (viz 133MHz-odd), but actually using 3 crystals and lots of other bits to boot. You can bend the frequency of the airband synthesiser quite a long way by simply trimming the reference frequency - enough, it would seem, to provide the degree of interpolation required for RIT.

Refer back to *fig. one* for the route adopted in this set, which avoids the use of prescalar by the usual mix-down to the LSI PLL (IC1) frequency range.

ON THE AIR

Despite frantic attempts to extract some form of definitive comment from local amateurs on the signal qualities of the rig, I couldn't. "It sounds alright", they said.

The receiver is certainly sensitive, and the 8640B tripped the mute in at around 0.15uV (which is the threshold of believable accuracy for most signal sources anyway), and the transmitter (as expected) produced nothing significant above -70dB.

Would that we might be more enthusiastic about the whole thing, but to be perfectly frank, it's not easy.

The main 'feature' is the £199 price tag. So.... the receiver's not as good on overload as an ICOM IC25E (sorry, but someone zapped our 150MHz BW scope, or we would have showed you a pic of what a sinewave 200mV input at 145MHz looks like, after the varicap on the output of the RF stage had done its stuff), but for most mobile users that can be a rather academic feature anyway.

If you want a rig that does all the usual party tricks and provides 25W in a fairly compact package, this looks like reasonable value.

■ R & EW

Your Reactions..........	Circle No.
Immediately Interesting	37
Possible application	38
Not interested in this topic	39
Bad feature/space waster	40

BATTERY BONANZA

High quality Every Ready Ni-Cad batteries at low, low prices

AAA	**1.29**
AA	**0.92**
C	**2.71**
Sub D	**2.48**
D	**3.51**
PP3	**4.26**

In addition a versatile charger that, with its range of adaptors will allow most batteries to be safely charged is also available.

Charger	**16.05**
Adaptors 1xD	**2.02**
1xC	**2.02**
2xAA	**2.02**

Also shown is a unique series of adaptors that will allow small Ni-Cads to be used in place of larger cells.

Sold in pairs these enable an AA size to be used in place of a C cell, a C instead of a D, or an AA in place of a D.

Battery Adaptor 1.10

Finally a battery tester, which may also be used as a continuity checker is available for only **£5.75.**

This rugged 10A autoranging LCD digital multimeter is professionally designed for those of you who like the professional approach.

At our low price of **£49.95** inclusive its time you replaced your old meter with this **R&EW** bargain.

This offer is limited to the first 100 orders - first come, first served so place your order now.

HOW TO ORDER

Write your order on a separate piece of paper and send together with the coupon below and your Cheque/Access/Barclaycard No. to

R&EW Special Offers,
117A High Street, Brentwood, Essex CM14 4SG.

All prices include VAT at 15% but please include postage and packing at 50p per order.

Also please remember the two special offers were featured last month, the test probe and glue gun. Both of these are still being offered at the fully inclusive price of **£9.95** each.

Name: ....

Address: ....

....

....

....

....

Cheque/P.O. No. ....

Access/Barclaycard No. ....

Signature ....

VIDEO NEWS

Peter Luke looks at a new camera, a new recorder, a midget monitor and much more besides.

THE IDEAL VIDEO CAMERA would seem to be one on which there were no user controls with the exception of the power zoom rocker switch. The camera would be ready to point and shoot as soon as something to point it at materialised without having to fiddle with White Balance, sensitivity controls or focus. Judging by some of the recent offerings by camera manufacturers, far from approaching this ideal, the products are becoming ever more complex meaning that valuable recording time is lost while making sure that the camera is set up to suit prevailing conditions.

The new camera from Panasonic, designated the WVP - 100E, bucks the trend however, with the removal of one of the most important camera controls - namely focusing.

The WVP - 100E features an ultrasonic auto-focus system which, according to Panasonic can lock onto both stationary and moving subjects. Based on an ultrasonic system, the focusing is obviously not affected by low lighting levels or subjects with little variation in contrast.

The camera 'looks the business being', what Panasonic choose to term, ENG styled. The camera incorporates a 6:1 two speed power zoom, a macro facility and an AGC switch that allows it to be used in low light conditions.

The viewfinder is a 1.5" CRT and provides indication of a camera/recorder combinations's status, ie low battery, record run etc. in addition a stop-watch timer and date setting ability (for chronological record) are built in.

Fade in/out and negative/positive picture reversal, a la Sony 400P, also make an appearance on the WVP - 100E.

On the Thorny issue of camera - recorder compatibility, the new camera, while designed for use with Panasonic's NV - 100B portable recorder, features a compatibility switch that allows it to be used with other brands of VHS recorders that have different trigger polarities in addition, an optional adaptor can be used to hook the camera up to Sony standard camera connectors.

When used with the aforementioned NV - 100B recorder, the remote control unit of the recorder may be clipped to the camera's handle and thus offer a selection of transport control functions (record, play, cue, insert edit etc) from the camera. This sort of function was found to be very useful on the Sanyo portable system reviewed last month.

The camera should be available by the time you read this, pay a visit to your nearest Panasonic dealer and tell them **R&EW** sent you.

TAPING WITH TELEFUNKEN

Telefunken have recently introduced a full facility VHS machine at the quite keen price of £600. The front loading machine packs in just about everything that's anything in the features stake - Dolby, 14 day / 8 event timer, IR remote control, 9 times visual search, insert editing, slow play, pause, frame advance, memory rewind, tape indexing etc, etc in short - it's got the lot.

What's more the machine is designed to record and playback both PAL and SECAM G formats and has a UHF/VHF tuner.

A very impressive machine that should be worth checking out.

MIDGET MONITOR

A monitor that may well find applications in portable recording set ups is the new 2 inch TV2S from Thandar.

By making use of phase locked line and injection locked oscillators, the TV2S provides a very good picture lock. The monitor provides a 525/625 capability and a 75R bridge option.

It is powered from its own internal ni-cad supply but can be supplied from the usual range of sources, car battery, mains (with adaptor) etc.

Details from

Thandar Electronics,
London Road,
St. Ives,
HUNTINGDON,
Cambridgeshire,
PE17 4HJ.

AMERICAN ADD-ONS

Two quick items from the States now in the shape of a stereo simulator and a room expander from MFJ enterprises.

The stereo simulator uses a comb filter technique that puts alternate 1kHz bands of the audio spectrum into the left and right speakers, thus giving an impression of a stereo image from a mono source. This

making an appearance, and while reported to be an 'interesting' effect rather than a convincing stereo image, is better than the crude high/low filtering techniques that some record manufacturers adopted in the late 60's and early 70's to simulate stereo.

The room expander is a sophisticated reverberation unit and by means of Ambience, Expand, and volume controls, is said to be able to create the impression of 'big screen sound' in the most moderate of surroundings.

Put the two units together and you have six sound modifiying controls to twiddle with, it'll give you something to do if you lose interest in what's happening on the TV screen.

More information from:

MFJ Enterprises,
921A Louisville Road,
St Arkville,
MS 39759.

ET VT'ED

If we are to believe the various spokespersons representing the vested interests of the film industry, many video recorders spend most of their time producing illicit copies of the latest box office hit. It cannot be disputed that pirate copying of films is a thorn in the side of the movie moguls with the impact of the launch of a film such as ET being much diluted by the fact that many people will have already seen Steven Speilberg's latest money spinner. Fifty pounds was the asking price for a first generation copy of the tape at one of the less reputable purveyors of video software that **R&EW** knows about.

The industry is so concerned about this black market dealing in films, that it is actively campaigning for a levy to be charged on all blank cassettes sold - a move that is likely to be strongly resisted not only by the various tape and recorder producers, but by the public at large. In the meantime, phone numbers for members of the public to, in the strictest confidence, provide information on any illicit sources of software; vigourous prosecution of all persons suspected of involvement in illegal copying; and various watermark systems to enable any legal tapes to be positively identified; (and hence by implicaton any niggers in the woodpile to be spotted); are all part of the battle against the pirates.

The answer to the problem would, of course, be a copy guard system that would somehow allow tapes to be played back via a TV set but NOT to be copied. Some ideas along these lines have been tried in the States and usually involve some distortion of the recorded sync pulses, distortion that a TV receiver circuitry is able to cope with, but which throws any slaved recorders servos into a state of confusion. The problem with most schemes along these lines is that they are very easy to counter and numerous sync stabilisers are freely available in the States.

If the manufactures of video hardware were to show some positive commitment to supressing the pirate trade, a workable form of copy guarding could be a viable proposition. There seems little prospect of this, however, and unless some technical person with the interest of the movie industry has some flash of inspiration, the pirating problem will remain.

LEADING ASTRAY

There are a number of occasions when copying can be carried out without breaking the law of the land; assembly editing of your holiday tapes for example. To cater for these situations many firms are now supplying leads to connect to the many and varied audio and video in/out sockets encountered within the various recorders.

The list below details some of the input/output connections of the more popular makes of machine and may be of help if you're trying to sort out the leads to copy from your machine to that of an ET?-oops.

■ **R & EW**

Video	**BNC**
Audio	**3.5mm Jack**
Akai	VP7100
Ferguson	3V01
Ferguson	3V24
JVC	HR2200
JVC	HR4100
Nordmend	V250
Video	**BNC**
Audio	**5 Pin Din**
Akai	VS10EK
Ferguson	3V23
Ferguson	3V29
Ferguson	3V30/3V31
JVC	HR 7200/7300
JVC	HR 7650
JVC	HR7700
Telefunken	VR 520
Video	**6 Pin Din**
Audio	**6 Pin Din**
Grundig	2 x 4/2 x 4 Plug
Korting	VR 8
Nordmende	V 350/V 500
Philips	VR 2023
Philips	VR 2025
Saba	VR2000
Saba	VR6000
Saba	VR6012
Saba	VR6024
Saba	VR6069
Video	**PL259**
Audio	**RCA Phono**
Sanyo	VTC 5500/5600
Video	**Phono**
Audio	**5 Pin Din**
Akai	VS9700
Akai	VS5EK
Sharp	VC 2300
Video	**BNC**
Audio	**RCA Phono**
Sanyo	VTC 3000
Sanyo	VTC 5300P
Sony	SL C5
Sony	SL C6
Sony	SL C7
Sony	SL F1
Video	**RCA Phono**
Audio	**RCA Phono**
Fidelity	VTR 1000
GEC	4000/4001
Granada	VHS WH1/3
Granada	VHS VH1/2
Hitachi	VT 5000 E/ER
Hitachi	VT 5500 E
Hitachi	VT 6500
Hitachi	VT 7000
Hitachi	VT 8000/8040
Hitachi	VT 8300/8500
Hitachi	VT 8700/9700
Hitachi	VT 9300/9500
Toshiba	V 5470
Toshiba	V 8600B
Video	**PL259**
Audio	**5 Pin Din**
Akai	VS 9300
Akai	VS 9500
Akai	VS 9800
Ferguson	3292
Ferguson	3V16
Ferguson V. Star	3V22
Granada	VHS TJ1
JVC	HR 3200
JVC	HR 3320
JVC	HR 3330
JVC	HR 3660
Normende	Spectra Video VIS
Normende	V200/V400
Sanyo	VTC 9300
Sharp	VC 6300
Sharp	VC 7300
Sharp	VC 7700/7750H
Sharp	VC 8300H

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

CIRCUIT BLOCKS

Design by Chris Parsons.

A Sine- Cosine Oscillator with Variable Switched Frequency Control.

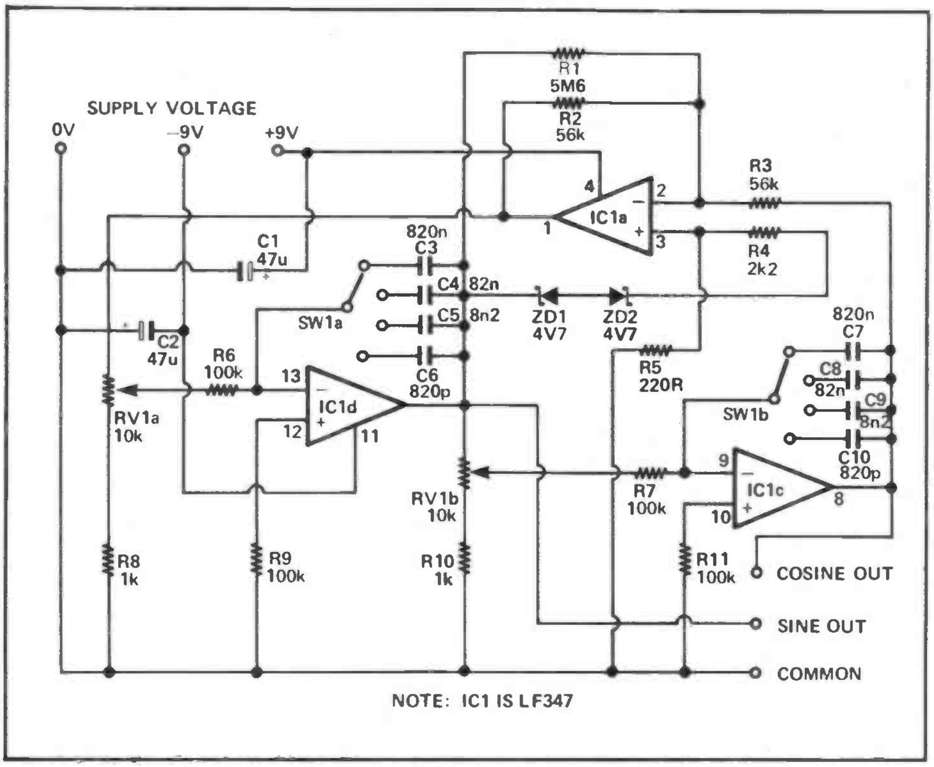


Figure 1: Circuit diagram of the quadrature sine - cosine oscillator.

MOST SIGNAL GENERATORS have either just sine or sine, square and triangle wave outputs, with various amplitude and range controls. This arrangement is quite adequate for most purposes, but there do exist certain special applications where something more exotic is required. One such is obtaining two sine waves, 90 ° out-of-phase, whose frequencies are matched and variable. With a LF output, it's possible to simulate a radar display - but more of this later.

The circuit shown in *Fig. 1* is a quadrature sine-wave oscillator, with switched frequency bands (RV1 set for no attenuation) of 2,20,200 and 2000 Hz. Each band is fully variable over a 10:1 range, by adjusting RV1 - a dual ganged linear slider is useful here. The output frequency is computed from $f_{out} = 1/2\pi RC$, where R is taken as R6 = R7 and C as the capacitors selected by SW1. For instance, with SW1 connected to C4 and C8 (R = 100k) the frequency will be variable from $1/(2 \times 3.14 \times 82 \times 10^{-9} \times 100 \times 10^{3}) = 20Hz$.

The oscillator is based around the LF347 quad BiFET operational amplifier. Two integrators, IC1c and d, are connected to an inverter, IC1a, with unity gain. The inverter is part of a positive feedback loop, which is stabilised by the addition of two level-clamping zener diodes, from pin 3 (via R4) IC1a. There is also a high value resistor (R5) to provide the small amount of negative feedback necessary to ensure oscillation occurs immediately at power on. With the values shown, you should obtain an 8V peak-to-peak sine-wave from both outputs. The rest of the circuity is fairly straightforward. Supply decoupling is provided by C1 and C2 - though, it may be necessary to add two parallel capacitors (of about 47n) to remove any HF spikes from the power lines. Current consumption is quite low (at 4mA) into a high impedance load, so battery operation is possible.

An application for this sine-cosine signal generator is as a simulator · By feeding the outputs into an oscilloscope - sine to the y input and cosine to the x input - and selecting the lowest frequency band (C3 and C7), a simulated radar trace is obtained. The screen will show a circular Lissajous figure, with the spot sweeping round at a speed controlled by RV1. Other uses include VCO's in sythesisers, effects units and test gear.

■ R & EW

Your Reactions......	Circle No.
Excellent - will make one	44
Interesting - might make one	45
Seen Better	46
Comments	47

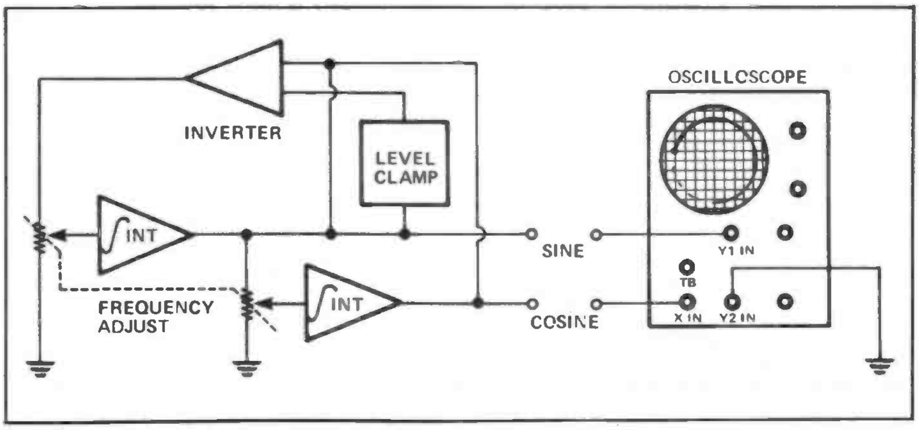


Figure 2: Block diagram of the oscillator showing connections for creating a simulated radar trace.

P.M.
ELECTRONIC SERVICES

PRICES SHOWN EXCLUDE VAT
UK CUSTOMERS PLEASE ADD 15%

2 ALEXANDER DRIVE, HESWALL
WIRRAL, MERSEYSIDE, L61 6XT
Tel: 051-342 4443. Cables: CRYSTAL, BIRKENHEAD

CRYSTALS MANUFACTURED TO ORDER

Prices shown are for "one off" to our standard amateur specs; closer tolerances are available. Please send us details of your requirements.

A Low frequency fundamentals in HC13/U or HC6/U
Total tolerance ± 100ppm 0° to +70°C

6 to 9·999kHz HC13/U	£32.80
10 to 19·99kHz HC13/U	£31.00
20 to 29·99kHz HC13/U	£23.08
30 to 59·99kHz HC13/U	£21.73
60 to 79.99kHz HC13/U	£15.69
80 to 99·99kHz HC13/U	£13.08
100 to 159·9kHz HC13&6/U	£11.32
160 to 399·9kHz HC6/U	£7.83
400 to 499·9kHz HC6/U	£7.00
500 to 799·9kHz HC6/U	£7.83

B High frequencies fundamentals/overtones
Adj. tol. ±20ppm, Temp. tol. ±30ppm −10°C to +60°C

800 to 999·9kHz (fund) HC6/U	£11.01
1 to 1·499MHz (fund) HC6/U	£11·25
1·5 to 2·59MHz (fund) HC6/U	£5.36
2·6 to 20·9MHz (fund) HC6/U	£4.87
3·4 to 3·99MHz (fund) HC18 & 25/U	£6.75
4 to 5·99MHz (fund) HC18 & 25/U	£5.36
6 to 21MHz (fund) All Holders	£4.87
21 to 25MHz (fund) ,,	£7.31
25 to 30MHz (fund) ,,	£9.00
18 to 63MHz (3 O/T)	£4.87
60 to 105MHz (5 O/T)	£5.61
105 to 125MHz (5 O/T)	£8.44
125 to 149MHz (7 O/T)	£8.62
149 to 180MHz (9 O/T)	£12.75
180 to 250MHz (9 O/T)	£13.50

Delivery—Mid range 1MHz to 105MHz normally 4/6 weeks. Other frequencies 6/8 weeks.

Holders—Low Frequencies 6 to 150kHz HC13/U, 150kHz to 3·4MHz HC6/U, 3·4MHz to 105MHz HC6/U, HC18/U or HC25/U, over 105MHz— HC18/U and HC25/U.
HC33/U (Wire ended HC6/U) is available on request as per HC6/U. HC17/U (Replacement for FT243) available as per HC6/U at 35p surcharge on the HC6/U price.

Unless otherwise specified, fundamentals will be supplied to 30pf circuit conditions and overtones to series resonance.

CRYSTALS FOR MICROPROCESSORS
Please let us know your requirements eg 4MHz HC18/U.
1 off £2.00, 100 off £1.10, 1000 off 99p, 2500 off 50p.

ANZAC MD-108 DOUBLE BALANCED MIXER
5 to 500MHz supplied with full details for only £6.95.

COMMERCIAL AND PROFESSIONAL CRYSTALS
NEW FASTER SERVICE

We are now supplying crystals to most commercial and MIL specifications in the range 1MHz to 60MHz ordered in small quantities in 2½ weeks AT NO EXTRA CHARGE. We also have even faster EXPRESS SERVICES available for that VERY URGENT order.

We can also supply crystals for commercial applications e.g. Microprocessor, TV etc. at very competitive prices. Let us know your needs and we will send you a quote by return, alternatively telephone or telex our Sales Engineer Mr Norcliffe who is normally available in the office for technical enquiries between 4.30 and 6.30p.m.

TWO METRE CRYSTALS

CRYSTAL FREQUENCY USE (TX or and HOLDER) OUTPUT FREQUENCY	4MHz-TX-HC6/U	6MHz-TX-HC25/U	8MHz-TX-HC6/U	10MHz-RX-HC6/U	11MHz-RX-HC6/U	12MHz-TX-HC25/U	14MHz-RX-HC25/U	18MHz-TX-HC25/U	44MHz-RX-HC6/U	44MHz-RX-HC25/U	52MHz-RX-HC25/U
144·4 (433·2)	b	c	b	e	e	b	e	e	e	e	e
144·800	e	e	e	e	e	c	c	c	e	c	e
144·825	e	e	e	e	e	e	e	e	e	e	e
144·850	e	e	e	e	e	e	e	e	e	e	e
145·000/R0T	a	c	a	c	c	b	e	b	e	a	c
145·025/R1T	a	c	a	e	e	b	e	b	e	e	e
145·050/R2T	a	c	a	e	e	b	e	b	e	e	e
145·075/R3T	a	c	a	e	e	b	e	b	e	e	e
145·100/R4T	a	c	a	e	e	b	e	b	e	e	e
145·125/R5T	a	c	a	e	e	b	e	b	e	e	e
145·150/R6T	a	c	a	e	e	b	e	b	e	e	e
145·175/R7T	a	c	a	e	e	b	e	b	e	e	e
145·200/R8R	a	c	a	e	e	b	b	b	a	e	c
145·300/S12	e	e	e	e	e	e	e	e	e	e	e
145·350/S14	e	e	e	e	e	e	e	e	e	e	e
145·400/S16	e	e	e	e	e	e	e	e	e	e	e
145·425/S17	e	e	e	e	e	e	e	e	e	e	e
145·450/S18	a	e	a	e	e	b	b	b	a	a	e
145·475/S19	a	e	a	e	e	b	b	b	a	a	e
145·500/S20	a	c	a	c	c	b	b	b	a	a	c
145·525/S21	a	c	a	c	c	b	b	b	a	a	c
145·550/S22	a	c	a	c	c	b	b	b	a	a	c
145·575/S23	a	c	a	c	c	b	b	b	a	a	c
145·600/R0R	a	c	a	c	c	e	b	b	a	a	c
145·625/R1R	e	e	e	c	c	e	b	e	a	a	c
145·650/R2R	e	e	e	c	c	e	b	e	a	a	c
145·675/R3R	e	e	e	c	c	e	b	e	a	a	c
145·700/R4R	e	e	e	c	c	e	b	e	a	a	c
145·725/R5R	e	e	e	e	c	e	b	e	a	a	c
145·750/R6R	e	e	e	c	c	e	b	e	a	a	c
145·775/R7R	e	e	e	e	c	e	b	e	a	a	c
145·800/R8R	a	c	a	c	c	b	b	b	a	a	e
145·950/S38	a	e	e	c	e	e	e	e	a	e	e

PRICES: (a) £2.15. (b) £2.56, (c) £2.80 and (e) £4.87

AVAILABILITY: (a), (b) and (c) stock items normally available by return (we have over 5000 items in stock). (e) 4/6 weeks normally but it is quite possible we could supply from stock. N.B. Frequencies as listed above but in alternative holders and/or non stock loadings are available as per code (e).

ORDERING: When ordering please quote (1) Channel, (2) Crystal frequency, (3) Holder, (4) Circuit conditions (load in pf). If you cannot give these, please give make and model of equipment and channel or output frequency required and we will advise if we have details.

EXPRESS SERVICE
Many types of made to order crystals are available on our "EXPRESS SERVICE"—with delivery of three days on our class "A" service. Telephone for details.

70cm CRYSTALS

Due to the much higher multiplication involved compared with 2 metres all our stock 70cm crystals are to a much higher tolerance than our standard amateur spec. crystals.

We are stocking the following channels:—RB0, RB2, RB4, RB6, SU8, RB10, RB11, RB13, RB14, RB15, SU18 and SU20 TX and RX for use with: PYE UHF Westminster (W15U), UHF Cambridge (U10B), Pocketfone (PF1) and UHF PF70 Range and Storno CQL/CQM 662 all at £2.55.

For other channels and/or equipments crystals can be made to order to the same closer tolerances as our stock range at a cost of £5.72 for frequencies up to 63MHz and £6.58 for 63-105MHz or to our standard amateur specifications see "CRYSTALS MANUFACTURED TO ORDER" Prices opposite.

4m CRYSTALS FOR 70·26MHz—HC6U
TX8·7825MHz and RX6·7466MHz or 29·7800MHz £2.56.

10·245MHz "ALTERNATIVE" I.F. CRYSTALS—£2·55
For use in Pye and other equipment with 10·7MHz and 455kHz I.F.s to get rid of the "birdy" just above 145·0MHz. In HC6/U, HC18/U and HC25/U.

CRYSTAL SOCKETS (LOW LOSS)
HC/6U and HC13/U 25p each, HC25/U 20p each plus 20p P&P (P&P free if ordered with crystals).

CONVERTER/TRANSVERTER CRYSTALS—HC18/U
All at £3.00, 38·6666MHz (144/28), 42MHz (70/28), 58MHz (144/28), 70MHz (144/4), 71MHz (144/2), 96MHz (1,296/432/144), 101MHz (432/28), 101·50MHz (434/28), 105·6666MHz (1,296/28) and 116MHz (144/28).

TEST EQUIPMENT FREQUENCY STANDARD CRYSTALS
200kHz and 455MHz in HC6/U £3.50
100kHz in HC13/U and MHz in HC6/U £2.95
5MHz in HC6/U and 10MHz and 10·7MHz in HC6/U and HC25/U £2.80.

AERIALS
MULTI-BAND INVERTED "V" TRAPPED DIPOLE
80 Thru 10m—Rated @ 2kW—Only 26m long.
Introductory offer £32.00 + VAT (£36.80 INC VAT) P&P £2.50

THE ARAKI RANGE OF AERIALS

10m whip only 1·3m long with magmount	£18.00	P&P £3.00
10m whip only 1·3m long with guttermount	£15.20	P&P £3.00
2m 5/8 λ whip with magmount	£16.00	P&P £3.00
2m 5/8 λ whip with guttermount	£13.20	P&P £3.00
2m 1/4 λ whip with magmount	£12.50	P&P £2.50
2m 1/4 λ whip with guttermount	£9.70	P&P £2.50
2m/70cm DIBAND whip with magmount	£20.90	P&P £3.00
2m/70cm DIBAND whip with guttermount	£18.10	P&P £3.00
2 Base Station Aerials		
2m 5/8 λ Ground plane 3·5db gain	£18.95	P&P £3.50
2m 5/8 + 5/8 Colinear 6db gain	£25.00	P&P £3.50
70cm 5/8 + 5/8 Colinear 5db gain	£25.00	P&P £3.50

The Araki Range are handmade of top quality anti-corrosion treated aluminium or stainless steel.

TERMS: CASH WITH OROER—MAIL OROER ONLY. PRICES INCLUOE P&P (BRITISH ISLES) EXCEPT WHERE STATED OVERSEAS CHARGED AT COST.

PLEASE ENCLOSE S.A.E. WITH ALL ENQUIRIES

164 for further details

SUBSCRIPTIONS

If you want to be sure of getting YOUR copy of Britain's most informative Radio/Electronics magazine, PLAY SAFE AND SUBSCRIBE. Fill in the form below.

With the increase in our cover price this month we have had to adjust our subscriptions rates accordingly.

The new rates are as shown below:

UK (12 issues) £13:00
Overseas (12 issues) £13:50

SUBSCRIPTION ORDER FORM

I would like to subscribe to Radio & Electronics World for one year (12 issues). Please start my subscription from the ______________ issue.

SUBSCRIPTION RATE:
(tick ✓ as appropriate)
UK **£13.00 for 12 issues**
Overseas **£13.50 for 12 issues**

PAYMENT:
(Access/Barclaycard orders may be sent using reply-paid order card)
I enclose my (delete as necessary) Cheque/Postal Order/ International money order for £

Please use BLOCK CAPITALS and include postal codes.

Name (Mr/Mrs/Miss) ____

Address: ____

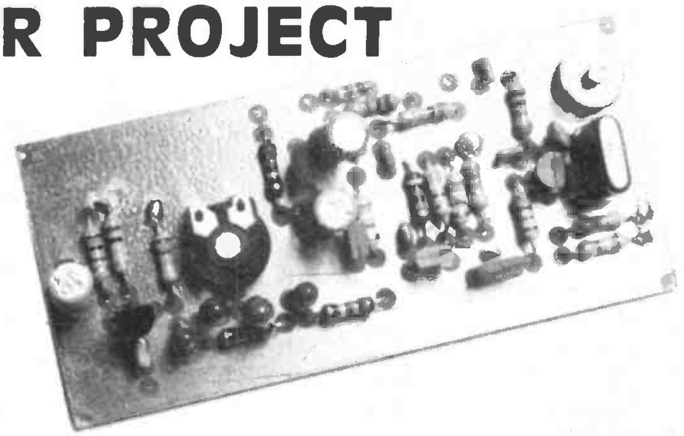
____

Signed: ______________________________ Date: ______________

Please send this order form, with your remittance, to Radio & Electronics World, Subscriptions Department, 45, Yeading Avenue, Rayners Lane, Harrow, Middlesex. HA2 9RL

R&EW TRANSCEIVER PROJECT

CW GENERATOR



Design by Simon Ruffle G4EAG

THIS PROJECT is a CW Generator for the **R&EW** transceiver. It provides a 10.7MHz carrier, keyed by the mixer board (October **R&EW**) and a sidetone output, which can be fed to the audio amplifiers of the receiver. CW generation is not linked to the SSB module, because it would preclude the construction of a CW-only transceiver. The CW generator has, however, been designed for DC mode-switching.

PRINCIPLES OF OPERATION

The CW generator consists of two distinct parts; the 10.7MHz oscillator and the audio sidetone oscillator. These are linked *only* via the DC switching arrangement. Mode selection and transmit/receive switching in the transceiver are simplified to +12V 'enable' lines (one for each mode) and a +12V 'transmit' line. All boards in the system must obey this protocol. Therefore, the CW board will deliver a continuous 10.7MHz carrier wave drive when enabled. This is keyed by the mixer board, and, at the same time, delivers an audio sidetone which must not be present when USB, LSB or FM are transmit- keyed.

All mode generators are now being fitted with a diode switch, which allows them to be connected together at the mixer's 10.7MHz input. This requires an additional resistor/diode arrangement (identical to R17/D1) to be fitted to the output of the SSB generator (July 1982). Also, a 1mH choke is connected across the input of the mixer board to provide a DC return path.

CIRCUIT DESCRIPTION

The 10.7MHz carrier-oscillator is similar in design to that used in the SSB generator - with the addition of tuning adjustment. The output is taken from a tap in the emitter resistor and fed to a 10.7MHz ceramic filter. The stopband characteristics of this filter are used to remove unwanted harmonic energy and the output is fed to a buffer amplifier (Q2). It is then passed to the 10.7MHz drive-input on the mixer board.

The diode switch, D1, relies on a DC return path at the mixer input; when 12V is available from R17, D1 conducts and allows the CW energy to flow. When D1 is reverse biased, it will offer a high impedance to the other mode generator feeding the mixer.

The audio sidetone oscillator is of the 'twin T' variety and has frequency control via RV1. This kind of oscillator needs a high impedance buffer, provided by Q5. This should give adequate output to feed the receiver's audio amplifier or a separate amplifier if prefered.

The +12V 'transmit' line, which also serves as the keyed line in CW, is available in all modes. It therefore needs to be disconnected from the audio oscillator when CW is not selected. This is accomplished by a DC switch, Q3, which keys the +12V, from the CW enable line (under control from the transmit line), and feeds it to Q4.

CONSTRUCTION AND SETTING-UP

The CW generator is constructed on a small double- sided printed circuit board. All earthed leads, passing through the board, should be soldered to the top plane wherever possible. There is no need to test the board in stages, though it may be useful to try out the audio oscillator before connecting the switching transistor, Q3. RV1 should offer a useful range of frequencies, but do not set it up yet (for the moment, leave the sidetone oscillator disconnected).

Wire the CW 10.7MHz output to the mixer board and link the 12V 'transmit only' pin (mixer) to the +12V 'keyed line'

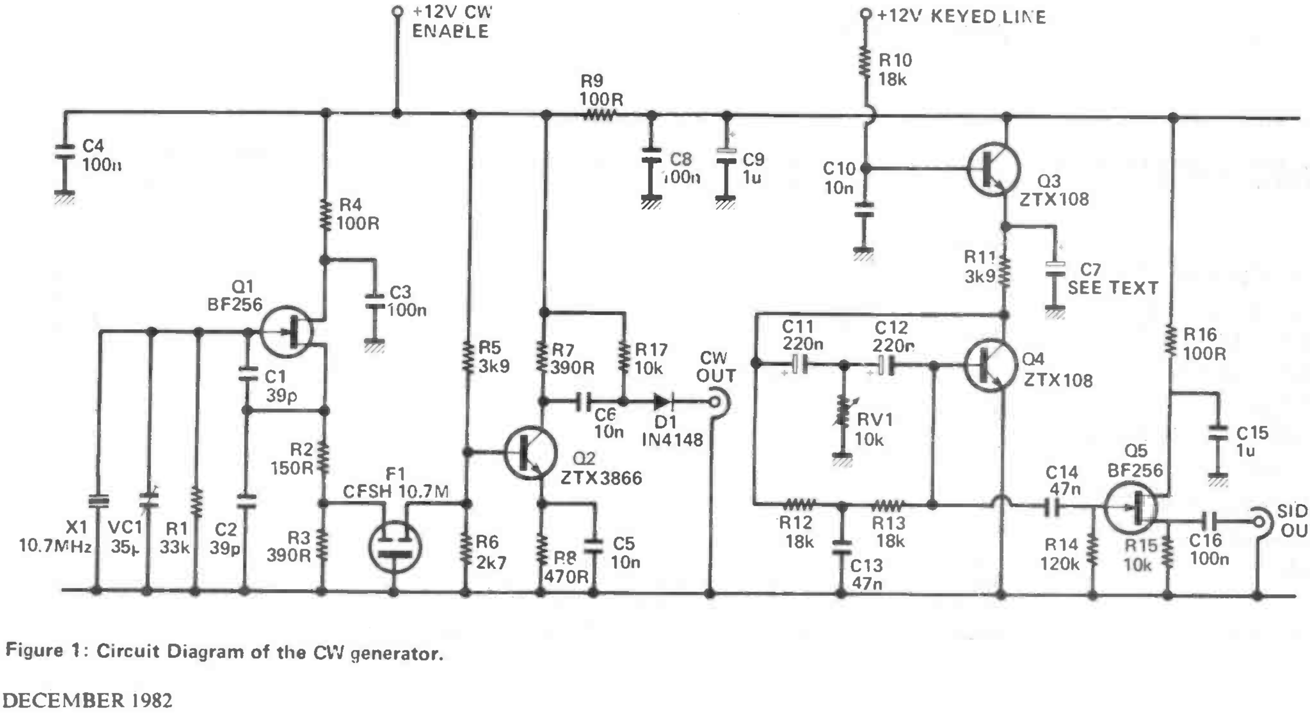


Figure 1: Circuit Diagram of the CW generator.

▶

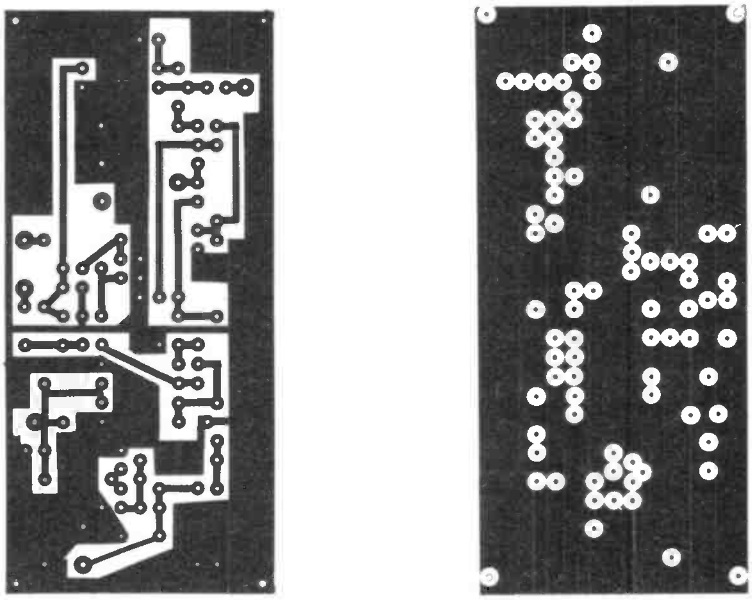


Figure 2: The PCB foil patterns for the double sided board.

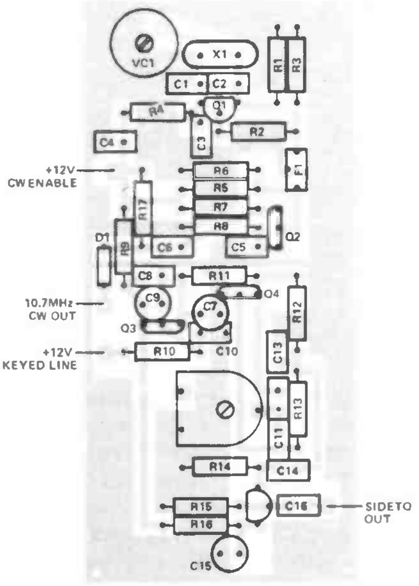


Figure 3: Component Overlay.

pin (CW). Now connect the 12V oscillator pin to 12 volts and switch on the CW enable line. As you key the transmit line, you will hear the signal at the receiver; anywhere in the 0-30MHz range. Tune VC1 until the 'beat' notes are identical when the receiver is switched between USB or LSB. The transmit signal is now dead co-channel with the receiver, and the beat note will be 1.5KHz (the BFL offset). The implication here, is that in order to net accurately onto a received CW signal, the transmit and receive beat notes must be identical. It is likely, however, that the 1.5KHz note is too high for comfortable CW reception, and this can be overcome by allocating one of the two BFO's for CW. This allows you to choose your own CW note on, say, the LSB position, and then use VC1 to match that with the transmit beat note. Take care once you have done this - you can't work CW on the receiver 'USB' position because you will be way off frequency.

Once you have chosen your CW beat frequency, you can match it with the audio sidetone. The sidetone is necessary because the receiver will be muted on transmit; it is possible, but unsatisfactory, to monitor the transmitted CW itself. The sidetone, therefore, should be of the same audio frequency as the beat note caused by the transmitted signal. This is achieved by rotating RV1 until the two notes are identical. Netting to a received CW signal, then, merely involves matching the received beat note and the sidetone frequency. Beware, however, that the correct receive BFO is selected to ensure co-channel operation.

Two capacitors, C7 on the CW generator and C22 on the mixer board, allow shaping of the CW signal, which eliminates key clicks. Their values will depend on the type of amplification (RF and audio) used, which can only be found by experimentation. I suggest values of 330n, for both capacitors, as a good starting point. In fact, C22 is the more important variable because it affects the transmitted CW (C7 is only necessary to adjust for personal listening preferences).

FINAL THOUGHTS

I was excited to hear that the 18 and 24MHz bands have been released to UK amateurs - albeit for low-power CW operation. With the CW generator module, **R&EW** transceiver owners will have a great headstart over the non-synthesised rig-owners. Indeed, it is not difficult to take the mixer output up to ten watts - so what are you waiting for?

Next month I hope to bring together the three modules described so far, and present the Mark I Controller Board. This performs all the functions necessary to combine the modules - into a HF exciter. It will contain all necessary DC supplies, changeover modes, control transmit/receive (via push-to-talk), offer adjustable semi-break-in for CW *and* control receiver muting and aerial change-over. I will then describe how to make all the inter-connections to the receivers, and summarise any modifications.

COMPONENTS LIST

Resistors (All ¼ W 5% carbon film)

R1	33k
R2	150R
R3,7	390R
R4,9,16	100R
R5,11	3k9
R6	2k7
R8	470R
R10,12,13,	18k
R14	120k
R15,17	10k

Potentiometers

VR1	10k preset

Capacitors

C1,2	39p ceramic
C3,4,8,16	100n monolithic
C5,6,10	10n monolithic
C7 - see text.	
C9,15	1u electrolytic
C11,12	0.22uF tant
C13,14	47n monolythic
VC1	35p variable preset

Semiconductors

Q1,5	BF256
Q2	ZTX3866
Q3,4	ZTX108
D1	1N4148

Miscellaneous

X1	10.700 crystal
F1	CFSH 10.7M1 ceramic filter
PCB	

Your Reactions......	Circle No.
Excellent - will make one	9
Interesting - might make one	10
Seen Better	11
Comments	12

S.E.M. UNION MILLS, ISLE OF MAN
Tel: MAROWN (0624) 851277

SENTINEL 2M LINEAR POWER/PRE-AMPLIFIERS.
Now feature either POWER AMP alone or PRE-AMP alone or both POWER AND PRE-AMP or STRAIGHT THROU when OFF. Plus a pre-amp GAIN control from 0 to 20dB. N.F. around 1dB with a neutralised strip line DUAL GATE MOSFET.

Ultra LINEAR for all modes and R.F. or P.T.T. switched. 13,8V nominal supply. SO239 sockets.
Three Models:

1. **SENTINEL 36** Twelve times power gain. 3W IN 35W OUT. 4 amps. Max. drive 5W. 6" × 2½" front panel, 4¾" deep. **£62.50 Ex stock.**
2. **SENTINEL 50** Five times power gain. 10W IN 50W OUT. Max. drive 16W 6 amps. Same size as the Sentinel 35. **£74.50 Ex stock.**
3. **SENTINEL 100** Ten times power gain. 10W IN 100W OUT. Max. drive 16W. Size: 6½" × 4" front panel, 3½" deep. 12 amps. **£100 Ex stock.**

All available less pre-amp for £8.00 less.

POWER SUPPLIES for our linears 6 amp **£34**. 12 amp **£49**.

SENTINEL AUTO 2 METRE or **4 METRE PRE-AMPLIFIER**
Around 1dB N.F. and 20dB gain, (gain control adjusts down to unity). 400W P.E.P. through power rating. Use on any mode. 12V 25mA. Sizes: 1½" × 2½" × 4". **£28.00* Ex stock.**

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

SENTINEL STANDARD PRE-AMPLIFIER. £15 Ex stock.

PA3. 1 cubic inch p.c.b. to fit inside your equipment. **£10 Ex stock.**
70cm versions of these (except PA5) **£4.00 extra. All ex stock.**

S.E.M. TRANZMATCH
The most VERSATILE Ant. Matching system. Will match from 15-5000 Ohms BALANCED or UNBALANCED at up to 1kW. Link coupled balun means no connection to the equipment which can cure TV1 both ways. SO239 and 4mm connectors for co-ax or wire feed. 160-10 metres TRANSMATCH **£69.60 Ex stock**, 80-10 metres **£62.60**. EZITUNE built in for **£19.50 extra**. (See below for details of EZITUNE). **All ex stock.**

3 WAY ANTENNA SWITCH 1Kw SO239s £15.00.

S.E.M. 2 METRE TRANZMATCH. 5½" × 2", 3" deep. SO239s £24.90 **Ex stock.**

S.E.M. EZITUNE
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 50 Ohms into your transceiver. Fully protected, you can transmit through it, save your P.A. and stop QRM. **£25.00* Ex stock.**

S.E.M. AUDIO MULTIFILTER. To improve ANY receiver on ANY mode. The most versatile filter available. Gives "passband" tuning, "variable selectivity" and one or two notches. Switched Hi-pass, Lo-pass, peak or notch. Selectivity from 2.5KHz to 20Hz. Tunable from 2.5KHz to 250Hz. PLUS another notch available in any of the four switch positions which covers 10KHz to 100Hz. 12V supply. Sizes: 6" × 2½" front panel, 3½" deep, all for only **£57.00 Ex stock.**

SENTINEL AUTO H.F. WIDEBAND PRE-AMPLIFIER 2-40MHz, 15dB gain. Straight through when OFF. 9-12V. 2½" × 1½" × 3". 200W through power. **£19.55 Ex stock.**

SENTINEL STANDARD H.F. PRE-AMPLIFIER. No R.F. switching. **£12.62* Ex stock.**

S.E.M. IAMBIC KEYER
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.**

AN IMPORTANT NEW RECEIVER BREAKTHROUGH
Following our development of an rx for commercial watchkeeping, we are producing this for the amateur.
Although this is a very small and economically priced unit, it is NOT a "toy", as the spec below shows. It is ideal as a first receiver for the beginner or an additional one for the shack or pocket.

*IF Breakthrough, NONE; *IMAGE, NONE; *Selectivity ±2KHz; *OUTPUT, 1W; *Sensitivity .1 uV; *9-12V, 20mA quiescent; *2½" × 6" × 3"; *OVERLOAD, Wanted sig. 30 uV, UNWANTED, 100 MV. 50KHz away. No degredation; *Case: Ca. plated steel. Black Al. cover; *Freq.: 3.5-3.8MHz (80 metres); *Modes: SSB/CW.
Since nothing like this has appeared before, you may be a little sceptical, (especially when you get to the price). So if you are not delighted or amazed with its performance, we will refund your money in full if it is returned within 14 days.
PRICE: £39.00.

12 MONTHS COMPLETE GUARANTEE INCLUDING ALL TRANSISTORS.

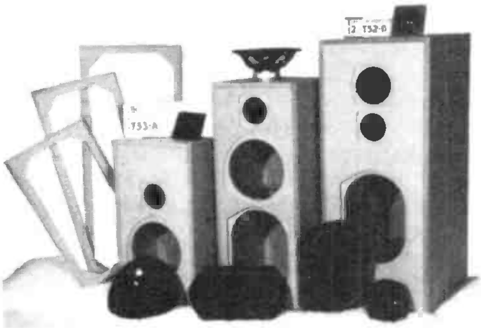
Prices include VAT and delivery. C.W.O. or phone your credit card number for same day service.
*Means Belling Lee sockets, add £1.90 for SO239s or BNC sockets. Ring or write for more information. Place orders or request information on our Ansaphone at cheap rate times.

165 for further details

KEF

Constructor Series Speakers

IT'S
SO
EASY



Have fun, save money, building a Kef design with a Wilmslow Audio CS Total kit.
No electronic or woodworking knowledge necessary and the end result is a proven top-quality design that you'll be proud of.
Each kit contains all cabinet components, accurately machined for easy assembly, speaker drive units, crossovers, wadding, grille fabric, terminals, nuts, bolts, etc.
The cabinets can be painted or stained or finished with iron-on veneer or self adhesive woodgrain vynil.
Easy foolproof assembly instructions supplied. Set of constructor leaflets sent free on receipt of large S.A.E.

Prices:	CS1 (As 101)	**£110**	pr. inc. VAT, plus carr./ins. £ 5.50
	CS1A (simplified LS3/5A)	**£103**	pr. inc. VAT, plus carr./ins. £ 5.50
	CS3 (as 103.2)	**£129**	pr. inc. VAT, plus carr./ins. £10.00
	CS5 (as Carlton II)	**£192**	pr. inc. VAT, plus carr./ins. £15.00
	CS7 (as Cantata)	**£250**	pr. inc. VAT, plus carr./ins. £18.00

WILMSLOW AUDIO
The firm for Speakers

☎ 0625 529599

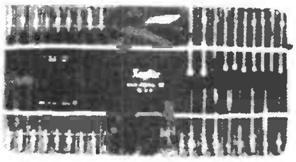
35/39 Church Street, Wilmslow, Cheshire SK9 1AS
1982 Catalogue — £1.50 post free
Lightning service on telephoned credit card orders!

166 for further details

Versatile Professional Hand Tools

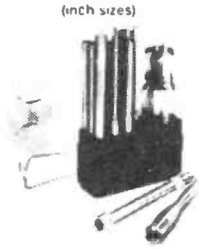
'SERIES 99' from XCELITE

99MP Multi-purpose tool kit



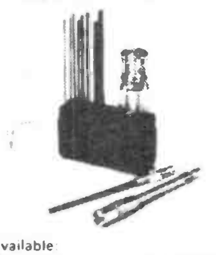
All most needed 99 Series tools etc, snips or other tools.

99PS50 13pc. S/driver, n/driver set.
(inch sizes)



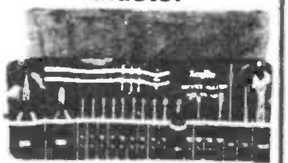
Also available with metric sizes Ref. 99PS51mm

99PS40. Allen Hex Socket S/driver set (inch sizes)



Also available:
99PS41mm (metric).
99PS41mmBP (metric ballpoint).
99PS40BP (inch sizes—ballpoint)

99SM Service Master



Versatile 23 pc set of quality tools in roll-up, plastic coated canvas case. Quick change tools and tool combinations for assembly and service work.

Check our prices **Complete** Xcelite catalogue freely available on request from

SPECIAL PRODUCTS DISTRIBUTORS LTD.
81 Piccadilly, London W1V OHL
Tel. 01-629 9556. Cables: Speciprod, London, W.1
Telex 265200 (Answerback RACEN G)

The 99 Series is **the** complete selection of interchangeable tools

167 for further details

REWTEL UPDATE

Rewtel has been in operation for a couple of months. Roland Perry assesses the current state of play and looks at some of the features to be added to the service in the near future.

REWTEL has now been up and running for a few months, including a period at the PCW show (see last month's R&EW). Many suggestions have been received from intrepid users of the system, most of which have been incorporated into the software which provides the service. Our energies are now fully occupied extending the range of information available, rather than tinkering with the day-to-day operation of the service. Much of the new information being made available is restricted to subscription holders-so why not become a subscriber and help us to extend the service even further.

A major advance in information access has been achieved by using every word on a page as a keyword. To retrieve a page, by using keywords, the operator should specify enough words to uniquely identify the information required. The more words used in the search the longer the search will take, but if sufficiently 'unusual' words are used, then the search will be of manageable proportions. Should the words supplied indicate more than one page, then the various page titles available will be displayed. Faced with a selection of titles a secondary access method becomes apparent. Each page has a symbolic page number (eg *6667) and direct access to that page can be acheived simply by typing its number; either after the normal REWTEL prompt or at the continue search prompt.

Everything typed into the computer is logged (big brother is watching you !) and we can therefore observe the way in which users operate REWTEL. We see that very little use is made of the keyword editing facilities, maybe through lack of understanding, so here is a brief repetition of the rules. The last line of keywords used is remembered and can be added to or subtracted from by using a + or - as the first character of the next line typed at the prompt. The computer will then display the edited keywords. To inititate a search, using the edited keywords, type a single / as the next input line (followed by return of course). The addition feature is the most useful, particularly when a set of keywords results in only a few titles or perhaps a 'PAGE1' 'PAGE2' combination. To avoid having to subtract keyword(s) immediately after adding them they should be typed on a line with a / as the first character. This initiates a single search using the new keywords added to the existing ones.

WHAT IS THERE ON REWTEL

Information about new products is available to all users and is identified by the keyword 'UPDATE'. These pages are basically an overflow from the new products pages in R&EW. Book reviews and further coverage of magazine projects are available together with corrections of mistakes and cumulative indexing.

REWTEL BULLETIN BOARD

The 'Chalk' facility allows the REWTEL user to leave bulletins for other users and for the system operator. Messages to the operator requiring a reply will usually result in a bulletin from the operator. Access to all the messages is gained by the same keyword searching facilities as are available for UPDATE pages. The keyword BULLETIN will concentrate the search to bulletin board pages only and it is usual to expect the names of both the sender and audience somewhere in the bulletin. All the bulletins are editied and corrected before being placed on the system so minor slip-ups when inputting are not disasterous. To send a message use the keyword 'CHALK'.

WORLD OF RADIO AND ELECTRONICS

In conjunction with Ambit International the contents of the Word of Radio and Electronics catalogue is available for inspection. Parts can be identified by the use of keywords (suggestions on each page of WRE), descriptions, Ambit part numbers and even an additional facility of cross-references with RS and Farnell part numbers.

The pages containing book abstracts are also keyed by the keyword 'BOOKTEL' and will be extended beyond the contents of WRE as more titles are added.

SUBSCRIPTION SERVICES

Screen Formatting. The standard REWTEL page is 16 lines of 64 characters, although the last line is not completely sent to avoid losing the first line of the page on a 16 line scrolling VDU. REWTEL waits until a return is typed before continuing to the next prompt. Subscribers may describe to us a smaller screen format (eg 63 characters a line) to avoid rollover problems. **Further Information.** Another facility available to subscribers is the opportunity to request further information arising from UPDATE pages and any other pages that may indicate that there is more (paper) that could be sent. This is in addition to accepting feedback from the R&EW service card via REWTEL. Use the keyword 'BINGO'. **REWSHOP (Components, kits and books).** Subscribers can benefit from the ability to place orders in the REWSHOP obtaining instant feedback of the stock availablity and any price changes. A direct link to the invoicing system will give such an order high priority. This facility is entered by using the keyword 'SHOP'.

REWTEL SUBSCRIPTION FORM

★ ★ Subscription Rate: £10 per annum. ★ ★

NAME: ....

ADDRESS: ....

....

TELEPHONE NO: ....

CREDIT CARD: ....

PASSWORD: ....

DATE: ....

SUBSCRIPTION NUMBER: ....

TERMINAL/PERSONAL COMPUTER

† LINES/SCREEN : ....

* CHARACTERS/LINE: ....

MODEM: ....

† WE WILL NOT TRANSMIT MORE THAN THE LAST CHARACTER ON THE LAST LINE.

* BEFORE ROLLOVER

THE BBC MICRO AS AN RS232 TERMINAL

Based on a program supplied by Andrew Holt.

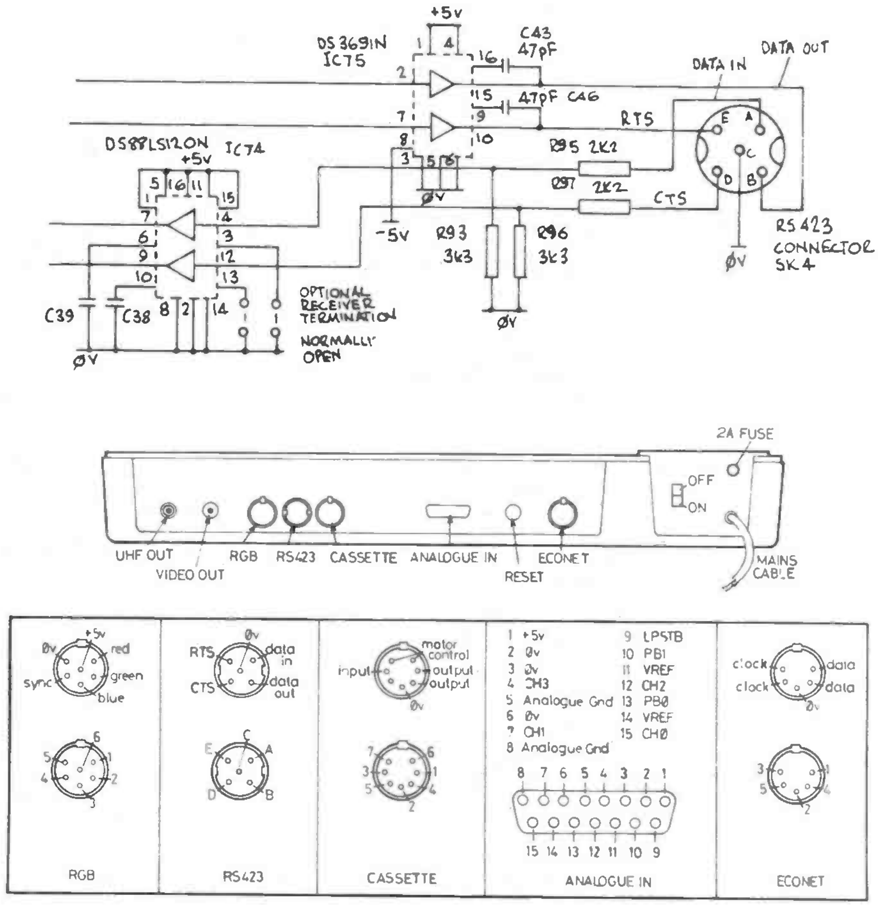


Figure 2: The BBC micro's RS232 interface and rear panel connection

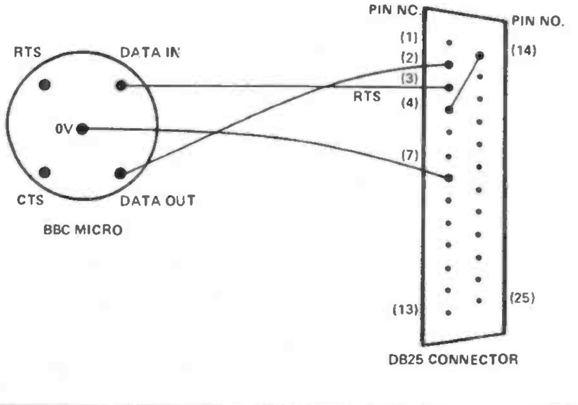


Figure 3: Connections to the modular technology modem.

The model B BBC MICRO already contains all of the hardware required to turn it into a very respectable RS232 terminal emulator.

This article presents all the information required to enable the conversion to be undertaken and consists of a short program, plus some wiring work.

THE SOFTWARE

The program listing is given in *Fig. 1*, and will turn a BBC Micro into a full or half duplex 300 Baud terminal, with a display of 25 lines of 80 characters.

The program listing should be typed in as shown and is set up to run with REWTEL or most other telephone databases. The software is capable of generating the full range of ACSII characters including shift and control versions.

If a parallel printer is available then functions keys 1 and 2 will stop and start copying data to the printer. The break key is re-programmed to automatically restore the program if required, and function key 9 will re-RUN it.

The program is quite straightforward due to the sophistication of the BBC micro's operating system.

If the flag ECHO% is false then the 'terminal' is in full duplex mode. (ie Characters typed on the keyboard will be sent directly to the remote-end without being displayed on the screen. They will only be displayed if they are echoed by the remote end. This is the mode in which most systems operate, alternatavely if the flag EHCO% is set TRUE then the terminal will be in half duplex, and characters typed on the keyboard will be locally echoed on the screen.

Having typed the program in as shown with ECHO% set to false type RUN, the screen format should change to 25 lines of CYAN, with interspersed black rules.

Typing characters on the keyboard should have no effect on the display. Now short together the data in and data out from the BBC micro. (See *Fig.2*). This simulates the remote end echoing characters and keyborad strokes should cause the corresponding character to appear on the screen.

Once all is well then the BBC micro can be connected to a suitable MODEM, *Fig. 3* shows the method of connection to MODULAR TECHNOLODGY acoustically coupled modem. The connections required for other types of modem should be fairly self evident from the above description. ▶

```
 10 REM TERMINAL PROGRAM FOR BBC COMPUTER
 20 REM (C) 1982 BY ANDREW D. HOLT
 21 REM       AND R&EW
 28 REM ECHO% indicates whether characters sent are to be echoed
 30 ECHO%=FALSE
 40 CHFLAG=FALSE
 48 REM let print receive line feeds
 50 *FX 6,0
 54 REM
 55 REM set up some useful function keys
 56 REM "0" for 'break'
 60 *KEY 0 "|[|A"
 70 *KEY 10 "OLD|M*FX 6,0|MLIST|M"
 75 REM "1" to start printer
 80 *KEY 1 "|[|B"
 85 REM "2" to stop printer
 90 *KEY 2 "|[|C"
 95 REM "3" to send 'escape'
100 *KEY 3 "|[|["
110 *KEY 9 "RUN|M"
115 REM compile assembler routines
120  PROCCOMPILE
125 REM 25 lines of 80 columns
130  MODE 3
135REM switch off Escape (o/s version  0.1 only)
140?&226=&FF@z
145 REM set colours (black on cyan) for best readability
150 VDU19,1,0,0,0,0,19,0,6,0,0,0,12
152 REM mode% is used to set transmission mode -
153 REM 2 = 7 bit even parity 2 stop bits
154 REM 10 = 7 bit even parity 1 stop bit
155 REM 18 = 8 bit no parity 2 stop bits
156 REM 22 = 8 bit no parity 1 stop bit
160 mode%=10
165 REM reset acia
170 ?&FE08=3:?&FE08=mode%
175 REM set speeds (300 baud)
180 *FX 8,3
190 *FX 7,3
195 REM main loop starts here
200 STA%=?&FE08:IF 1 AND STA% THEN 270
220 CH=INKEY(0)
230 IF CH=-1 THEN 200
240 PROCSENDCH(CH)
250 GOTO 200
260 REM CGET is an assembler routine to get a character
262 REM and display it if it is 'safe'
270 CALL CGET
280 GOTO 200
375 REM this is a procedure to send a 'break'
380 DEF PROCSENDBK
390 LOCAL X
400 X=TIME
410 ?&FE08=mode% OR &60
420 REPEAT UNTIL TIME > X+5
430 ?&FE08=mode%
440 ENDPROC
445 REM procedure to decide what to do with keyboard character
450 DEF PROCSENDCH(CH)
460 IF CHFLAG THEN PROCESCAPED(CH):ENDPROC
465 REM 'Escape' is used as a flag
470 CHFLAG = CH=&1B:IF CHFLAG THEN ENDPROC
480 A%=CH:CALL CPUT%
490 IF ECHO% THEN PRINT CHR$(CH);
500 ENDPROC
505 REM Esc Ctrl A for 'Break'
506 REM Esc CTrl B(C) for printer on(off)
510 DEF PROCESCAPED (CH)
520 CHFLAG=FALSE
530 IF CH=1 THEN PROCSENDBK:ENDPROC
540 IF CH=2 OR CH=3 THEN VDU CH:ENDPROC
550 ?&FE09=CH
560 ENDPROC
570 DEFPROCCOMPILE
580 DIM CPUT%100:P%=CPUT%:[OPT 2:STA &FE09:RTS:]
590 ITC=P%:PTC=P%
600 CGET=P%:OSWRCH=&FFEE
610 FOR X%=0 TO 1
620   P%=CGET
630   [OPT 2:LDA &FE09:AND #&7F:BEQ ITC
640   CMP#&7F:BEQ ITC:CMP #&1F:BPL PTC
650   CMP #14:BPL ITC:CMP #7:BMI ITC
660   .PTC JSR OSWRCH:.ITC RTS:]
670   NEXT X%
680 ENDPROC
```

Figure 1: Software routine to convert the BBC micro into a full or half duplex 300 Baud terminal.

MICROWAVE MODULES LTD

FROM THE HALL OF FAME No. 2

MTV435

Price: £149 inc VAT (p + p £2·50)

435MHz 20 WATT ATV TRANSMITTER
Two channel, two video inputs, internal aerial changeover switching internal waveform test generator

MML144/30-LS

Price: £69.95inc VAT (p + p £2·50)

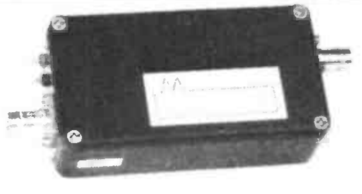
144MHz 30 WATT LINEAR AMP AND RECEIVE PREAMP
Switchable input, 1 or 3 Watts, suitable for use with rigs such as C58, FT290-R, TR2300 etc

MML144/50-S

Price: £85 inc VAT (p + p £2·50)
MML144/100-S pictured above

144MHz 50 WATT LINEAR AMP AND RECEIVE PREAMP
Suitable for 10 Watt transceivers, RF Vox, switchable PA and preamp

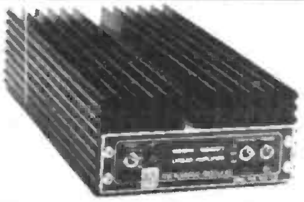
MMC435/600



Price: £27·90 inc VAT (p + p £1)

435MHz ATV RECEIVE CONVERTER SUITABLE FOR UHF TV SETS-CH35
Gain: 25dB Noise figure: 1·9dB
Fully compatible with our MTV435 transmitter

MML144/100-LS



Price: £159.95 inc VAT (p + p £3)

144MHz 100 WATT LINEAR AMP AND RECEIVE PREAMP
Switchable input, 1 or 3 Watts, suitable for use with rigs such as C58, FT290-R, TR2300 etc

MML144/100-S

Price: £139.95 inc VAT (p + p £3)

144MHz 100 WATT LINEAR AMP AND RECEIVE PREAMP
Suitable for 10 Watt transceivers RF Vox, switchable PA and preamp

MM1000 KB

Price: £99.95 inc VAT (p + p £3)

MORSE KEYBOARD—
12-30wpm, 4 × 256 character memories, 80 character keyboard buffer, Meteor Scatter high speed facility—

MM2001

Price: £189 inc VAT (p + p £2·50)

RTTY TO TV CONVERTER
Suitable for:
45·5, 50, 75 and 100 baud RTTY, 110, 300, 600 and 1200 baud ASCII, with printer output facility

MMT1296/144

Price: £115 inc VAT (p + p £2.50)

THE MORSETALKER
Speech synthesised Morse Tutor. 2-20wpm, variable group length. Ideal for amateur, post office and Maritime Exams.

OUR ENTIRE RANGE OF PRODUCTS IS DESCRIBED IN OUR 1982 CATALOGUE. PLEASE SEND 40P IN STAMPS FOR YOUR COPY.

ALL MICROWAVE MODULES PRODUCTS ARE FULLY GUARANTEED FOR 12 MONTHS (INCLUDING PA TRANSISTORS)

Access BARCLAYCARD VISA
WELCOME

MICROWAVE MODULES
BROOKFIELD DRIVE, AINTREE, LIVERPOOL L9 7AN, ENGLAND
Telephone: 051-523 4011 Telex: 628608 MICRO G
CALLERS ARE WELCOME, PLEASE TELEPHONE FIRST

HOURS:
MONDAY-FRIDAY
9-12.30, 1-5.00

179 for further details

INSIDE COLO

Michael Graham looks at came

WHILST MANY READERS of R&EW will be familiar with the general principles behind the operation of a colour TV set, the systems within a colour TV camera are less likely to be understood. It may seem logical to suppose that a camera's circuits will be rather like a TV's, but in reverse - this, however, is NOT the case.

An article such as this, is not the place to describe the basic characteristics of a TV signal. So, it will be assumed that readers are familiar with the general nature of a TV signal with its line and frame sycs, luminance and chroma subcarrier signals.

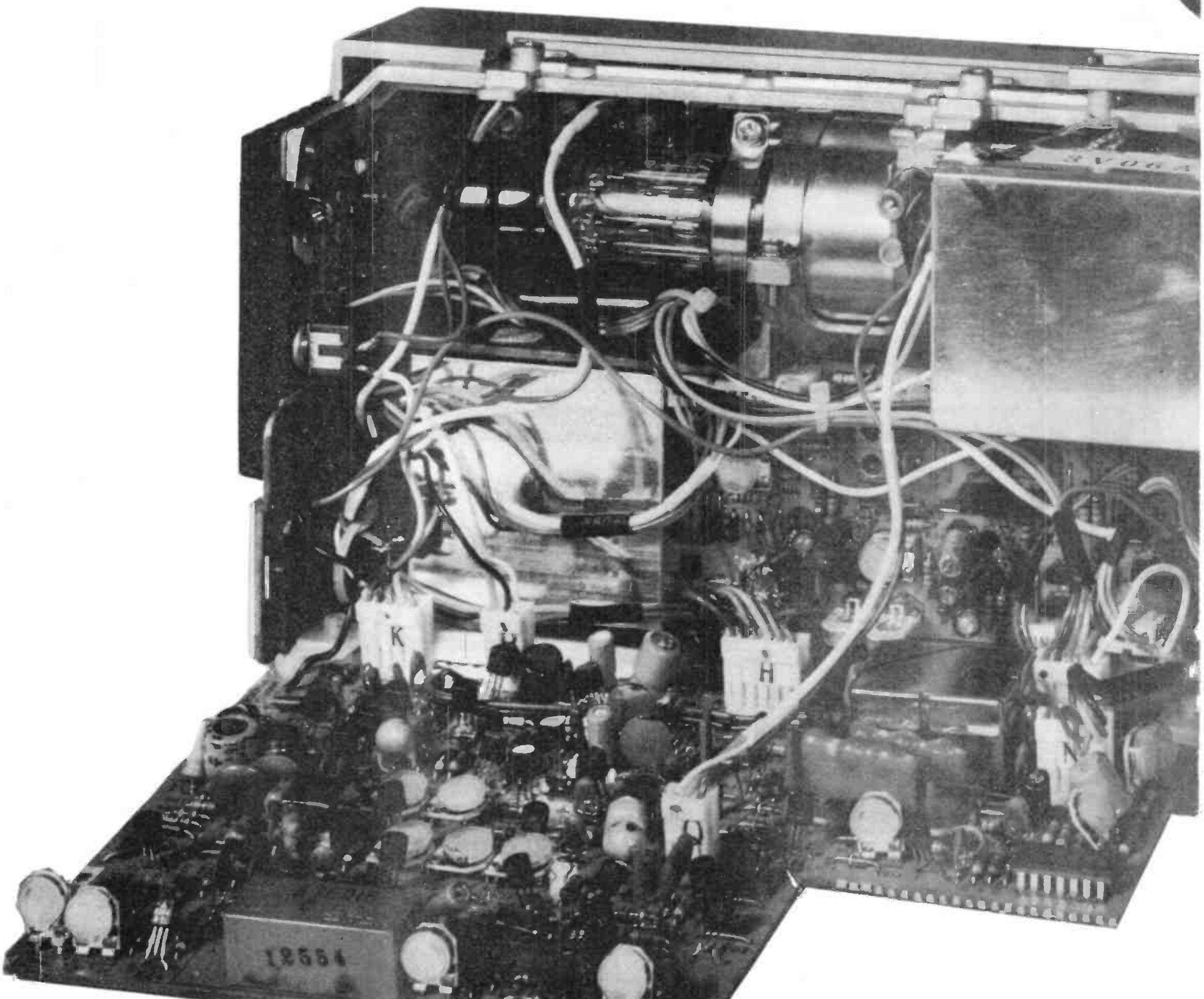
IN THE BEGINNING

Following the general principle that it's better to 'begin at the beginning', rather than any where else, the first requirement of a camera is that light (from the object to be 'filmed') is brought to focus on the faceplate of the camera's vidicon tube. We'll not delve too deeply into the optics of a multi-element lens system, but merely point out that the quality of the final video output (from the camera) can obviously be no better than the image formed by the lens. That is why the lens system, in any camera, is one of the most important elements and often one of the most costly.

When selecting a camera, make sure that the lens features the zoom range that you will require and that the maximum aperture is as large as possible this latter point being of particular importance if a lot of indoor use (low light levels) is anticipated. The general 'quality' of a lens will be more difficult to assess, but many cameras use lens systems from companies such as Canon. Such a recognisable name on a lens is a reasonable assurance of quality.

LIGHT TO ELECTRONS

The central part of any camera (and in particular the Ferguson Videostar 3V20 which will be examined first) is the pick-up tube. In the 3V20 this is described as a '2/3" electrostatic focus/electromagnetic deflection, unipotential focusing type vidicon tube, having a colour separation stripe filter attached in front of the photo conductive film of the vidicon target'. Quite a mouthful, but reference to *Fig 1* and an orderly examination of the translation of the image formed (on the tube's faceplate) to a



UR TELEVISION CAMERAS

ra circuitry from the vidicon to the final encoded video signal

modulated beam current, should make things clear - we hope!

The tube face is scanned from bottom left to top right by an electron beam, emitted by the vidicon's cathode. This process is rather like a reverse CRT tube; scanning being a back-to-front version of that encountered in a TV set (to cope with the fact that the image formed by the lens is upside down). The electron beam, instead of being modulated by a video signal to cause variations in a phosphor on the tube face, has its current varied by the instantaneous level of incident light at any point on the tube's photoconductive layer. *Figure 2* shows the make-up of the tube's face plate, being a slice through the various layers (we'll come to the stripe filter in a moment), while *Fig. 3* shows the target area from a head-on viewpoint.

The electron beam is deflected and focussed by a combination of electromagnetic and electrostatic systems. After leaving the cathode, the electrons are accelerated by electrode G2 - an alignment magnet between the beam control electrodes, G1 and G2, ensures that the electron beam is equidistant from (and parallel to) the sides of the tube.

The beam then passes through an 'electronic lens' formed by electrodes G3, G4 and G5 - these ensure that the beam, when it strikes the face plate, is consistently at right angles to the target's surface. This is important if an adequate resolution is to be maintained at both central and peripheral areas of the target. The beam is then deflected by an external magnetic field produced by a set of scan coils.

Thus far, the description of the vidicon could apply to a monochrome camera - it is the inclusion of the colour stripe filter at the vidicon's surface that marks the difference between colour and mono systems.

GAINING ONE'S STRIPES

Harking back to a colour CRT tube, it will be remembered that such tubes use an additive mixing of three colours, Red, Green and Blue to produce any hue/saturation of colour that is required. A colour camera must 'analyse' the incident light falling on the vidicon and break it down into these three colours. The stripe filter may thus be expected to pass only red, green or blue light at various points across the tube s surface.

Figure 4 reveals that this is not the case - the various elements of the filter passing green, cyan and white. The reason for this choice of 'stripe characteristics' becomes clearer if the constituent colours of each stripe are examined. The green stripe obviously cannot be broken down any further, but the cyan stripe, when ▶

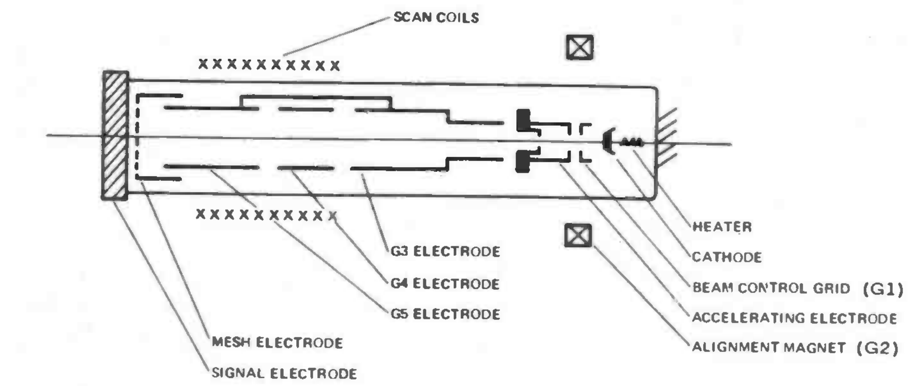


Figure 1: Simplified outline of a typical Vidicon tube with colour separation filter.

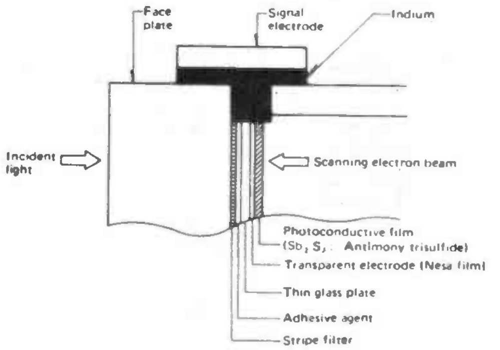
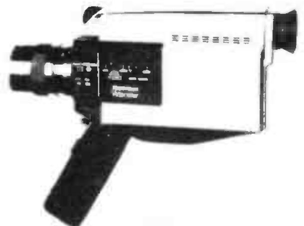


Figure 2: The construction of a Vidicon's target, showing the various layers interposed between the scanning electron beam (right hand side) and the image formed by the lens on the tubes face place.



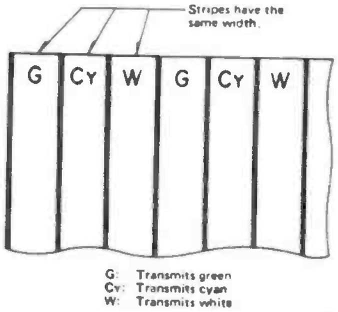
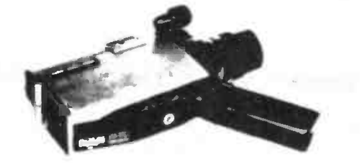


Figure 4: Detail of the colour stripe filter.



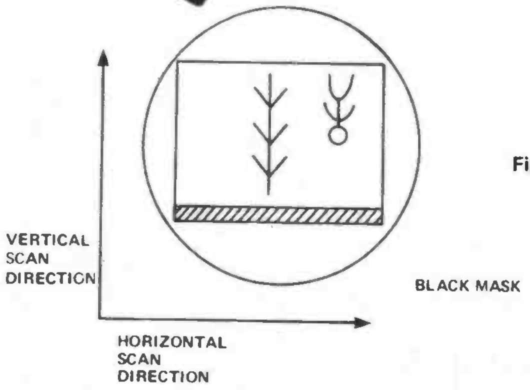


Figure 3: A 'head-on' view of the Vidicon's face plate.

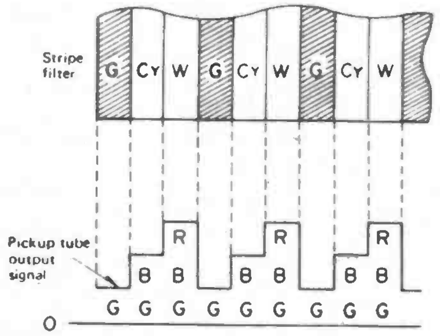


Figure 5: The output signal, in terms of primary colours, as the elctron beam scans the Vidicon's target (assuming white incident light).

broken down passes both Blue and Green but No red (the white stripe passes all three colours).

Thus a repetitive sequence of Green, Green + Blue, and Green + Blue + Red colour signals results, as the beam scans across the surface of the vidicon tube.

The mask area at the bottom of the vidicon (*Fig 3*), is used to adjust to the dark current of the system.*Figure 5* shows that a step-like signal is the result of incident white light upon the face of the pick-up tube. The waveform is the result of B and R signals being modulated onto a G carrier.

The 'frequency' of modulation will quite clearly depend upon the pitch of the stripes in the filter - the output being a combination of the tri-colour mixed signals (the DC component) and the HF modulation signal (AC components). Without going into the mathematics involved, the HF signal will be a combination of the 'fundamental stripe frequency' (f_1) and its second harmonic. The 3V20 uses a fundamental frequency of $f_1 = 4.1$ MHz and thus $f_2 = 8.2$ MHz.

INTO ELECTRONICS

The block diagram of *Fig. 6* shows that the electronics of the camera can be broken down into a number of discrete blocks. The vidicon's output signal is fed to a multiple-signal colour processing circuit (pre-amplifier, dark current compensation, peak compensation, and AGC circuits), a luminance-signal processor, a colour demodulator, matrix and auto-white circuits.

The details of the colour multiple and luminance signal circuits are beyond the scope of this article (their tasks being to provide an output signal of adequate contrast and stable black- level as well as providing protection to avoid damage to the vidicon tube).

The colour demodulation circuit works on the phase (not amplitude) of the stripe frequency 2nd harmonic to separate the B and R signals. Use of the 2nd harmonic frequency overcomes problems with the small physical size of the vidicon target area.

The G signal can be derived from the Y (luminance) signal and the demodulated B and R signal. The R, G and B signals are taken to a matrix circuit that produces PAL type R-Y and Y-B colour difference signals.

ARE THE WHITES RIGHT?

Any colour camera must take account of the fact that the 'colour' of a subject will depend upon the 'colour temperature' of the light illuminating that subject.

Table one shows there is a wide variation in colour temperature - not only between indoor and outdoor light, but between the 'colour' of daylight - whether the day is overcast or bright.

Most colour cameras include an optical correction filter to compensate for the extremes of colour temerature revealed in the chart. A camera would usually be balanced at around the 3000 °K mark (indoor light) with a filter 'shifting' the neutral point to around 7000 °K.The filter is used for outdoor correction as there will obviously be some light absorbed. Under indoor conditions, light levels are usually lower and a filter may make the difference

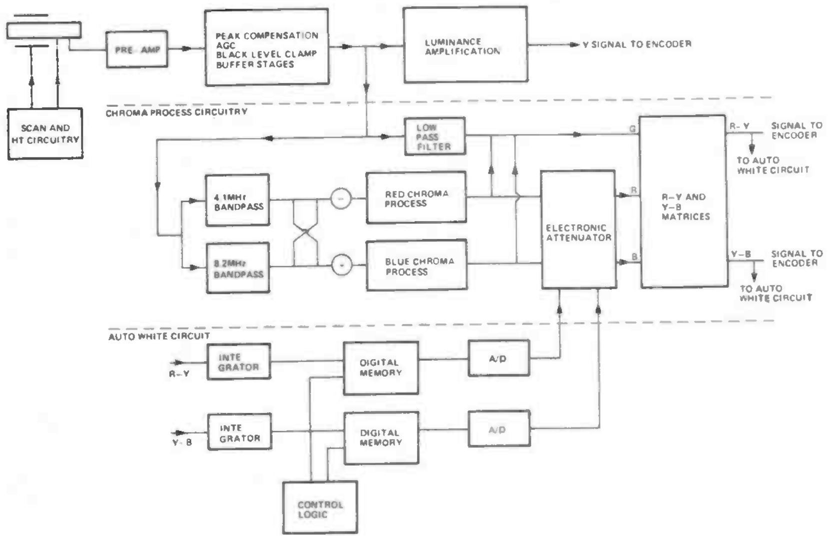


Figure 6: Block diagram of the 3V20 colour camera.

Colour temperature of natural light (°K)		Colour temperature of artificial light (°K)
Clear blue sky	10,000	
Slightly cloudy sky	8,000	
Cloudy Sky and rainy weather	7,000	
		Fluorescent lamp (daylight)
Sunlight		Camera flash bulb
Direct sunlight		
	5,000	Photographic blue bulb
2 hours		Fluorescent tube (white)
	4,000	
1 hour		General flash bulb
	3,500	Fluorescent tube (warm white)
Time after sunrise and before sunset		Photographic tungsten filament lamp
	3,000	Halogen lamp
		Iodine lamp
	2,500	Tungsten-filament bulb
30 minutes		
20 minutes		
Sunrise and sunset	2,000	
		Candlelight

Table one: All light has a 'colour temperature'. It varies a great deal as this table shows.

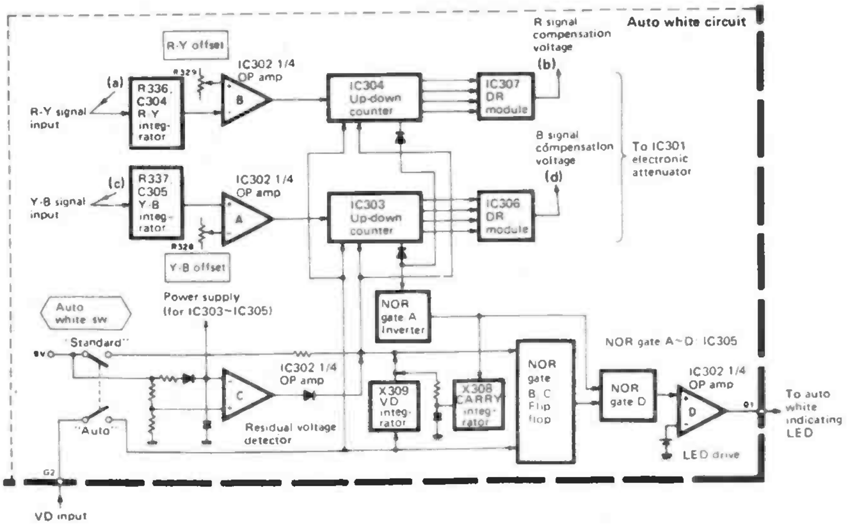


Figure 7: The 3V20's auto white circuit.

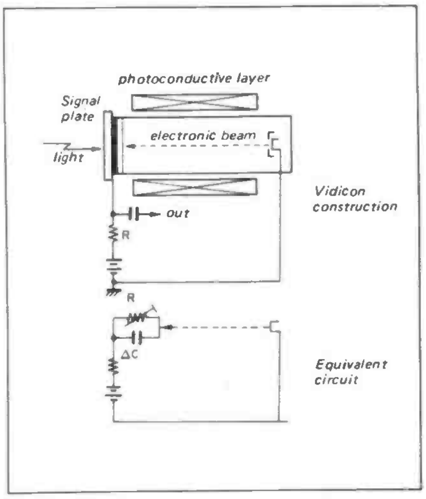


Figure 8: A simplifier outline of a Trinicon tube together with its equivalent circuit.

between an acceptable or not acceptable level of light.

Finer adjustments within the coarse range, defined by the filter, are made by varying the relative levels of the B and R signals. In most cameras this adjustment is made manually, but the 3V20 features an interesting 'auto white' facility.

AUTOMATICALLY RIGHT

The auto-white circuit is designed around the fact that while 'shooting' a black and white scene (under 'standard' light), the colour difference signals (R-Y and B-Y) will have zero amplitude. Under anything other than standard light,these signals will have some *non-zero* component.

When the auto-white circuit is activated, the R-Y and B-Y signals are integrated and compared with a reference voltage (near to zero, but in practice differing from zero by a small amount). These 'difference' voltages are digitised and stored in two up/down counters. The outputs from these counters are converted back to an analogue signal and fed to a pair of electronic attenuators in the R and B signal paths - compensating for any non-standard lighting conditions.

HOUSEKEEPING

The various other functions to be performed by the camera are sync generation, encoding and power supply regulation.

The generation of all sync, control and colour sub-carriers is usually achieved via the HD 44007 IC, a CMOS device that has cornered the market for this sort of function. As for the deflection circuitry it is fairly straightforward as are the power supply sections.

The encoder circuit's job is to bring together all the various sync, chroma, luminance and blanking signals to produce a PAL spec, composite video output signal. *Figure 9* shows that once again this task is largely taken care of by ICs.

SONY'S SYSTEM

The Trinicon system developed by Sony uses a different method for extracting the chroma information from the image formed on the vidicon's faceplate. In a Trinicon camera, the stripe filter consists of Red, Green and Blue stripes, the chroma information is encoded by means of an Index Electrode.

In order to understand the Index Electrode's operation it will be necessary to take a closer look at the way in which a vidicon tube converts the light incident on its face plate into a modulated beam current.

Figure 8 shows a simplified outline of a vidicon tube together with its equivalent circuit considering just one element of the photoconductive layer, which may be thought of as a resistance (whose value varies according to the amount of incident light falling upon it) in parallel with a small capacitance, as the scanning electron beam passes the 'beam' side of the plate assumes the cathode's potential (oV) while the 'signal plate' sides is at target voltage (T). Any light incident on the tube's face will have the effect of discharging the capacitance as the value of the parallel resistance

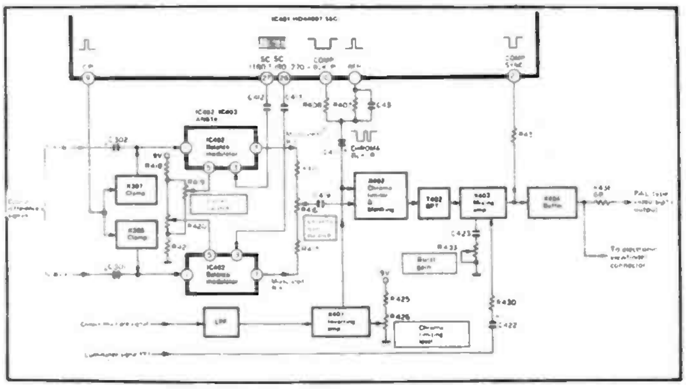


Figure 9: The PAL encoder of the 3V20 camera is largely based on IC devices.

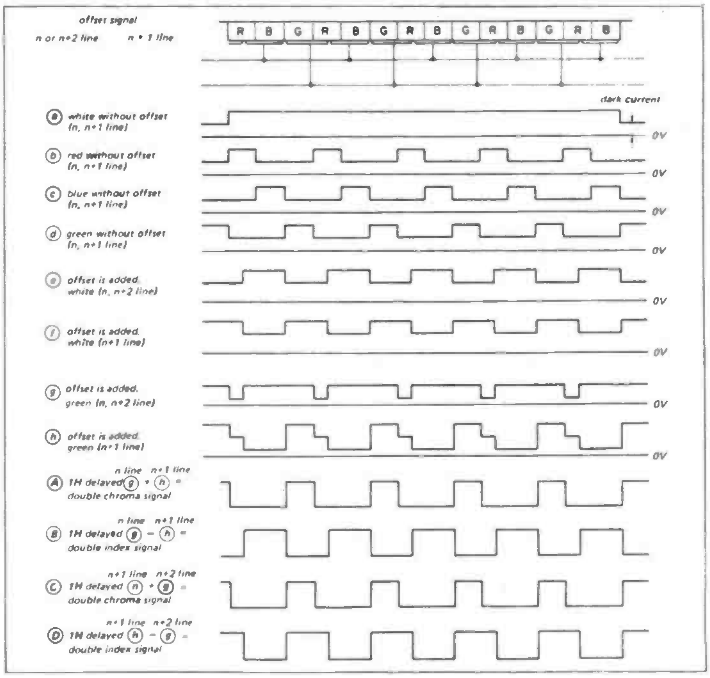


Figure 11: The wave forms present in a Trinicon tube.

is reduced. The next time the beam scans the particular element, it will restore the plates initial conditions, the charge required to do so being supplied by an increase in nominal beam current.

Output current at any instant in time can conveniently be expressed as

$$It = \Delta C \frac{\Delta Vs}{\Delta t}$$

Where is the time that the beam is on a 'picture element'.

Figure 10 shows the position of the indexing electrodes with respect to the photo conductive layer. The indexing electrodes are a series of transparent stripes parallel to the 'colour' stripes, alternate stripes being connected to one of two bus bars. Applying a voltage to an index stripe will raise (or lower) the signal plate voltage along the stripe and the expression for the instantaneous beam current for a picture element along its surface will be a modified version of the one shown above; namely

$$It = \Delta C \frac{(\Delta Vs + \Delta VD)}{\Delta t}$$

where D is the voltage applied to the indexing electrode.

The voltage applied to the indexing electrodes is inverted at the end of each horizontal scanning line. Reference to the block diagram of *Fig. 11* and the timing waveforms of *Fig. 12* will show how the Trinicon's combination of Red, Green and Blue stripes plus the indexing electrode achieves the separation of the three colour signals.

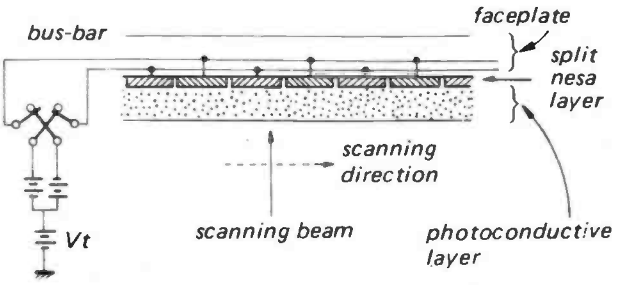


Figure 10: A series of transparent index electrodes placed in front of the photo conductive layer are a feature of Trinicon tubes.

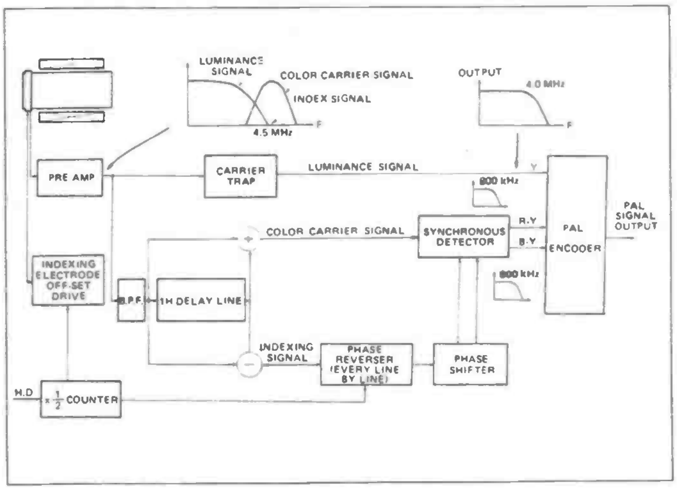


Figure 12: A block diagram of a Trinicon camera.

The first line of *Fig. 12* shows the output of just the Green stripe while the next two lines show the potentials applied to the indexing electrodes.

Adding the indexing offset voltages to the Green output gives the waveforms shown on the next two lines.

The significance of the block marked one line delay in the block diagram now becomes apparent by adding the chroma and index signal from any line together with delayed signal from the previous line produces a signal that is twice the output of the primary chroma signal. Subtracting the same two signals produces an output that is twice the index signal.

The indexing signal and chroma signal, when applied to a synchronous detector produce the familiar R-Y and B-Y signals ready for PAL encoding.

The rest of the trinicon system, white balance, scanning, power supplies etc, follows the pattern outlined for the 3V20.

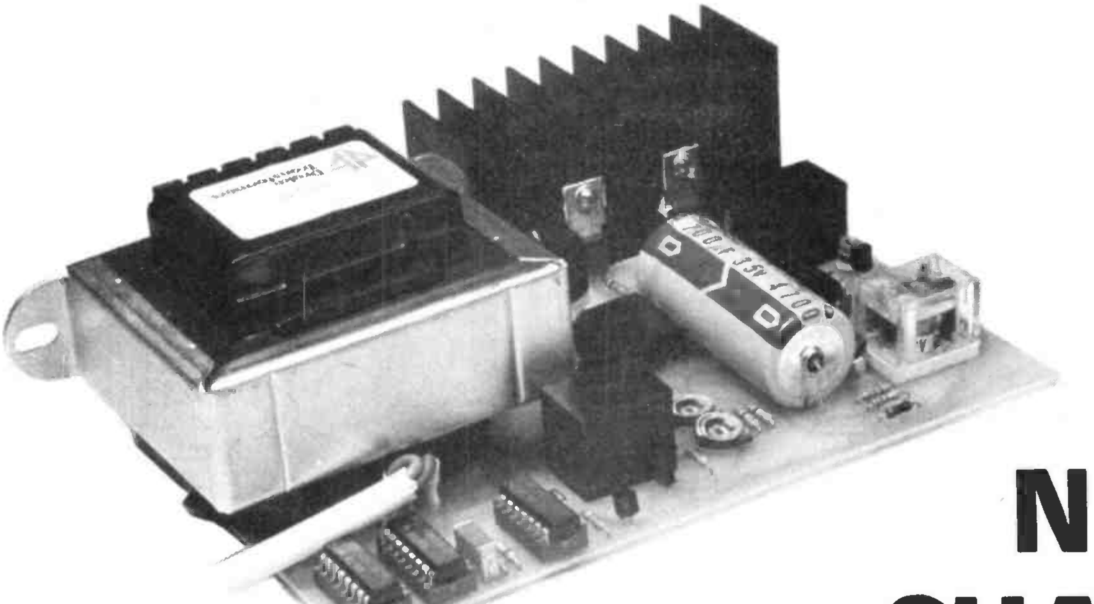
Another point of note in Sony cameras is the optical low pass filter that is placed in front of the vidicon tube. This removes any high frequency component of the scene being videoed, these high frequency signals would cause interference in the colour encoding process if passed to the vidicon tube.

The filter is of a double refraction type which, in effect, slightly blurs the image, forming a double image shifted half the pitch of an individual filter stripe.

The Sony system, using the indexing electrode and delay system is said to offer superior results to encoding systems such as the one adopted by the 3V20. Certainly the quality of results produced by Sony cameras is very good with excellent definition and colour rendition.

OVERVIEW

Many cameras feature an elctronic viewfinder - these follow conventional TV practice, although in miniature, and have no RF circuits to worry about. So, that's about it, a brief look at the various sections of a typical colour TV camera, devices that pack a great deal of electronics into a small light-weight package.



NI-CAD CHARGER

Adrian Barnes presents a novel design for charging your 'run-down' NiCads.

THE **R&EW** NI-CAD CHARGER enables a wide range of Ni-Cads to be given a quick, safe, charge. The circuit monitors the batteries on charge and will shut down if a fault condition is detected.

Our circuit allows the user to decide ultimately what charge current is employed, and uses two VFET's (in parallel) as a constant current source. Four cells may be charged at a time using battery holders, so they're effectively in series. It should be noted that these must be single cells, with the vented tops, such as supplied by Ever-Ready, who also helped with information for this article.

Since the cells are in series, they should all be in approximately the same state of charge - being used usually in fours, this should not present a great problem. If some cells do overcharge a little, they will only dissipate the extra energy as heat - however *prolonged* overcharge will damage the cell. To this end, a monitor point (in the battery) is taken between the third and fourth cells from earth. If the cells are in a vastly different state of charge, or are internally short- circuited, the voltage at this point will be detected and the unit will cease to charge.

When the overall voltage on the battery reaches a certain level the charge changes to a trickle. This is taken as a 'sample', about every thirty seconds, so that the battery has to reach a constant level rather than reverting to trickle charge at a spurious peak. Four arbitrary samples are taken, so the counter is reset if the battery is charged - to ensure this reset (when changing batteries), touch the test point to the negative of the battery connector, turning Q6 and 7 on and Q5 off.

CONSTRUCTION

As usual start with the IC sockets, links and resistors. The transformer and C3 should be left until last - please remember to insulate *all* the mains connections. If desired, the fuse can be mounted remotely, with indicator LEDs to show the state of the relays - that is, charge/sample, fast/trickle and fault.

A PP3 type connector can be used for the output and a small piece of tin plate acts as the test point probe. The PCB is supported by the transformer and the heatsink should be bolted on to the outside of the case.

SETTING UP

Set RV1,2 and 5 to midway, and RV4 fully clockwise to turn Q5 on. Apply a potential to the test point of about 4.8-5V, about the negative end of the battery and adjust RV3 so that RLA2 switches off if the voltage increases above this. Then set RV4 so that the relay switches off if the test point goes below 3-3.2V, above the negative end of the battery.

Adjust RV2 so that the supply voltage across IC4 is 5V. Then, finally, adjust RV5 so that pin 10 of IC4 goes high when the top of RV5 is at 6.1V.

RV1 sets the charge rate, which depends on which cells are being charged. Cells will be damaged if the charge rate is much greater than C/1, (the current necessary to charge the cells in one hour) - the life of the cells being inversely proportional to the current.

As a guide, if the current is set between 1.2 and 1.5 amps, AA cells will charge in about an hour and larger cells will take longer.

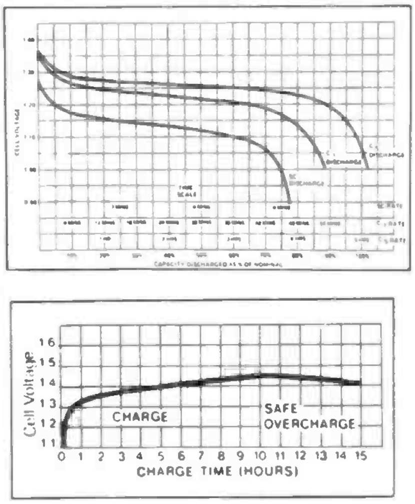


Figure 1. Charge/discharge curves for typical NiCad cells

▶

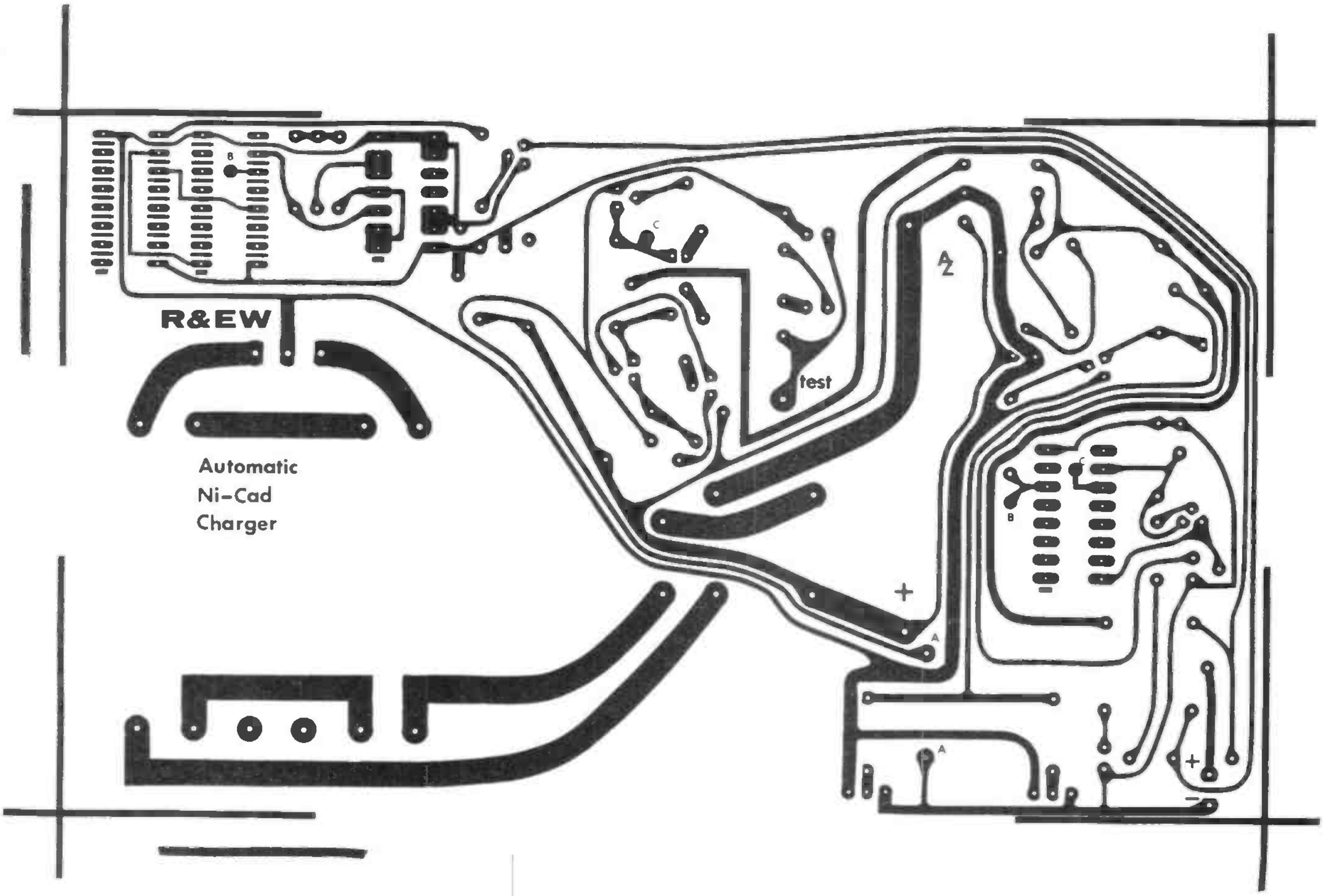
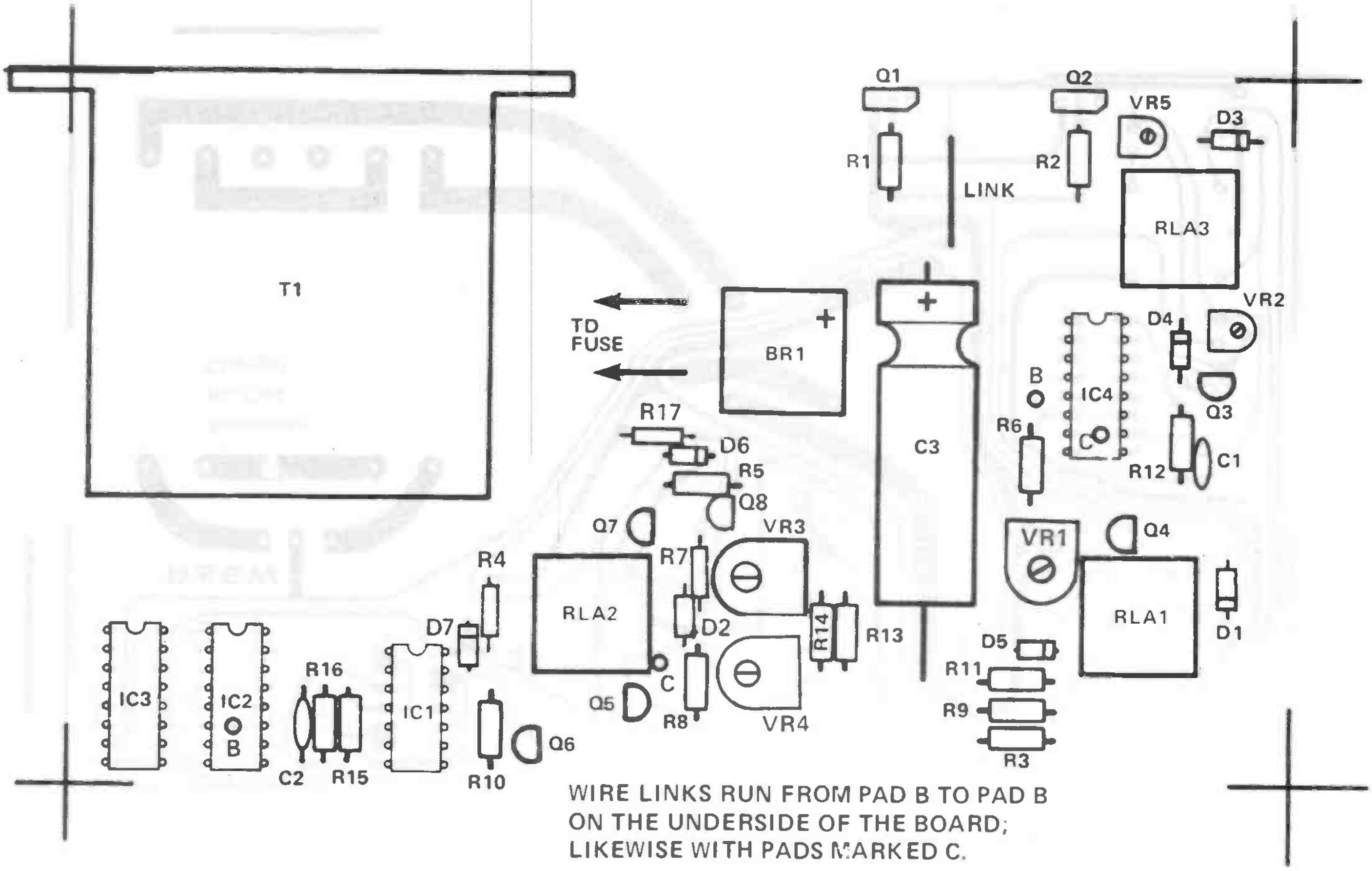


Figure 2: The Ni-Cad charger PCB



WIRE LINKS RUN FROM PAD B TO PAD B ON THE UNDERSIDE OF THE BOARD; LIKEWISE WITH PADS MARKED C.

Figure 3: Component Overlay

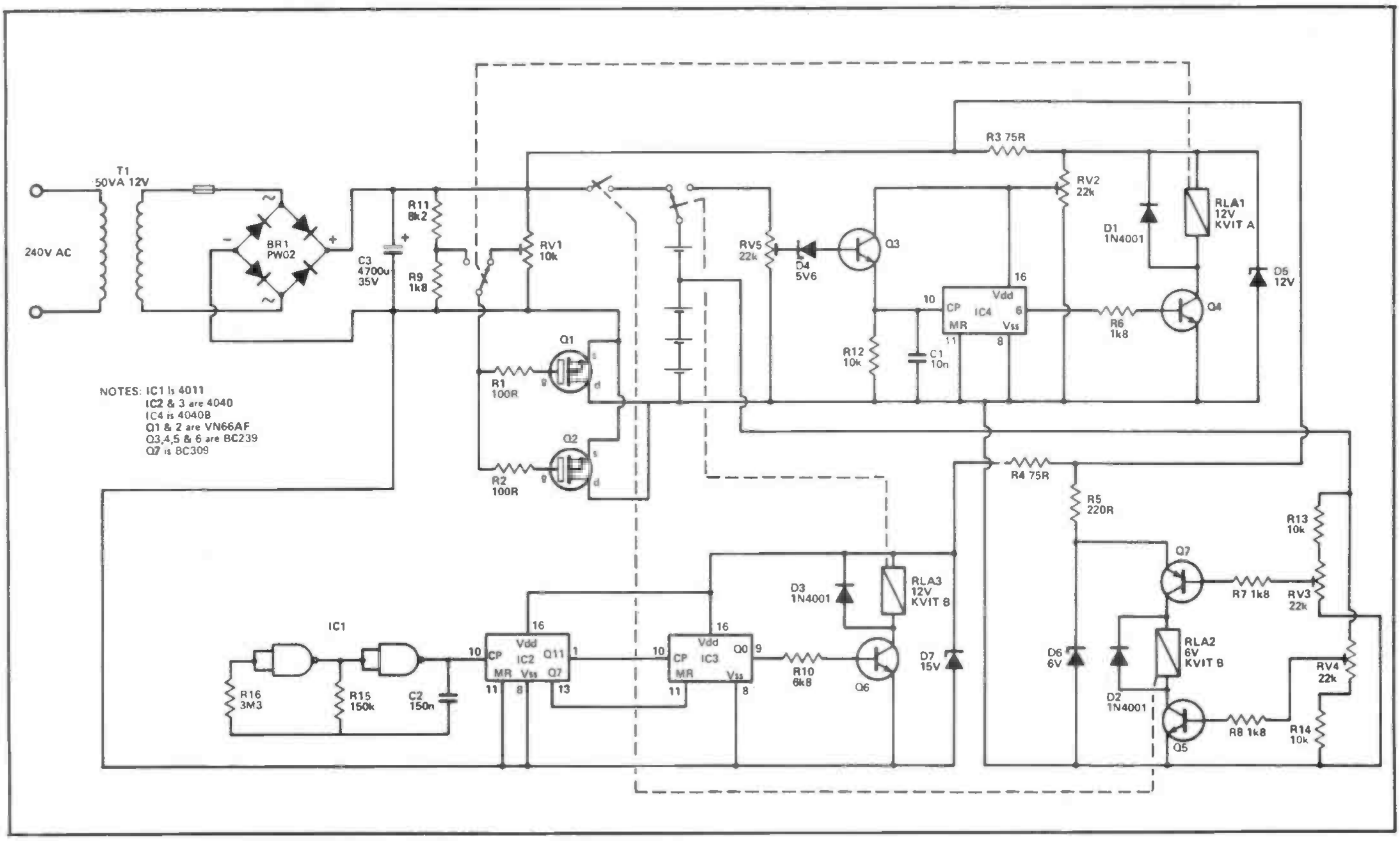


Figure 4: The Ni-Cad charger circuit diagram.

CIRCUIT DESCRIPTION

A normal transformer-rectifier circuit, smoothed by C3, supplies the circuit. The current is controlled, on the negative rail, by two VFET's. VN66AF's are used here, because they are fairly cheap and easy to mount onto heatsinks - two are used to give more current capability. R9 and R11 set the trickle current and RV1 the charge current, which is switched by RLA1.

RLA1 is controlled by IC4 and Q3. A potential divider, RV5, lowers the voltage from the battery being sampled and Q3 and D4 provide a switch at a given voltage. The supply voltage on IC4 is adjusted, along with the collector voltage on Q3, in order to lower the triggering threshold of IC4. R12 pulls the input down, when Q3 is turned off, and C1 decouples it. The Q2 output of IC4 (pin 6) is used, so that Q4 changes state every fourth time that Q3 does.

The sampling is controlled by IC1,2 and 3. IC1 is set up as an oscillator; IC2 divides this down and gives out approximately 30 second pulses at Q11. This is fed to the clock input of IC3. Master reset on IC3 is connected to Q7 of IC2, thus a high at the output Q1 (IC3) is only obtained when there is a negative-going edge on Q11 (IC2) and Q7 (IC2) is low - since MR is active high. This produces a pulse, which via Q6, turns RLA3 on once every thirty seconds, for about a second.

The final part of the circuit is the fault sensor. RLA2 is normally held on by Q5,7 and 8. Q8 lowers the threshold at which Q7 turns off, which is adjustable with RV3. Similarly, if the voltage is too low at the test point, Q5 will turn off. ■ **R & EW**

COMPONENTS LIST

Resistors

R1,2,3	100R
R4	75R
R5	220R
R6,7,8,9	1K8
R10	6K8
R11	8K2
R12,13,14	10K
R15	150K
R16	3M3
R17	33K

Capacitors

C1	10n Ceramic
C2	150n Polycarbonate
C3	4700u 35V Radial electrolytic

Semiconductors

BR1	PW02
Q1,2	VN66AF
Q3,4,5,6	BC239
Q7,8	BC309
D1,2,3	IN4001
D4	5V6 zener 400mW
D5	12V zener 400mW
D6	6V8 zener 400mW
D7	15V zener 400mW
IC1	4011
IC2,3,4	4040

Presets

RV1	10K 6mm
RV2,5	22K cermet 6mm
RV3,4	22K 10mm

Miscellaneous

T1	C5006 transformer

Chassis fuse holer +3.15A fuse.

RLA1	12v kuit A
RLA2	6V kuit B
RLA3	12V kuit B

Heatsink type E1.58 Ambit 21-08030

Two 6BA 3/8" round head slotted two 6BA plain washers.

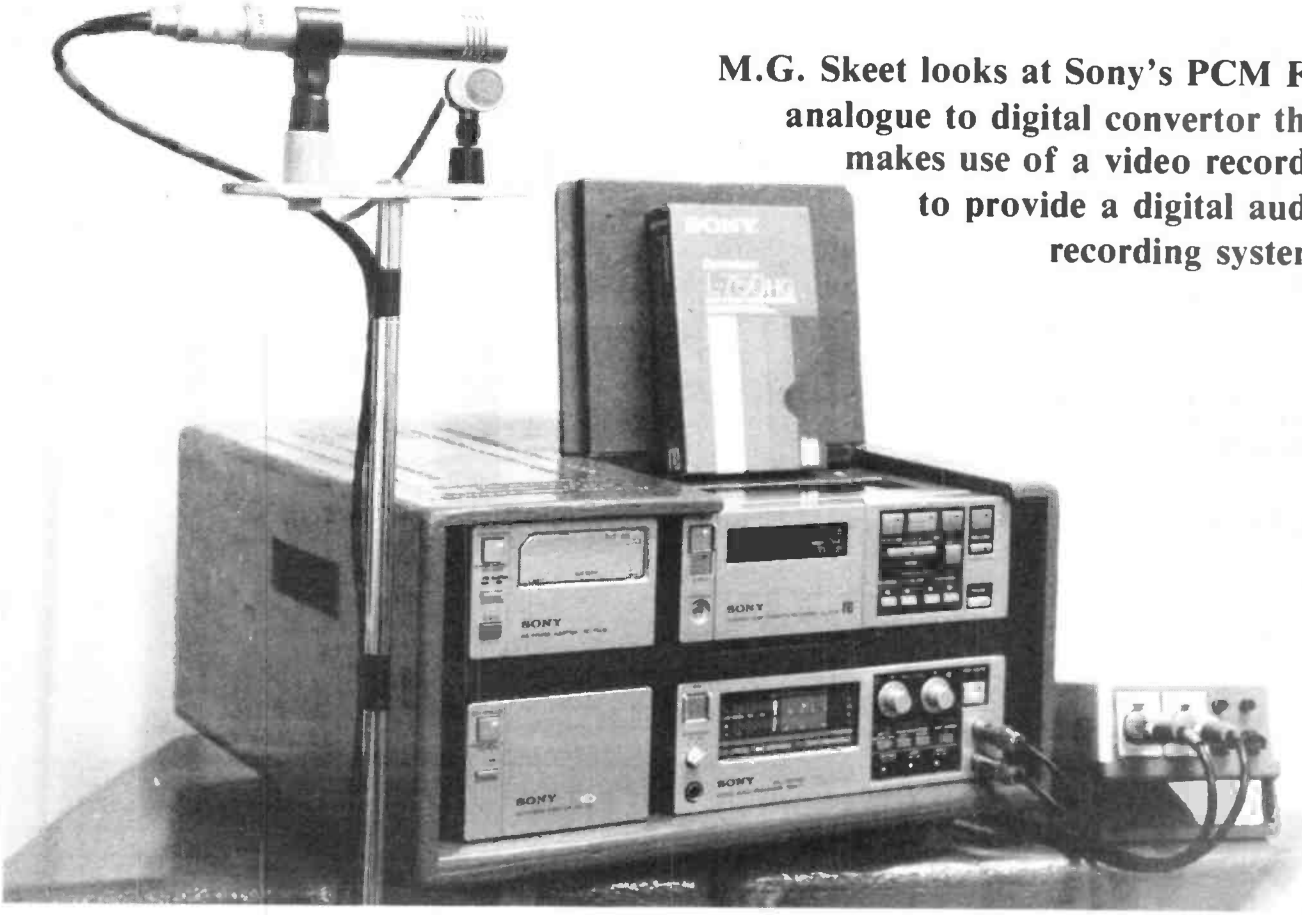
8pc half pins

PCB

Dil set.

Your Reactions......	Circle No.
Excellent - will make one	29
Interesting - might make one	30
Seen Better	31
Comments	32

A DIGITAL RECORDING SYSTEM



M.G. Skeet looks at Sony's PCM F1 analogue to digital convertor that makes use of a video recorder to provide a digital audio recording system.

What constitutes a 'perfect' audio recording? Briefly, it must be a system which introduces no changes whatever in a high quality signal being recorded and played back. Using the finest quality microphones it would be a very fine recording system that would introduce no changes to the sound quality possible from the mics. Up to now, with conventional analogue tape recording, the changes can be remarkably small, as a result of the many individual improvements made to these machines.

Ignoring cassette recorders for the moment, at a cost, analogue reel to reel tape recorders can have a frequency range of 20Hz to 20kHz (but with irregularites at the low frequency end and compression of the dynamic range of high frequencies at high levels), low intrinsic noise (but still worse than the best mics), low modulation noise (but still a noticeable clouding of high level high frequency signals due to noise produced by signal modulation), low print through (but still a problem on, say trumpets, with consequent audible pre or post echo), generally inaudible pitch changes (wow and flutter, depending on deck transport design and maintenance), ability to produce a few multigeneration copies (with careful machine alignment and level control, good 2nd generation copies are possible - progressively deteriorating with more than this). All the parameters are a magnitude worse with the compact cassette of course, but surprisingly good results can be achieved on a good tape and a machine aligned for it.

It has taken a radical change in signal processing to remove the constraints imposed even by the best conventional audio recorders. This change involves converting the audio waveform into a PCM (Pulse Code Modulation) or Digital signal, then recording the digital stream of pulses and on playback re-creating the original audio waveform. The system allows wide band frequency ranges right up to peak levels with intrinsic noise, modulation noise and print through, better than 90dB down (conventional machines might manage 70dB with respected noise reduction systems) and unmeasurable wow and flutter. Add to this the possibility of multigeneration copying and the importance of Digital audio recording is evident, doing justice to the use of decent microphones or recording from any commercial digital sources that will appear before long (the Compact Disc?)

NOW AVAILABLE

This home quality revolution is available now, courtesy Sony and the PCM F1 Analogue to Digital convertor which uses any Betamax or VHS video recorder as the storage medium. Why a video recorder? Simply to get the bandwidth needed for the millions of pulses generated per second in the A to D conversion.

Interestingly, mentioning 'home' use is not entirely correct, for a number of professional recordists have taken up its use in lieu of their previous digital equipments (at 1/10 the cost!)

PCM & VIDEO PACKAGE

The PCM F1 A to D convertor accepts normal domestic 'line' inputs or low impedance (200 to 600R) microphones. The link to the video recorder is rated at 1 volt peak to peak. The PCM F1 unit is supplied with a mains power box (AC700) but can be run on a NP1 nicad pack or for that matter a car/boat battery. The model brought into the UK and Europe is of course a PAL/SECAM version to couple correctly with PAL or SECAM video recorders.

In the October 1982 issue of **R&EW** we looked at Sony's portable SL F1 video recorder. This and its mains adaptor AC F1 are an ideal physical match for the PCM F1. Together they are shown in a proposed 'hold it all together' case from Whitetower Records. It enables the package to be easily carted around to recording sessions. A third matching unit, TT F1, programmable tuner/timer provides theTV signal source for the SL F1 when used in its other roll of TV recorder. With the latter also having a camera input, the whole system is very much the home audio/video recording centre. But to look at the audio use of the PCM F1.

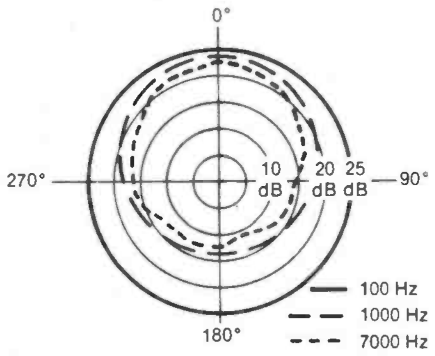


Figure 1a: The theoretical pickup pattern of an omnidirectional microphone. Note that at high frequencies the microphone becomes increasingly directional.

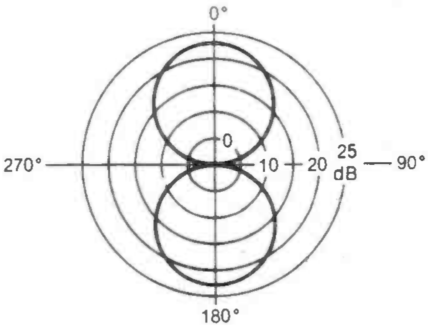


Figure 1b: The 'figure of eight' response typical of a ribbon microphone.

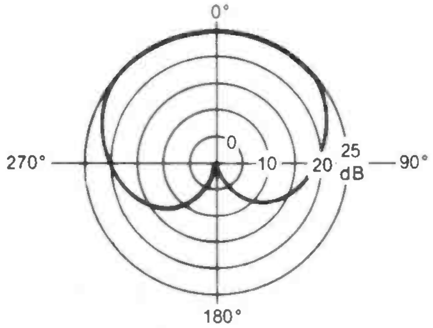


Figure 1c: A cardioid's pickup pattern.

AUDIO RECORDING

Quite frankly, the only source capable of doing justice to the PCM F1 available at the moment would be a pair of high quality microphones! Assuming of course that the owner wishes to get out and about, recording music. The system is not in any way stretched by recording conventional LPs or cassettes. A decent FM tuner and aerial system would however be an ideal way of collecting superb microphone material, by proxy from BBC radio 3's many live concerts or their own digital recording. No point in recording any broadcast disc program!

There is very little knowledge about concerning microphones. The run of the mill moving coil or electret capacitor mics would be useless. No, the only way is to ape the professionals and use the same mics as they do! This will mean 'proper' capacitor mics from such makers as AKG, Neumann, Schoops, Sennheiser, Milab or Calrec.

If it's orchestral, choral, small ensembles or similar 'non pop' activity, then a simple crossed pair produces a superior stereo recording of the sound sources and the acoustic's of the venue. This latter point is almost the most vital part as far as the writer is concerned. One is conveying the music and its environment. A coherent, realistic and hence satisfying illusion is created by coincident crossed pairs or directional microphones.

The alternative of spaced pairs or the jumble or multimiking fails to produce a coherent stereo in the writer's view and interestingly the advent of phase stable digital recorders is showing up deficiencies in the commercial recording world's microphone techniques.

MICROPHONE TYPES

The type of microphone one is looking for in the crossed pair field is the wide, flat frequency response, uniformly directional at all frequencies, type. *Figure 1* shows the theoretical polar pickup patterns of the basic different type of mics. Uniformly directional responses means that similar patterns are produced at all frequencies - many low cost direction mics have narrow high frequency polar pickup giving poor centre stage definition when used as crossed pairs. *Figure 2* shows a pair of 'cardioid' mics crossed at around 110^0 on an easily made stereo bar and *Fig. 3* shows the concept of crossed pair stereo coherence from mics to listener.

The manufacturers listed earlier all produce a number of flat response 'proper' capacitor directional mics. Prices vary considerably as many offer variable polar patterns. I must define 'proper' capacitor mics as opposed to electret capacitor types. The former require polarizing by external power supply whereas the latter are polarized at manufacture - the internal 1V5 battery in the body simply powering the FET impedance convertor.

Most mics in the class being described offer balanced feeds - the powering being by 'phantom' feeds down the signal wires in parallel with screen return. The PCM F1 is in fact unbalanced at its input and a certain amount of involvement would be necessary at the input with transformers to allow phantom powered capacitors to be connected. But there is a neat solution provided by the only UK microphone manufacturer in the list, Calrec. They have a CM652D cardioid capacitor mic which is unbalanced and is powered by 50V DC on one wire and screen return. Long leads are perfectly feasible and the combination of these mics and the PCM F1 is easily the lowest cost way of getting an input quality up to the recording potential. The power supply can be made by DIY (battery or mains) and then one is looking at an outlay of between £150 to £180 depending on the lead length and mic stand arrangement decided upon. This is significantly less than equivalent performance units from other sources or even Calrec themselves - they have the unique Soundfield microphone system at around £2000!

RECORDING WITH THE PCM F1

The metering system is quite respectable and it needs to be. Live microphone signals

Figure 2: A pair of cardioid mics crossed at 110°.

▶

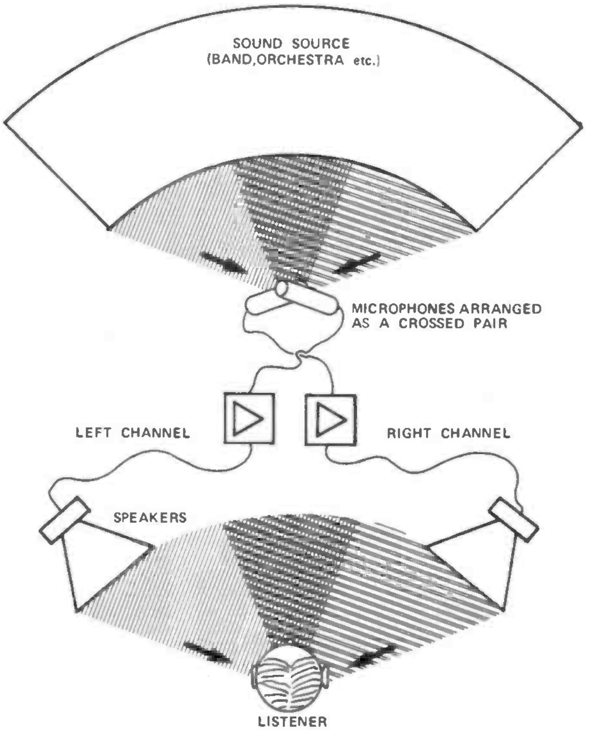


Figure 3: Stereo sound from source to listener using the 'crossed pair' microphone technique.

have amazing dynamic range - all other sources are compressed to a remarkable degree in comparison. In theory digital systems have a finite peak handling capability - analogue systems squash gently. When the input exceeds the quantization range available somthing has to happen. Interestingly the PCM F1 tolerates odd excursions 'over' - but it is poor technique to drive the system that hard. There is no need to as the 'other end' is a long 90dB down.

Allowing one's recordings to generally hover around the minus 20dB position on the PCM F1 units metering will allow the odd climax and natural dynamic range to be encompassed. With analogue recording there is undoubtedly a lot of gentle clipping and compression going on. The scaling has an expanded area above the -20dB point and levels anywhere in this area are safe. Unlike analogue, particularly cassette, where the HF compression effect is present the higher one goes.

Ideally one should set up and monitor in a separate room. Taking along a pair of decent speakers and an amplifier is necessary. It is very easy to monitor off the PCM F1. When idle or recording, the input signal is fed to the line output. Playing back automatically substitutes the recording.

My favourite input arrangement is unfortunately absent on the PCM F1. There are two separate record level controls instead of the ideal, ganged master and separate pre-sets. Balanced fades and sensible peak setting is then possible.

Where to place the mics is the old age question. No amount of writing on the subject substitutes for getting out and making mistakes! It is not easy to judge on site just what is a satisfactory balance. One is out of one's normal listening environment and so are the speakers, which affects their performance in turn.

Obtaining a balance means placing the performers and mics so that the music is internally balanced and the whole is balanced against the acoustic. It's a case of experimentation - you have to start somewhere - so put the mic initially where impulse and your ears in the room suggest. The sound in the monitoring room will not be exactly the same! It will be stereo as opposed to the natural surround sound of the 'studio' itself. But long critical listening will give one ideas for improvement. Is the mic too distant or too close? Do some of the instruments or singers leap out or are too recessed? The stereo presentation should be judged - there is no point in having a 20 ft wide piano or a quartet as wide as a full orchestra.

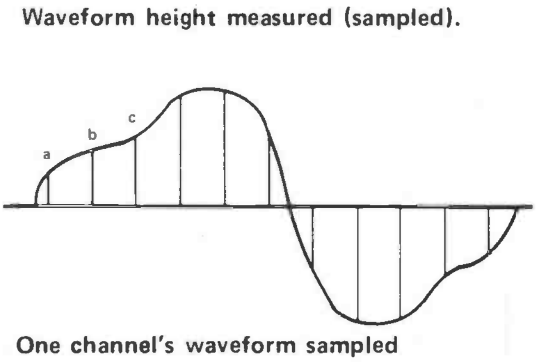


Figure 4: The first step in the digital recording process is to sample the analogue signal.

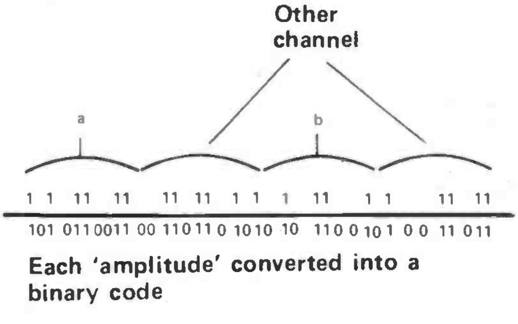


Figure 6: The stream of digital data that represents the audio signal.

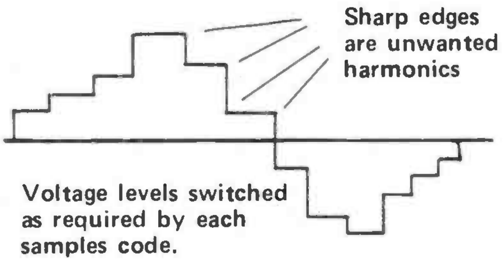


Figure 5: The sampled audio signal.

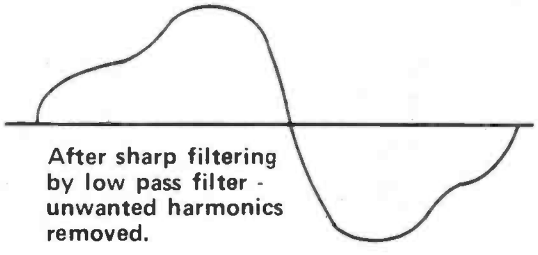


Figure 7: The audio signal is recovered after digital to analogue conversion.

DIGITAL PCM GLOSSARY

PCM	Pulse Code Modulation - the use of Pulses (digits, hence digital) in a Binary Code to quantisize the amplitude of a signal waveform.
Sampling	The rate at which the amplitudes are sampled. Has to be at least twice the highest audio frequency required.
Quantization accuracy	The more bits per sample, the greater the number of amplitude levels that can be accurately realized. Telephone systems use 8 bits ($2^8 = 256$ levels). Currently 16 bits are the norm for high quality audio ($2^{16} = 65,536$ levels). More bits, less noise - theoretically 6dB better for each additional bit.
Stereo handling	Alternate sampling of the left and right channels.
Basic Bit Rate	Calculated by the number of channels X the sampling rate X the bits per sample. (2 X 44.1K X 16 = 1,411,200)
Avoiding Wow & flutter	The signal off tape is put into a buffer store and is read out under strict time clock control at the 44.1KHz sampling frequency. Thus any speed drifting into the store is of no consequence.

SOME INTERESTING TEST RESULTS

The overall excellent specification was obviously being very well met. In fact it can be regarded as an amplifier, rather than as a recorder as far as testing is concerned. I am more interested in the 'practical' technical aspects so here I shall briefly relate some of these.

When hovering around the 20KHz region it is possible to produce audible by products similar to those often heard in analogue tape equipments with bias beats. This seems to be due to beats with the 44.1kHz sampling rate. In practice it is inaudible as it is provoked by high level 20kHz signals and there is not much of that about in music signals - program masking occurs anyway.

SONY PCM F1 SPECIFICATION

Quantization	16 bit linear (14 bit option!)
Sampling	44.1kHz (PAL/SECAM)
Freq response	10-20kHz ± 0.5dB
Dynamic range	More than 90dB
THD	Less than 0.005%
Wow & Flutter	Not measurable

The Beta cassette on which the F1 records the PCM signal.

I like to know where I am with the metering and a system's limits. When the 'over' legend is lit, that is the genuine peak point. On tones this is easily heard. On signal transients which flash the legend, limiting merely occurs with no nasty audible effect!

On the test sample I was not all that enamoured with the scaling accuracy. Neg 20dB being minus 16 in practice with similar other relative errors higher up the scale. The metering shows the emphasis at HF used in signal paths - compared to my 'flat' BBC type PPM there is a lot of leaping about with audience clapping and the transients from drum kits etc. It is essential that these things are seen to be present and the metering clearly shows what is going on and should be believed.

Line inputs, signal to noise ratios are not degraded by the record gain control position but on mic inputs there is a limit of around 40% if this is to be avoided. Luckily in both cases it is possible to work down to small rotations without clipping problems. An essential feature this especially where mic inputs are used. With the Calrec capacitors the author frequently uses it is possible to trim the levels in the power supply. The PCM F1 input is not affected by source impedance it sees.

Sometimes in playing around with review equipment some novel opportunities present themselves. The PCM F1 was in fact invited along to the Albert Hall to record experimentally for the BBC and Calrec the last two nights of the 1982 Prom season direct from a Calrec Soundfield mic. Some spectacular single mic balances were obtained making an interesting comparison with the Radio 3 broadcast possible.

SUMMING UP ON THE SONY PCM F1

If the video out and video in connections are linked, by-passing any recorder, it is not possible to detect any difference in switching the processor in or out of a high quality audio chain in ideal listening conditions! Remember, a full A to D and D to A process is taking place. The process of recording and playing back cannot change it - so we truly have a 'straight wire' recorder. It is sobering that it is now left to improvements in microphones and loudspeakers (and their arrangement for Ambisonics for instance) to improve sound reproduction. The Sony Compact Disc player uses the same LSI chip as the PCM F1 and this augers well for the performance of CD, expected next spring.

SUPPLIES AND FURTHER INFORMATION

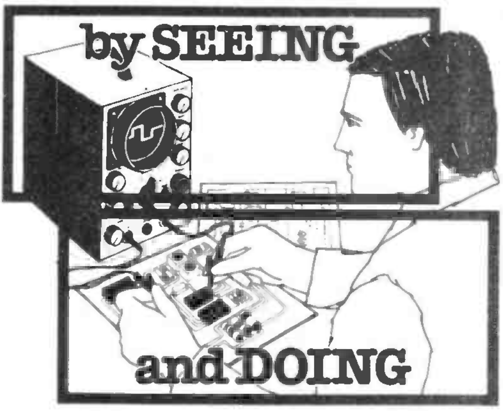
Calrec Microphones —	details and DIY power unit circuit available from Whitetower records, 2 Roche Gardens, Bletchley, Milton Keynes, MK3 6HR. (0908) 73969
Sony PCM F1 etc —	Details available from Feldon Audio, 126 Great Portland Street, London, W1N 5PH. (01) 580 4314

Mention RADIO & ELECTRONICS WORLD of course.

■ R & EW

Your Reactions..........	Circle No.
Immediately Interesting	17
Possible application	18
Not interested in this topic	19
Bad feature/space waster	20


microdot
microdot


by SEEING
and DOING

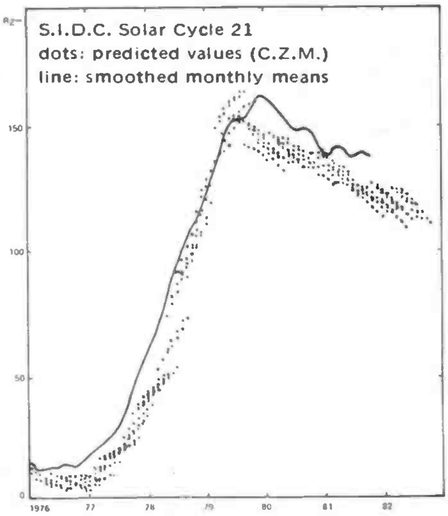
AMATEUR RADIO WORLD

Compiled by Arthur C. Gee, G2UK.

MOST AMATEUR radio signals in the VHF-UHF region, ie., above 20 MHz, are propagated via the lower part of the atmosphere about 5Km above ground. The term 'troposphere' is applied to this region and the chief properties of the air which affects these signals are the vertical distribution of the temperature and the water vapour content. The ionosphere however, does occasionally give VHF propagation, in layers of ionisation about 100 Km above ground. One of these modes is 'auroral propagation' which as its name suggests, is associated with the appearance of displays of the aurora in the skies around the earth's magnetic poles.

The past few months have produced some of the best 2 metre auroral conditions ever experienced. Auroral openings were recorded in January, throughout February and early March. April 10th provided a particularly good opening. Again in May, June and July openings occurred; on July 13th one of the most intense ever experienced, was being recorded, and even now, at the time of writing, reports of very intense auroral openings are still coming in.

We reproduce herewith, a chart recently issued by the Sunspot Index Data Centre in Brussels, which shows very well that we have now reached the downward trend in sunspot activity in Solar Cycle 21. With this decrease in solar activity, it might seem surprising that this auroral activity should still be so strong. However, according to the pundits, a peak in auroral activity occurs on either side of the 11 year cycle maximum and we are now enjoying the downward peak. This is however, not likely to last much longer. So make the most of these openings whilst they last.



Much influenced by ionospheric propagation conditions is, of course, the 10 metre band. Activity on this band is nowhere so great as it has been during the past few years, but DX contacts are still possible particularly from the south. In the past few weeks PY and ZS stations have been coming in strongly at times. A very good idea of the conditions on 10 metres can be got by listening for the 10 metre beacons of which there are a considerable number. These have been purposely established to give an indication of 'conditions' and quite a lot of interest can be had by listening for them and keeping records of their signal strengths. The writer has logged DL0IGI on 28.20, 5B4CY on 28.22, HG2BHA on 28.225, LA5TEN on 28.236, VP9BA on 28.237, Z21ANB on 28.248, DK0TE on 28.257 and ZS6PW on 28.270 recently.

With future changes in propagation conditions which may affect the 10 metre band in particular, fears are being expressed that the 10 metre band may be neglected by radio amateurs and may be taken over by 'intruders'. To promote the use of 10 metres, J.D. Harris, G3LWM of Bishop's Stortford, J.D. Petters, G3YPZ and N.J. O'Brien, G3ZEV of Harlow, recently issued a 'news sheet' in which they outlined what they feel are dangers likely to befall the ten metre band. As they say:- 'With the advent of 27 MHz CB; widespread use and congested channels, the amateur radio movement faces a new and worrying threat. Already there are many intruders in the bottom end of 10 metres, using rigs widely available that go up to 30 MHz. The CB operators find 28 MHz a godsend, due to the apparent lack of use by amateurs at times when there is no DX present.'

G3LWM and his colleagues aim to bring to the notice of the amateur radio fraternity the benefits of 10 metre as an alternative to 2 metres for local - and 'not so local'- working. They point out that historically, 10 metres has always been lumped into the HF spectrum and is looked upon as one of the best amateur radio DX bands. This it certainly is during sunspot peaks, but it provides little in the way of DX openings at other times. Not so much notice, however, is taken of the fact that when it is not providing DX propagation, it is a very useful band for less distant communication. Direct line of sight, refractive, tropospheric and sporadic E types of propagation are far more prevalent than is realised. This is a point that has often been made in the past, but still seems to be little appreciated. 3LWM asks why this should be and suggests one reason is that 10 metre operation is approached with H F rather than VHF techniques. As he says:- 'Whoever heard of anyone using a trapped vertical, long wire or dipole for 4 or 2 metres or 70 cms? At VHF, the correct aerial and polarisation are essential to get results. A good, sensitive receiver is also needed.' Again as he says, many of the receivers designed for amateur band use are 'deaf' at 28 MHz! 3LWM continues:- 'In the mid-70's, a group of stations in Bermuda set up a local net on 29.60 MHz using low power and vertical aerials. Activity spread to the U S A with PMR and C B sets being converted for FM use. The availability of the FT 901 with its FM facility created world wide FM activity on 10 metres. G3YPZ with a modified FT 101 was the first 'G3' on FM and caused much interest and some 'pile-ups'! The following prefixes have been worked on FM by G3YPZ:- W 0,1,2,3,4,5,6,7,8 and 9; VE 1,2,3,6 and 7; JA, JH, HH, PY, ZS, VO 7, UA, EA, DL, LA, OZ, HB 9, 4Z4 and VK. All except the VK were using 10 watts and vertical aerials.

G3LWM suggests that, to encourage 10 metre activity, Groups should be formed to monitor 10 metres regularly, particularly at the low end; they should encourage activity on 10 metres, particularly when it seems to be dead; they should report intrusion from C B and other intruders into the low end of the band.

Since G3LWM's first Newsletter was issued, a very satisfactory response has been received. So it was decided to form a national group to be called '10-UK'. A Newsletter will be issued two or three times a year. Annual subscription £3.50. Details from:- N.J.J. O'Brien, G3ZEV, 88, The Maples, Harlow, ESSEX.

☐ R & EW

Your Reactions..........	Circle No.
Immediately Interesting	25
Possible application	26
Not interested in this topic	27
Bad feature/space waster	28

THE CQ CENTRE

LONDON'S NEWEST AND BRIGHTEST EMPORIUM
**10 MERTON PARK PARADE,
KINGSTON RD.,
LONDON SW19
TEL: 543 5150**
We are open till 8 pm Wednesdays
ACCESS – BARCLAYCARD
INSTANT CREDIT THROUGH
TRICITY FINANCE

NEW AND SECOND HAND EQUIPMENT ALL FULLY GUARANTEED

**YAESU – ICOM – SOMMERKAMP
STANDARD – TRIO – AZDEN – FDK**

Full range of Mobile/Base Antennas by G Whip – Jaybeam – S.M.C.

Poles — Lashing Kits — Cable — Rotators — Plugs and Sockets

STOP PRESS
THE NEW G4HXZ MORSE TAPE
15 MINS LETTERS 5 WPM
15 MINS NUMBERS 5 WPM
15 MINS MIXED 10 WPM
15 MINS LETTERS 15 WPM
£1.75
inc. P+P

2 METRE SLIM JIM

We can now supply this antenna by Mail Order at **£8.50** with 4 metres of co-ax (inc. post & package). The cheapest antenna in the business.

HB9-CV COMPACT 2 EL. BEAM

4.5dB gain, 18dB front to back. **£8.50** (with clamp) ***now available.***
Also in 70cms version (same gain)

N.B. We regret we cannot supply the 2 metre version on Mail Order as it is too long to go by post.
Please allow up to 28 days for Delivery

DEALERS FOUND GUILTY!

The CQ Centre in Merton Park were recently found guilty of paying excessive prices for second-hand radio equipment. Roads in the district were totally jammed as eager customers flocked in to take advantage of the generous prices being offered. A spokesman for the company would only comment that this was a firm policy and would be continued in the future. Further investigations revealed that there was a sale or return service in operation for which the charges are only 10%. It was also found that copious amounts of tea and coffee were being served on the premises.

160 for further details

ELECTRONIC HOBBIES FAIR

Alexandra Pavilion London
November 18 – 21 1982

The biggest and best event ever to be staged for the electronic hobbies enthusiast!

Walk into a whole world of electronic equipment. – Everything from resistors, IC's to home computers, transmitting and receiving units, citizens band radio and peripheral equipment, video games, musical instruments, radio control models. . . . In fact whatever your particular electronic hobby you'll find this show will be the most interesting and informative way to discover all the latest developments in your particular field.

Ticket prices at the door are £2 for adults, £1 for children but party rates are available for 20 people or more. To find out more, contact the Exhibition Manager, Electronic Hobbies Fair, IPC Exhibitions, Surrey House, 1 Throwley Way, Sutton, Surrey SM1 4QQ. Tel: 01-643 8040.

Electronic Hobbies Fair is sponsored by Practical Electronics, Everday Electronics and Practical Wireless and is organised by IPC Exhibitions Ltd.

OPENING TIMES
Thursday 18 Nov. – 10.00-18.00
Friday 19 Nov. – 10.00-18.00
Saturday 20 Nov. – 10.00-18.00
Sunday 21 Nov. – 10.00-17.00

Cheap rail fare direct to Alexandra Pavilion

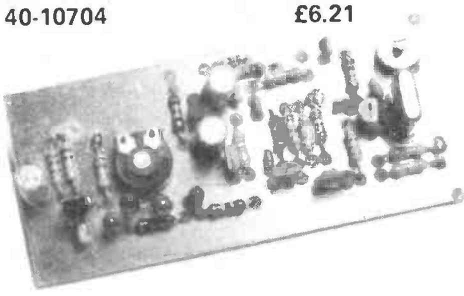
172 for further details

R&EW PROJECT PACKS

SSB CW GENERATOR

CW add on for the SSB transceiver system. PCB and all components.

Stock No.	Price
40-10704	**£6.21**



PEAK PROGRAMMER METER

High accuracy professional design PPM. Mono meter and driver unit, with unique stereo add-on.

Mono Unit

Stock No.	Price
40-10240	**£49.68**

Stereo Add-on

PCB, all components and LEDs.

Stock No.	Price
40-10241	**£11.61**

WIDE BAND AMPLIFIER

Wide band, 14 - 70MHz, transmitter amp., with a gain of 40dB.

Stock No	Price
40-14700	**£4.18**

6m

6m TRANSVERTER

Project packs available for these previously published designs:

MULTIBAND UP CONVERTER

PCB and components for mixer and oscillator (94MHz) sections.

Stock No.	Price
40-28007	**£14.89**

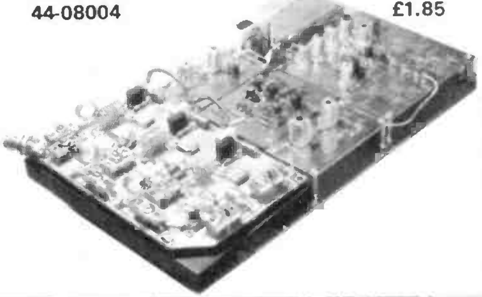
6m PRE AMP

PCB and components.

Stock No.	Price
40-08007	**£4.71**

PRE AMP PCB

Stock No.	Price
44-08004	**£1.85**



AUTO NI-CAD CHARGER

Automatic battery charger for fast charging of 4 Ni-Cad cells. PCB, mains transformer, heatsink and all board mounted components.

Stock No.	Price
40-40004	**£22.70**

TX10 VIDEO INTERFACE

Complete kit of parts available directly from the author. PCB, all components, sockets, switches, sub chassis and interconnecting cable.

Price **£21.60** inc. VAT and P&P.

From: Paul Pitts
7, Inglewood Drive,
Otley
W. Yorks. LS21 3LD

All prices include VAT @ 15% Please allow 21 days for delivery. Postage & Packing 60p per order.

**Send your order to Radio & Electronics World,
200, North Service Road,
Brentwood, Essex CM14 4SG
Tel: (0277) 230909**

Access/Barclaycard Welcome.

'PROJECTBOARDS'

January	UHF/VHF Converter	£3.51
	TV Pre-Amp	£1.28
	TV Pre-Amp PSU	£0.96
	LC7137	£2.73
February	TV Pattern Generator	£6.55
	TV Antenna Selector	£4.65
	TV Antenna Select PSU	£0.96
	TK10321 (Undrilled)	£2.04
March	70cm Pre-Amp	£1.38
	23cm Converter	£8.33
	Converter PSU	£1.77
	MC145151	£2,95
	ULN2283B (Undrilled)	£0.46
April	Radiation Monitor	£3.27
	Rewbichron Logic Board	£6.76
	Rewbichron Rx Board	£3.04
	2m Pre-Amp	£1.11
	Key Pad Security Lock	£1.79
	KB4417 (Undrilled)	£0.69
	KB4413 (Undrilled)	£0.58
May	UOSAT	£10.17
	4-way Distribution Amplifier	£5.91
	pH Meter	£5.04
	KB4412 (Undrilled)	£1.43
	ULN2240 (Undrilled)	£0.94
June	Radio Control Tx	£3.58
	2ch Mains Timer – Display	£6.40
	PSU	£2.07
	Triac	£2.07
	Switch	£0.85
	CB Selcall	£3.33
	ZX81 Keyboard - A	£2.99
	ZX81 Keyboard - B	£2.99
	0-30v PSU	£4.50
	2m PA Mk II	£5.91
	ULN3859 (Undrilled)	£0.96
	LM1035 (Undrilled)	£1.29
July	SSB Exciter	£3.87
	HA12017	£2.48
	DC Controlled Pre-Amp	£12.00
	Radio Control	£1.84
	Autobridge	£3.50
	Autobridge RF Head	£2.25
	Autobridge LED	£0.73
August	18W Power Booster	£3.74
	ZX81 Expansion Board	£9.60
	Ga As Fet Pre-Amp	£4.37
	Ga As PSU	£1.54
	Multiband Up Converter	£5.46
	KB4436 (Undrilled)	0.67
	Switch Mode Power Supply (Undrilled)	£2.92
September	CB Noise Squelch	£1.20
	Drill Speed Controller	£4.76
	4/6/10m Pre-Amp	£1.86
	A/D Converter	£3.73
	Airband RX	£8.83
	DFM	£4.83
	DFM Display	£2.07
	4448 (Undrilled)	£0.93
October	70cm PA	£4.02
	SSB Mixer	£2.89
	SSB Buffer	£0.98
	2m GaAs FET Pre-amp	£4.14
	Train Controller	£4.96
	U264 (Undrilled)	£0.46
	MF10 (Undrilled)	£0 69

NOVEMBER PCBs

2m Converter	**£4.14**
20Hz - 150MHz DFM	**£2.90**
Video Interface:	
Thorn TX9	**£3.95**
Amstrad CTV1400	**£2.21**
TDA4420/1	**£1.10**
DNR (From Oct. issue)	**£3.31**

DECEMBER PCBs

Wide Band Amp	**£2.79**
SSB CW Generator	**£1.86**
PPM - Mono	**£1.86**
PPM - Stereo add-on	**£1.86**
Auto NiCad Charger	**£5.83**
TX10 Video Interface	**£3.10**

All Prices include VAT @ 15% Please allow up to 28 days for delivery. Postage & Packing 60p Per Order.

Send your orders to:

200, North Service Road, Brentwood, Essex CM14 4SG

Access and Barclaycard Welcome.

'PROJECTBOARDS'

Z8 ASSEMBLER IN EPROM

Dr. B. Jasper of Zilog discusses new software for the Z8 board consisting of a line assembler and improved utilities.

Many users of the Ambit 8671 microcomputer board will have by now realised that when programming with BASIC/Debug, it is a relatively easy matter to enter and modify programs or to input and output data to I/O ports, counter timers and locations in the memory/register file. For applications where the response times required are of the order of tenths of seconds or slower, the computational speed of the interpreted BASIC is usually adequate. However, in situations which are time critical and require a program to respond in milliseconds or even microseconds, it becomes necessary to use machine language. Moreover, a machine language program often requires less code to implement than a equivalent BASIC routine, particularly if bit text and bit manipulation operations are required.

As an example, consider the two programs shown in *Fig. 1*. Both programs are capable of providing a pulse train at pin 4 of port 3, consisting of 200 equal mark-space ratio pulses each of approximately 400 milliseconds. The machine language routine takes 28 bytes of code against 117 for the equivalent BASIC routine. Further, if we want to reduce the pulse period, the minimum time that can be achieved with the BASIC routine is 74 milliseconds while with the machine language routine we can get down to 23 microseconds.

```
25    C=A
30    IFC=0 RET          !  Check for end of pulse
40    IFG=F STOP         !  Check for 200 pulses
50    C=C-1
70    GOTO30
100   A=6: G=0: F=200    !  Entry point
110   @3=%10             !  Set bit 4 in por 3=1
115   G=G+1
120   GOSUB 25
130   @3=0               !  Set bit 4 in port 3=Q
140   GOSUB25
150   GOTO 110


MACHINE CODE ROUTINE


110   PUSH 253
120   SRP, #%20
130   LDR14, #200        !  load number of pulses
140   LDR12, #%10
150   LDR10, #%6E        !  Pulse time value in
160   LDR11, #%09        !  R10 & R11 (RR10)
170   XOR R12, #%10      !  XOE bit 4 in reg 12
180   LD3, R12           !  Output to port 3
190   DECW RR10          !  Loop around until RR10
200   JR 2*190           !  = 0
210   DEC R14            !  Check for 200 pulses
220   JR NZ *150         !  Gone
230   POP 253
240   RET
```

Figure 1.

With the Z8 BASIC/Debug microcomputer, it is possible to solve a particular programming problem by using either BASIC, Machine code or a combination of the two. If circumstances dictate that both languages are to be used in a program, the mechanism for comunication between them is for the machine code sections to be constructed as subroutines and called by either the GO@ command or the USR function.

Both GO @ and USR require a subroutine address argument which in turn may be followed by two optional arguments used for parameter passing.

```
i.e. GO @ % 2000, A,B
  or GO @ % 2000, A,58
```

The USR function is similar to the GO@ command, but it can also be used to return an argument back to BASIC. For example, C = USR (%2000,A,B). The argument returned will be assigned to the variable C.

To enter a machine code routine into memory, however, is not quite so easy. Certainly, it is possible to modify bytes or words by using BASIC operators such as @ (ADDRESS) = (BYTE VALUE) or ∧ (ADDRESS) = (WORD VALUE). But if a large subroutine is to be entered, then this method is both tedious and, since the programmer must know the exact coding for each machine instruction, prone to error.

With Version 2.0 software, it is now possible to invoke a line assembler routine which will convert standard Z8 assembler mnemonics entered via the free format BASIC/Debug editor, into machine code at some specified address in memory. The line assembler occupies the lower half of the 2732 monitor EPROM and utilises only the internal registers in the Z8 for data manipulation, thus freeing the RAM space for storage of source or object code and the parameters used by the BASIC interpreter.

To write a source code program, it is a simple matter of just entering a line number and the appropriate Z8 mnemonic plus two assembler directives. Note that this is possible because the editor will accept any text on a line providing there is a valid line number ie 100 RUBBISH.

Two directives are used to indicate to the assembler where the source code ends and where the object code is to be located. The directive 'END' is mandatory, and is placed at the end of the source code. The other directive '$ABS(ARG)' is used to define where

```
100 $ABS%2000 ! Location directive
110 PUSH 253  ! Push RP onto stack
120 SRP.#%20  ! Set RP = hex 20
130 LDR3,2    ! Load R3 from port 2
140 LDR4,#%06 ! Load R4 with hex 6
150 AND R3,R4 ! AND R3 with R4, result in R3
160 POP 253   ! POP 253
170 RET       ! Return
180 END       ! END directive
```

Figure 2.

the object code will be located; ARG being the location address. If this directive is not given then the assembler will automatically store the generated code at the first location available after the source text. It should also be remembered that machine code subroutines must be stored in memory that is not otherwise occupied by the BASIC program or the stack.

The entry point for the line assembler is at hex location B3EO, so to invoke the assembler we simply type

```
GO@%B3E0,<Source line number>
```

where the source line number is the first line of code to be assembled. For the program in *Fig. 2* we would write

```
GO@%B3E0,100
```

The assembler will then return the message 'NO ERROR' or 'ERROR' depending on whether or not assembly was successful. If we use the USR call rather than GO@, the assembler will return the line number of the first error detected. Thus, by writing LIST USR(%B3EO,100) to invoke the assembler, the first line encountered that contains an error will be listed. For example, say we replaced the 'AND' in line 150 with 'ANDD' the assembler will return:-

```
ERROR

150 ANDD R3,R4
```

The assembler is able to detect the following errors:

1. Syntax error.
2. The line number given as the first line to assembly does not exist.
3. No END directive.
4. The line referred to by a * does not exist.
5. Invalid operands for this mnemonic.
6. Displacement>127 or<-128 (relative addressing).
7. Mnemonic unknown.
8. Condition code unknown.

PSEUDO-OPS

Apart from the standard Z8 instruction mnemonics, there are two pseudo-operations which can be helpful for data insertion. These are DEFS and DEFB. The DEFS n (define storage) pseudo-operation can be used to reserve n bytes of memory space starting at the current program pointer ie, DEFS 30 reserves 30 bytes and increments the program pointer by 30.

The second pseudo-operation DEFB has two forms and is used to both reserve space and to initialise data. If we say DEFB&n, where lower case n is any decimal (or hex-decimal number, it is possible to initialise several (n) bytes at a time by separating each byte by a delimiter (coma). For example

```
100 DEFB & %20,%EE,$44,2,32
```

will initialise 5 bytes with the respective hexadecimal values 20,EE,44,2,20.

DEFB"X is the second form of this operation and is used when it is required to initialise a string 'X'. For example, 100 DEFB 'HELLO will reserve 5 bytes and initialise them with the ASCII values of the charactors HELLO.

BRANCH INSTRUCTIONS

Branches or subroutine calls to line numbers (labels)take the form JP*N, JR*N, CALL*N or DJNZ Rk*N where N is the line number. If we need to reference a program or subroutine at a known absolute location, then we leave out the * sign before the argument N which now becomes the address value. The following instructions are all valid codes.

```
JR %2100

JR 9000

CALL 8400

DJNZ R5 %2500
```

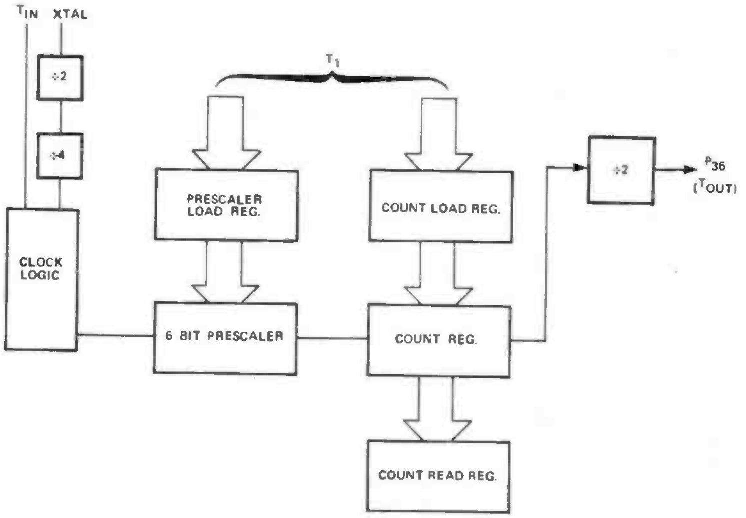
It may be noted that another method that can be used to specify an absolute branch or subroutine call address is to use indirect register addressing. For example, JP@20 or CALL@20 has the effect jump or call to the address in register pair 20/21.

MIXING BASIC AND MACHINE CODE

We now look at a modified version of the earlier pulse generation problem. Assume that we want to generate a pulse train of given length, only this time, with the facility for specifying the pulse 'OFF' time as well as the pulse width.

The example uses BASIC/Debug for inputing parameters from the terminal, while a machine code subroutine is used in conjunction with counter timer T1 to define the pulse 'ON' and 'OFF' periods. The output signal is taken from T1 output, Tout (pin 40).

In order to produce the variable mark-space ratio pulse at Tout, use is made of the Z8 feature which allows the counter timers COUNTLOAD register to be modified without disturbing the count in progress (see *Fig. 3*). Assuming that the pulse 'ON' time value has been programmed into the COUNTLOAD register, setting the load bit for T1 in the TMR (Timer Mode Register) will cause the value in the COUNTLOAD register to be transferred into the COUNT register and, if the count enable bit is set in TMR, start the COUNT register counting down. The value representing the pulse 'OFF' time can then be immediately programmed into the COUNTLOAD register and will be transferred to the COUNT register only when EOC (End of Count) occurs. Once EOC has been detected, say by monitoring IRQ5 in the IRQ (Interrupt Request Register), the pulse 'ON' value can again be reloaded into the LOADCOUNT register to await transfer to the COUNT register on the next EOC. This process is repeated until the desired number of pulses have been output from Tout.



```
100  List USR(%B3E0,105) ! Make object code
102  STOP
105  $ABS%2000            ! Location directive-hex 2000
110  Push 253             ! Push neg ptr onto stack
120  SRP,#%20             ! Set neg ptr to hex 20
130  LD 242,%31           ! Load T1 (Count Load) with "ON' time
140  LD 243,#%8F          ! Load T1 prescaler with 35 & modn
150  LD241,#%9E           ! Load T1 TM neg
155  LD250,#%17           ! Load IRQ neg with reset IRQ5
160  LD242,%30            ! Load T1 (Countload) with "OFF' time
170  DECW, RR14           ! DECW working reg pair 14&15 (2E)
180  JRZ *300             ! Jump out f RR14 = 0
190  CALL *400            ! Call "Test for EOC'
200  LD242,%31            ! Load T1 (Countload) with "ON' time
210  CALL * 400           ! Call "Test for EOC'
220  JR * 160             ! Jump back
300  LD243,#%8E           ! Load prescaler with 35 & single pass
310  POP 253              ! POP neg ptr.
320  RET                  ! Return
400  TCM 250,#%20         ! Test bit 5 in IRQ
410  JR NZ *400           ! Jump back = 0
420  LD250 #%17           ! Reset bit 5
430  RET                  ! Return
900  END                  ! END directive
1000 "Pulse on time=';    : GOSUB1100
1010 @%31 = I
1020 "Pulse OFF time=';   : GOSUB1100
1030 @%30
1040 "Number of pulses=' : INPUT C
1050 /\%2E=C
1060 GO @ %2000
1070 "<BELL>'
1080 GOTO 1000
1100 Input I
1110 IF I>255 I=255
1120 RET
 I
```

Figure 4.

The source program for the machine code subroutine is shown in *Fig. 4* along with the BASIC terminal interface routine (lines 1000-1120). In the subroutine source program, the instructions PUSH 253, SRP %20 and POP 253 have been included to save the register pointer (Rp) value used by BASIC and to set a value of hex 20 for use by the machine code subroutine. The reason for this is that registers hex 21 to hex 3F are available for the user and therefore if working register instructions are to be used, Rp must be set to point at this free area of the register file. If we don't do this there is a serious risk of overwriting parameters used for the internal workings of the BASIC interpreter, and hence causing an unpredictable situation when control returns to the BASIC mode.

Parameters are passed from BASIC to the machine code subroutine via registers %31 and %30 for the 'ON' and 'OFF' times, and register pair %2E and %25 for the value representing the number of pulses to be output. (Note Rp = %20 therefore Rp + R14 = %2E). To run this program we simply type GOTO 1000 and then, when the BASIC routine asks for them, type in the appropriate parameters. The performance figures are as follows:

Number of pulses that can be output = (0 to 65,536)
Minimum pulse 'ON' and 'OFF' times = 37.97 microseconds
Maximum pulse 'ON' and 'OFF' times = 9.68 milliseconds
Mark-space ratio range = 255.1 -> 1:255

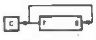
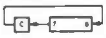
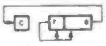
The values for Maximum and Minimum pulse time are governed by the size of T1 COUNT register (8 bits) and the delay in the subroutine loop line 150 to line 200 (approximately 30 microseconds) respectively. Calculation of machine code instructions can be made using the simple expression:

Instruction time = (Execution cycles + No Bytes)*0.271 microseconds

UTILITY	VERSION 2.0	VERSION 1.0
Program EPROM	Time to program 4K = 3 minutes 24 seconds *1	Time to program 4K = 10m 5sec
Read EPROM	<1 sec to read 4K *1	7m 15sec to read 4K
Find Program	<1 sec for 4K Basic Program	2m 34sec for 4K basic Program
Memory More	<1 sec for 4K Block	3m 4sec for 4K Block
Display	Takes 3sec to display full screen (255 Bytes of hex + ASCII) Press "Q' to Quit.	Takes 38sec for full screen
Ramchange	Enter only hex % sign & space no longer required - Will discard non hex value - Use "Dot' to continue "Q' to quit.	Needs space + %sign for every hex value
Fill Memory	<1sec for 4K block	NA
Compare Memory	Displays both bytes that are = Q=quit P=pause	NA
Cassette Write	Asks for start & stop addresses and a file number <0-65535>	Only asks for address - no file identity
Cassette Read	Asks for start & stop address and a file number. Will search for correct file number printing file numbers passed during search	Only asks for address - no file identity
Exit	Return to immediate mode	

Table 1: Comparison of version 2.0 software against version 1.0.
N.B.*1 in version 2 software the start address of the EPROM to be programmed is 1000 hex and the end is 1FFF.

Instruction Summary

Instruction and Operation	Addr Mode		Opcode Byte (Hex)	Flags Affected					
	dst	src		C	Z	S	V	D	H
ADC dst,src dst ← dst + src + C	(Note 1)		1☐	*	*	*	*	0	*
ADD dst,src dst ← dst + src	(Note 1)		0☐	*	*	*	*	0	*
AND dst,src dst ← dst AND src	(Note 1)		5☐	–	*	*	0	–	–
CALL dst	DA		D6	–	–	–	–	–	–
SP ← SP - 2	IRR		D4						
@SP ← PC; PC ← dst									
CCF C ← NOT C			EF	*	–	–	–	–	–
CLR dst	R		B0	–	–	–	–	–	–
dst ← 0	IR		B1						
COM dst	R		60	–	*	*	0	–	–
dst ← NOT dst	IR		61						
CP dst,src dst - src	(Note 1)		A☐	*	*	*	*	–	–
DA dst	R		40	*	*	*	X	–	–
dst ← DA dst	IR		41						
DEC dst	R		00	–	*	*	*	–	–
dst ← dst - 1	IR		01						
DECW dst	RR		80	–	*	*	*	–	–
dst ← dst - 1	IR		81						
DI IMR (7) ← 0			8F	–	–	–	–	–	–
DJNZ r,dst	RA		rA	–	–	–	–	–	–
r ← r - 1			r = 0-F						
if r ≠ 0 PC ← PC + dst Range: +127, -128									
EI IMR (7) ← 1			9F	–	–	–	–	–	–
INC dst	r		rE	–	*	*	*	–	–
dst ← dst + 1			r = 0-F						
	R		20						
	IR		21						
INCW dst	RR		A0	–	*	*	*	–	–
dst ← dst + 1	IR		A1						
IRET FLAGS ← @SP; SP ← SP + 1 PC ← @SP; SP ← SP + 2; IMR (7) ← 1			BF	*	*	*	*	*	*
JP cc,dst	DA		cD	–	–	–	–	–	–
if cc is true			c = 0-F						
PC ← dst	IRR		30						
JR cc,dst	RA		cB	–	–	–	–	–	–
if cc is true, PC ← PC + dst Range: +127, -128			c = 0-F						
LD dst,src	r	Im	rC	–	–	–	–	–	–
dst ← src	r	R	r8						
	R	r	r9 r = 0-F						
	r	X	C7						
	X	r	D7						
	r	Ir	E3						
	Ir	r	F3						
	R	R	E4						
	R	IR	E5						
	R	Im	E6						
	IR	Im	E7						
	IR	R	F5						
LDC dst,src	r	Irr	C2	–	–	–	–	–	–
dst ← src	Irr	r	D2						
LDCI dst,src	Ir	Irr	C3	–	–	–	–	–	–
dst ← src	Irr	Ir	D3						
r ← r + 1; rr ← rr + 1									
LDE dst,src	r	Irr	82	–	–	–	–	–	–
dst ← src	Irr	r	92						
LDEI dst,src	Ir	Irr	83	–	–	–	–	–	–
dst ← src	Irr	Ir	93						
r ← r + 1; rr ← rr + 1									
NOP			FF	–	–	–	–	–	–
OR dst,src dst ← dst OR src	(Note 1)		4☐	–	*	*	0	–	–
POP dst	R		50	–	–	–	–	–	–
dst ← @SP	IR		51						
SP ← SP + 1									
PUSH src		R	70	–	–	–	–	–	–
SP ← SP - 1; @SP ← src		IR	71						
RCF C ← 0			CF	0	–	–	–	–	–
RET PC ← @SP; SP ← SP + 2			AF	–	–	–	–	–	–
RL dst 	R		90	*	*	*	*	–	–
	IR		91						
RLC dst 	R		10	*	*	*	*	–	–
	IR		11						
RR dst 	R		E0	*	*	*	*	–	–
	IR		E1						
RRC dst 	R		C0	*	*	*	*	–	–
	IR		C1						
SBC dst,src dst ← dst - src - C	(Note 1)		3☐	*	*	*	*	1	*
SCF C ← 1			DF	1	–	–	–	–	–
SRA dst 	R		D0	*	*	*	0	–	–
	IR		D1						
SRP src RP ← src		Im	31	–	–	–	–	–	–
SUB dst,src dst ← dst - src	(Note 1)		2☐	*	*	*	*	1	*
SWAP dst 	R		F0	X	*	*	X	–	–
	IR		F1						
TCM dst,src (NOT dst) AND src	(Note 1)		6☐	–	*	*	0	–	–
TM dst,src dst AND src	(Note 1)		7☐	–	*	*	0	–	–
XOR dst,src dst ← dst XOR src	(Note 1)		B☐	–	*	*	0	–	–

Note 1

These instructions have an identical set of addressing modes, which are encoded for brevity. The first opcode nibble is found in the instruction set table above. The second nibble is expressed symbolically by a ☐ in this table, and its value is found in the following table to the left of the applicable addressing mode pair.

For example, to determine the opcode of an ADC instruction using the addressing modes r (destination) and Ir (source) is 13.

Addr Mode		Lower Opcode Nibble
dst	src	
r	r	$\boxed{2}$
r	Ir	$\boxed{3}$
R	R	$\boxed{4}$
R	IR	$\boxed{5}$
R	IM	$\boxed{6}$
IR	IM	$\boxed{7}$

Opcode map of the Z8

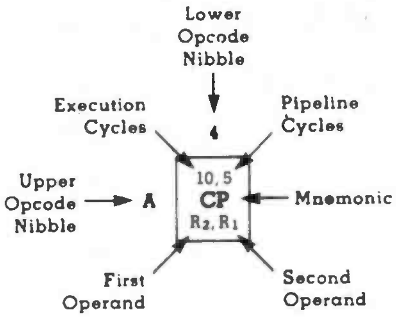
▶

Opcode Map

Lower Nibble (Hex)

Upper Nibble (Hex)

	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0	6,5 **DEC** R_1	6,5 **DEC** IR_1	6,5 **ADD** r_1, r_2	6,5 **ADD** r_1, Ir_2	10,5 **ADD** R_2, R_1	10,5 **ADD** IR_2, R_1	10,5 **ADD** R_1, IM	10,5 **ADD** IR_1, IM	6,5 LD r_1, R_2	6,5 LD r_2, R_1	12/10,5 DJNZ r_1, RA	12/10,0 JR cc, RA	6,5 LD r_1, IM	12/10,0 JP cc, DA	6,5 INC r_1	
1	6,5 **RLC** R_1	6,5 **RLC** IR_1	6,5 **ADC** r_1, r_2	6,5 **ADC** r_1, Ir_2	10,5 **ADC** R_2, R_1	10,5 **ADC** IR_2, R_1	10,5 **ADC** R_1, IM	10,5 **ADC** IR_1, IM	↓	↓	↓	↓	↓	↓	↓	
2	6,5 **INC** R_1	6,5 **INC** IR_1	6,5 **SUB** r_1, r_2	6,5 **SUB** r_1, Ir_2	10,5 **SUB** R_2, R_1	10,5 **SUB** IR_2, R_1	10,5 **SUB** R_1, IM	10,5 **SUB** IR_1, IM	↓	↓	↓	↓	↓	↓	↓	
3	8,0 **JP** IRR_1	6,1 **SRP** IM	6,5 **SBC** r_1, r_2	6,5 **SBC** r_1, Ir_2	10,5 **SBC** R_2, R_1	10,5 **SBC** IR_2, R_1	10,5 **SBC** R_1, IM	10,5 **SBC** IR_1, IM	↓	↓	↓	↓	↓	↓	↓	
4	8,5 **DA** R_1	8,5 **DA** IR_1	6,5 **OR** r_1, r_2	6,5 **OR** r_1, Ir_2	10,5 **OR** R_2, R_1	10,5 **OR** IR_2, R_1	10,5 **OR** R_1, IM	10,5 **OR** IR_1, IM	↓	↓	↓	↓	↓	↓	↓	
5	10,5 **POP** R_1	10,5 **POP** IR_1	6,5 **AND** r_1, r_2	6,5 **AND** r_1, Ir_2	10,5 **AND** R_2, R_1	10,5 **AND** IR_2, R_1	10,5 **AND** R_1, IM	10,5 **AND** IR_1, IM	↓	↓	↓	↓	↓	↓	↓	
6	6,5 **COM** R_1	6,5 **COM** IR_1	6,5 **TCM** r_1, r_2	6,5 **TCM** r_1, Ir_2	10,5 **TCM** R_2, R_1	10,5 **TCM** IR_2, R_1	10,5 **TCM** R_1, IM	10,5 **TCM** IR_1, IM	↓	↓	↓	↓	↓	↓	↓	
7	10/12,1 **PUSH** R_2	12/14,1 **PUSH** IR_2	6,5 **TM** r_1, r_2	6,5 **TM** r_1, Ir_2	10,5 **TM** R_2, R_1	10,5 **TM** IR_2, R_1	10,5 **TM** R_1, IM	10,5 **TM** IR_1, IM	↓	↓	↓	↓	↓	↓	↓	
8	10,5 **DECW** RR_1	10,5 **DECW** IR_1	12,0 **LDE** r_1, Irr_2	18,0 **LDEI** Ir_1, Irr_2					↓	↓	↓	↓	↓	↓	↓	6,1 **DI**
9	6,5 **RL** R_1	6,5 **RL** IR_1	12,0 **LDE** r_2, Irr_1	18,0 **LDEI** Ir_2, Irr_1					↓	↓	↓	↓	↓	↓	↓	6,1 **EI**
A	10,5 **INCW** RR_1	10,5 **INCW** IR_1	6,5 **CP** r_1, r_2	6,5 **CP** r_1, Ir_2	10,5 **CP** R_2, R_1	10,5 **CP** IR_2, R_1	10,5 **CP** R_1, IM	10,5 **CP** IR_1, IM	↓	↓	↓	↓	↓	↓	↓	14,0 **RET**
B	6,5 **CLR** R_1	6,5 **CLR** IR_1	6,5 **XOR** r_1, r_2	6,5 **XOR** r_1, Ir_2	10,5 **XOR** R_2, R_1	10,5 **XOR** IR_2, R_1	10,5 **XOR** R_1, IM	10,5 **XOR** IR_1, IM	↓	↓	↓	↓	↓	↓	↓	16,0 **IRET**
C	6,5 **RRC** R_1	6,5 **RRC** IR_1	12,0 **LDC** r_1, Irr_2	18,0 **LDCI** Ir_1, Irr_2				10,5 **LD** r_1, x, R_2	↓	↓	↓	↓	↓	↓	↓	6,5 **RCF**
D	6,5 **SRA** R_1	6,5 **SRA** IR_1	12,0 **LDC** r_2, Irr_1	18,0 **LDCI** Ir_2, Irr_1	20,0 **CALL*** IRR_1		20,0 **CALL** DA	10,5 **LD** r_2, x, R_1	↓	↓	↓	↓	↓	↓	↓	6,5 **SCF**
E	6,5 **RR** R_1	6,5 **RR** IR_1		6,5 **LD** r_1, IR_2	10,5 **LD** R_2, R_1	10,5 **LD** IR_2, R_1	10,5 **LD** R_1, IM	10,5 **LD** IR_1, IM	↓	↓	↓	↓	↓	↓	↓	6,5 **CCF**
F	8,5 **SWAP** R_1	8,5 **SWAP** IR_1		6,5 **LD** Ir_1, r_2		10,5 **LD** R_2, IR_1			↓	↓	↓	↓	↓	↓	↓	6,0 **NOP**
Bytes per Instruction	2				3				2					3	1	



Legend:
R = 8-Bit Address
r = 4-Bit Address
R_1 or r_1 = Dst Address
R_2 or r_2 = Src Address

Sequence:
Opcode, First Operand, Second Operand

Note: The blank areas are not defined.

*2-byte instruction; fetch cycle appears as a 3-byte instruction.

The reason that 'No Bytes' is included in the equation is because the extended timing mode is enabled (bit 5 of R248) which will put an extra t pulse into every machine cycle. Faster machine code routines can be run if we place an instruction at the beginning of the routine which disables this bit.

UTILITIES

Apart from the line assembler, version 2.0 software also contains improvements on the version 1.0 software and some additions, notably FILL and COMPARE (see Table 1.0 for comparison). A useful feature of this software is that nearly all of the utilities use machine code subroutines for the main body of the utility, with BASIC used for inputing and outputing parameters. Therefore, providing the appropriate parameters have been loaded, it is possible to call these subroutines from a user program or from the immediate mode.

As an example, if we wished to assemble the previous program and then examine the code produced, we might write the following:

```
100 LIST USR ($B3FO,105)
101 A = $20000 : B = %2100
102 GO@%B8EE
104 STOP
105 $ABS%2000
```

The routine at %B8EE would then give a hex and ASCII dump of the memory contents between the limits of A and B (%2000 to %2100).

I should like to thank my colleague Alain Georges of our French office for allowing me to modify his line assembler to work in the AMBIT Z8 board.

Next month: interrupts and math routines.

For more information the following documents should be referred:

Z8 Microcomputer Technical Manual.

Z8 PLZ/ASM Assembly Language Programming Manual.

NB. Z-8 is the registered trade mark of Zilog Inc.

■ R & EW

Your Reactions

	Circle No.		Circle No.
Immediately Interesting	65	Not Interested in this Topic	67
Possible Application	66	Bad Feature/Space Waster	68

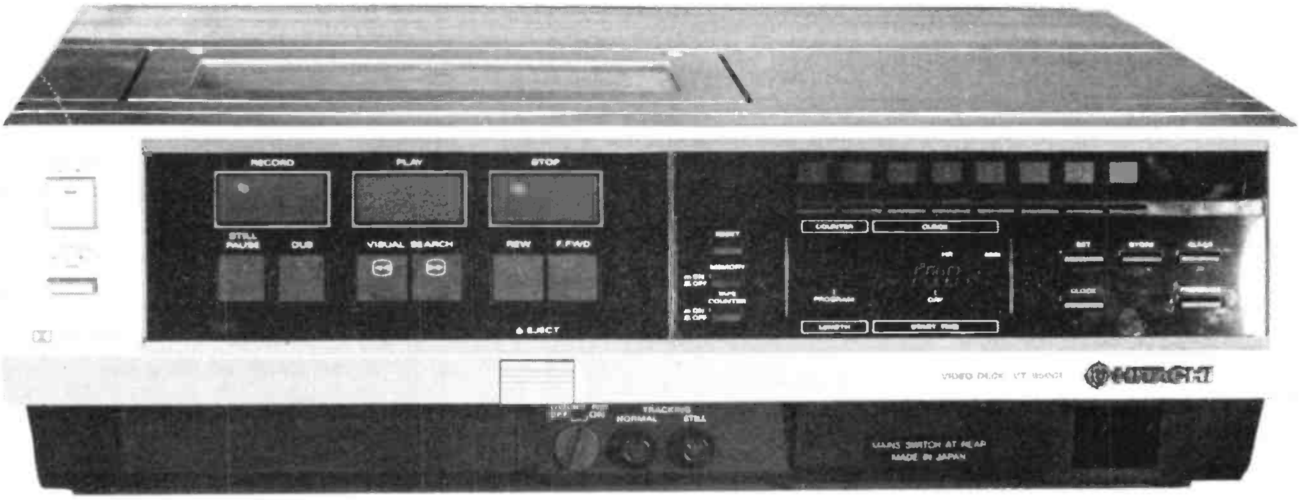
ASSEMBLER EXAMPLES

```
@=Indirect register
#=Immediate data
%=Hex value.
R=Working register designator

ADD     R4,@R8        DJNZ R3 %2006
ADC     30,20         DJNZ R12, *300
ADC     R0, @%23      IRET
ADD     %FD,@R0       RET
DEFS    15            DEFB " HELLO
DEFS    %20           SWAP R5
LDC     R3,@RR10      SWAP 20
LDCI    @RR4,@R6      XOR R4,R5
CALL    *210          SWAP @ 30
CALL    @30           XOR R5,#1
CALL    %3000         XOR @R6,#7
CALL    8040          XOR 60,@59
```

```
NOP                   LD R0,%54(R8) +
CCF                   LD 40(R2), R12
CLR     R15           LD 20, #2
CLR     @30           LD @20,R14
CLR     30            SUB @R4,#0
COM     R4            TCM 4,@R10
COM     @R3           TM R4,20
CP      20            JP *150
POP     253           DECW RR8
SH      @R15          RLC 25
OR      4,#%8         RL @ R6
RCF                   RR @30
DEFB    &24,36,%EE    RRC R15
DI                    SRA R9
INCW    RR10          SBC R9,@73
INCW    60            LDE R3 @RR12
INC     R2            LDEI @R1,@RR7
DA      R5            JR * 500
(+:- Index mode)
```

HITACHI 9500



A 'second generation' recorder that boasts full IR remote control and Dolby Noise Reduction amongst many other features. At around £500 Peter Luke concludes that it's a bargain.

THE RECENTLY LAUNCHED 9000 series of video recorders from the Hitachi stable are not merely cosmetically engineered versions of their previous 8000 range, but are, what might be termed, second generation recorders. The experience gained during the design and subsequent production run of the 8000 models has enabled Hitachi to produce a new batch of recorders that boast an impressive array of features, excellent performance and reliability at a reasonably low retail price.

The 8000 series was developed around the 8500 model (see **R&EW** July 1982), the range being expanded with the addition of the full spec. 8700 and the 8300 budget model. The 9000 series features direct replacements for each of the earlier recorders in the shape of the 9700, 9300 and, the subject of this review, the 9500. Each of the new models enters the market at about the same price as its predecessor but each has more facilities than the equivalent earlier machine. This philosophy of more and more machine for the same sum of money, rather than a continual downward move in pricing is common to nearly all consumer electronic goods - presumably there's no reason for Hitachi to 'buck the system'.

A MATTER OF STYLE

The appearance of the 9500 is a departure from that estabished with the 8000 series, being a mixture of the familiar Japanese metallic grey together with an all black front panel. Attractive yes, but some of the controls suffer from the black cat at midnight syndrome, being rather hard to accurately locate. The channel selector buttons, of which there are eight, suffer particularly in this respect, especially during programming of the timer as the channel number legend lights are extinguished during this process. Finding the right channel is very much a question of feeling your way along the row of buttons counting as you go.

The Hitachi's IR remote control unit duplicates all front panel motion controls (and adds frame advance) as well as offering sequential up and down channel changing.

The tape motion controls are all solenoid operated, a standard feature on even the cheapest machines today and under full logic control - again, to be expected on any new machine. The controls are large and feature LED indicators in most cases (the cat's eyes?).

The eject function is still manual rather than solenoid operated, although fully interlocked to prevent a cassette being ejected whilst the tape is in motion. This at least has the advantage that the cassette can be removed in the absence of power. The cassette draw is not damped, one feature that has surprisingly been dropped during the 8000 to 9000 transformation.

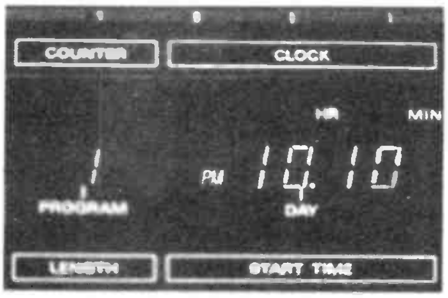
TRICKS OF THE TRADE

The 9500 offers most of the useful trick functions, omitting the gimmicky double speed play and the slightly more useful half speed functions. Also missing is an index facility. This feature is found on many 'up market' recorders and records, on a control track, a brief pulse that identifies the start of a recorded section. Very useful in rapidly locating various sections on a long tape and perhaps the facility most missed in the 9500's list of features.

The recorder does however provide visual search at nine times normal speed in both the forward and reverse directions. Also featured are pause, frame advance and audio dub.

We'll discuss the performance of the recorder later in this review, merely

The clock display and the four digit 'electronic' tape counter.



The first stage in setting up the Hitachi's timer is to select the program memory to be entered (one in this case) and the program start time.

The program duration and the day on which the recording is to commence are then entered.

working our way through the list of features for the moment.

Full IR remote control is a standard facility on the 9500, the remote unit duplicating all front panel motion controls and offering sequential channel change (step up/step down).

A full complement of audio/video in/out facilities are provided via four phono sockets concealed behind a front panel flap. The front panel location of these sockets does make them easily accessible but means that if leads are to be permanently connected to any of them (as may well be the case if the audio output is used to feed an external amplifier/speaker combination) a slightly untidy appearance can result.

As is usual on Hitachi machines, switching between video and audio sources (built-in tuner or front panel input) is done on a priority basis, thus inputting a signal via the input sockets will override the off-air signal. If the recorder is in the play mode, the played back signal will override all other sources.

The front panel flap also conceals a remote pause socket and a 'mic' input - both for use if the 9500 is to be operated in conjunction with a TV camera and suitable mains adaptor.

TAPE MEASURE

The 9500 features an electronic tape counter, although this is strictly an electronic implementation of a mechanical tape counter rather than a true elapsed time indicator. A disappointment as an elapsed time/time remaining indicator is a very useful device and a few pounds more spent in this area would have been very welcome. Having said that, the digital display of the 9500 is easily read, something that cannot be said for the tiny mechanical display of the 8000 series.

The tape counter's display is separate from that of the clocks and can be turned off by a front panel button and is extinguished when the recorder itself is set to standby - although in both cases its 'position' is memorised.

The counter is reset by another front panel button but is not automatically reset when a cassette is ejected - a useful feature on some machines: who said F1?

The recorder also has a memory option, which will stop the tape during rewind as the counter reaches the zero mark.

The most important facility that has found its way into the mid-priced 9500 is the Dolby Noise Reduction System. Some form of noise reduction is a must if the low linear tape speeds used in the VHS and Beta systems are to produce an audio performance that is anyway acceptable in terms of S/N ratio.

The Dolby circuitry is activated by a front panel control, rather than being hidden away behind a flap somewhere. A minor irritation however, is that there is no LED to indicate that the Dolby system is active and impossible to tell from a glance at the recorder - back to those black cats.

Construction of the 9500 is of an adequate quality although it does not ooze robustness with the on/standby and timer on/off switches not looking up to the job. It should, however, stand up to the gentle demands of domestic life - in fact according to some trade sources Hitachi recorders are some of the most reliable with a failure rate of only 1% during the first year - some other brands rating a 10, which unlike Bo Derrick's case, is not very good.

IN ACTION

Initial setting up of the recorder is a fairly straightforward procedure with each step being adequately explained in the manual for the benefit of the video tyro.

Tuning of the eight channels of the recorder is via a set of thumbwheel pots, rather close together and 'fiddly' to set but as this is a once and only - or at least rarely performed - operation such a failing is easily forgiveable.

Tuning the TV set to the Hitachi's modulated output is aided by a (vision only) test signal - the modulator's frequency is adjustable to allow it to be set at a frequency other than the preset channel 36 if this results in co-channel interference with a broadcast station in your area.

Setting up the recorder's clock is simple enough; set AM/PM (it's a 12 hour clock), then set hours (tens and units) and minutes (tens and units) - these operations accomplished by means of advance and set buttons. An operation that's more time consuming to explain than to implement.

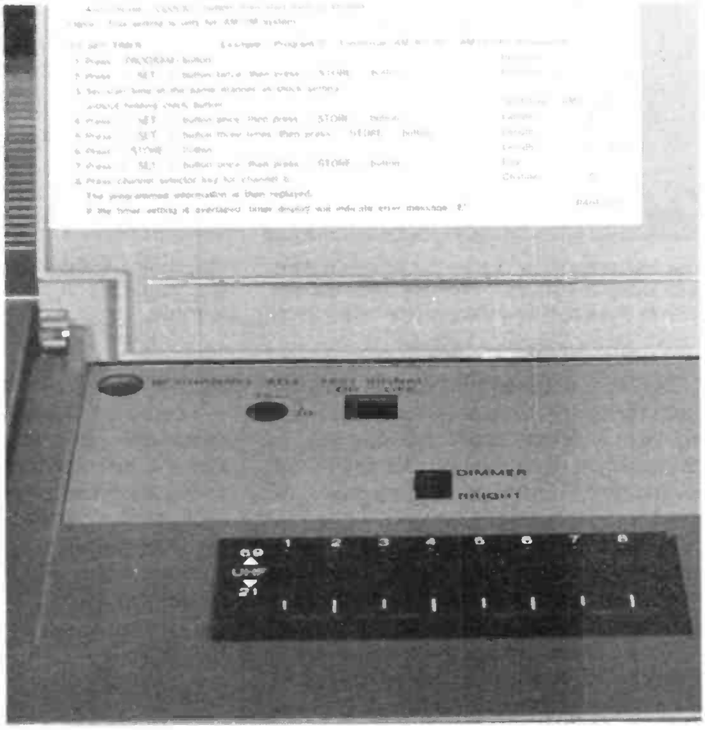
It is not necessary to set up the day as the timer is only capable of recording up to 10 days in advance, the precise day being entered as 'present' plus a number from 0 to 9.

Operation of the timer is delightfully easy - so much so that no error messages were thought necessary. Having set up the program memory to be entered (1-3) the start time is set in the same manner as the clock. At this stage, rather than entering a stop time, the duration of the recording is entered. Finally the day of the recording is entered (day 0 will record a program later the same day). The contents of the three program memories can be easily verified.

QUALITY COUNTS

The quality of the results obtained with the 9500 are up with the best that the VHS format can offer until, that is, the promised 'professional' VHS recorders make their debut.

The 9500's in/out sockets are concealed behind a front panel flap. While this means there's no groping about at the back of the machine to find the appropriate socket - it can lead to an untidy appearance.



The recorder features a manual as opposed to electronic tuner, and provides a test signal generator. A display brightness option is also available.

Playback of material recorded on the 9500 showed adequate resolution and little in the way of chroma shift or displacement.

Engaging play blanks the screen for about five seconds as the recorder's circuitry stabilises - an approach that is preferable, in this reviewer's opinion, is to maintain the off-air signal during the stabilising of the circuits.

On the subject of muting, many machines mute sound and vision while no off-air signal is present. A good idea as, while 'snow' on screen is not too objectionable, the roar of unmodulated audio is very annoying if, for example, the machine is stopped during a late night video film when the broadcast stations have closed down.

This photograph shows that the 9500's still frame performance is excellent.

The nine times visual search produces a picture that is viewable, noise bars are present and, as explained in last month's video news, the number of noise bars present depends on the linear tape speed and, as might be expected, a nine times visual search produces quite a few such bars.

The visual search functions are controlled by 'dedicated' buttons, much better than sharing the function with the rewind controls.

Pause worked well, with any noise hidden from view at the top or bottom of the screen. The recorder has about three frames in which to get things right, taking about half a second to do so.

Frame advance is just that, with the tape being 'pulsed' forward one frame at a time.

The Dolby system did an excellent job, with the annoying HF hiss, characteristic of any recorder without some form of noise reduction, being reduced to an acceptable level. Leaving the Dolby 'on' when playing back unencoded tapes resulted in a slightly dull, but quite acceptable, audio quality.

GOOD VALUE

The 9500 is widely available at around the £500 mark and at this price must be considered a good buy. The provision of IR remote control and Dolby Noise Reduction take it firmly out of the budget group of recorders, and the facilities it provides are comprehensive enough for most uses.

These points, together with Hitachi's name for reliability, make the 9500 worthy of serious consideration.

FOOTNOTE

Since preparing this review at least one other assessment of the 9500 has passed **R&EW**'s way. While the general consensus formed by the other review was much the same as that of our look at the machine - namely that it offers excellent value for money in terms of quality and features - in other areas the review finds fault with the recorder's operation which to us seemed faultless.

In particular the other magazine's reviewer found the Hitachi's timer difficult to master - reinforcing this opinion with phrases such as 'you'd need a degree to be able to fathom the timer's operation and 'the manual had to be left near the machine as it had to be constantly referred to when setting up the timer'.

If you've read the above review, you'll find that we thought the timer to be particularly easy to use. Now it may be that the **R&EW** staff, being in the main from an engineering background, are at one with computers/calculators and video recorder timers and that people from a more 'artistic' background would find the timer an obstacle. We somehow doubt it.

The divergent views on this machine's operation do highlight the fact that reviewers are only human and as such, any review will to some extent be a subjective assessment of a piece of equipment's performance (no more so than many of the reviews appearing in hi-fi magazines). This reinforces the oft made point, that while reviews can point buyers in the right direction and, to a certain extent, educate them as to what to look for, there is no substitute for going along to your local dealer and asking for a demonstration. Any reputable dealer should be able to put the recorder through all its paces and be able to answer any of your questions without having to continually refer to the manual. If he cannot, take your custom elsewhere.

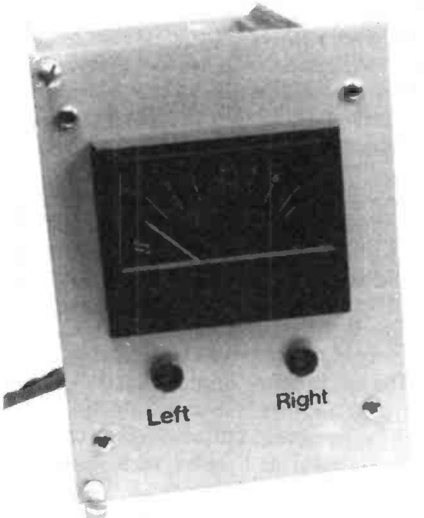
■ **R & EW**

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

AUDIO BRIEF

PEAK PROGRAMME METER

Following on from last month's introduction to audio specs and the theory of professional PPM design, David Strange describes a Peak Programme Meter project; easily adapted for mono or stereo signal sources.



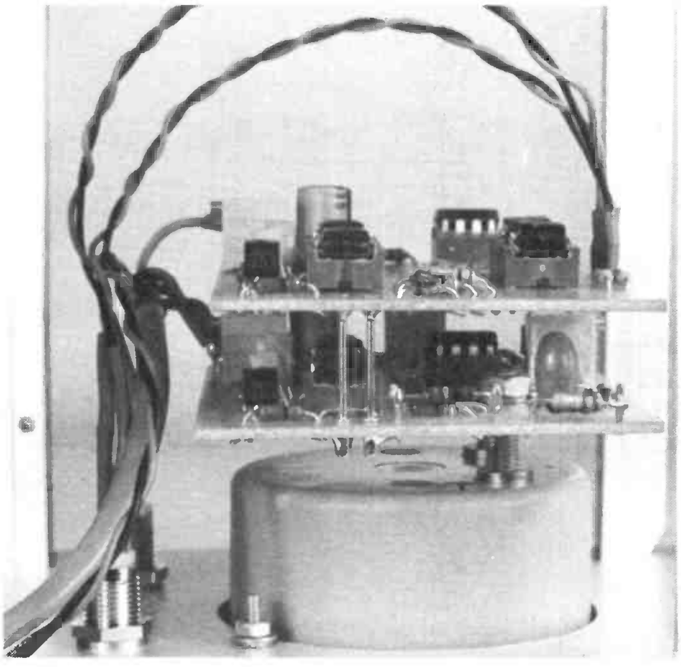
The basic unit consists of a mono PPM and optional adaptor board, which allows stereo presentation on a single meter. The impedance of the inputs is high, to prevent loading of the circuits being monitored, and although the amplifiers are intended for standard levels (0.775 V RMS = OdB), their gain is adjustable. 'Line-up', a lengthy and sometimes tedious task with some PPM circuits, has been simplified to just 2 steps-without compromising the meter's accuracy. The **R&EW** PPM will drive any BS PPM movement, and is dimensioned to mount directly onto the input studs of most commonly available meters.

CONSTRUCTION

High stability 2% resistors should be used, as indicated, and the first step is to insert wire links, pins and sockets into the boards. Round off the ends of the cage jack pins (if used) before soldering. ZD1, R1, C1 and C201 should be omitted if the PPM is to be driven from a split supply. It is preferable to use sockets to mount the IC's and then insert all the other components, checking correct orientation - the transistors used in the prototype were 'L' suffix types (collector centre leg). Finally, note that R11 and R10 are mounted via pins (R10 = 68R, R11 = 68k mono version; R10 = 68R, R11 = 220k stereo version).

SETTING-UP

Mono version: having had one last look at the boards to check everything is in place, secure the mono board to the meter studs, observing polarity. Check the mechanical zero of the meter and adjust if necessary. When using a single rail supply the audio may be referenced to either positive or negative rail, but when a split rail is used the signal should be referenced to OV. Apply power and adjust the meter to read zero using RV2. Then adjust RV3 so that the divider chain voltage is at maximum. Apply a 1kHz tone of -8dB (see equivalent RMS voltage in specification table) and adjust RV1 to bring the meter to read -8dB or PPM mark 2. Next apply a +8dB 1kHz tone and adjust RV3 to bring the meter to +8dB or PPM mark 6. Check the meter zero again and calibrate all scale points against the specification table. The time constants *should* be correct, but may be checked if the facilities for applying appropriate tone burst exists (remember that R11 has a different value in the stereo version).



Both boards are required for stereo - these plug together via long connecting pins.

DIMENSIONS (mm):	61 wide x 74 long x 30 deep (with 2 boards combined)
POWER REQUIREMENTS:	24V to 30V DC or +12V to +15V DC (current 40mA at 24V)
INPUT:	Unbalanced; may be referenced to either rail or OV. 50k impedance.
SENSITIVITY:	Adjustable from –6dB to beyond +20dB (indicated as OdB on the meter)
FREQUENCY RESPONSE:	31.5Hz to 16kHz + 0.3dB

Table 1: The specifications for our stereo/mono PPM.

When you've established the mono version is working correctly, switch off and plug in the stereo adaptor board. Restore power, and with no signal applied check zero; adjusting RV2 as necessary. Check that both LED's are extinguished. Next apply a +8dB 1kHz tone to both boards and adjust RV201 so that +8dB is indicated and both LED's remain lit. You should be able to observe the 'take-over' point, from one rectifier to the other, by watching the meter needle as well as the LED's. Once the PPM has been aligned, RV1 and RV201 may be used as gain control. ▶

CIRCUIT DESCRIPTION

The signal is applied to RV1, via AC coupling capacitor C2, and then to the non-inverting input of IC1. This has unity gain, in the positive half cycle of the input, and x2 gain in the negative half cycle. The signal is recovered from the junction of R3 and D2 and applied to the inverting input of IC2. Here, differential summation with the 'unprocessed' signal at IC2's non-inverting input, results in a 1:1 undirectional version of the original signal, which is then applied to the base of Q1. This transistor is used to obtain a lower output resistance from the rectifier and D4 is present to isolate the charged capacitor C7. In order to remove any non-linearity effects from Q1 and D4, feedback is taken from D4 to the input of IC2.

A capacitor, C7, is charged through R10, and discharged by R11, to provide the time constant of the PPM. From C7 the DC signal is applied to IC3, whose output is used to drive the PPM movement (via R25). With regard to IC3's gain, it is entirely signal dependant. Initially, when the signal is below approximately - 10dB, the gain is set by R15 and R16. However, with higher levels, Q5 is turned on and R17 is then 'seen' as parallel with R16. This increases the gain, which is 'held' until about -2dB input, when Q4 begins to conduct (R14 is parallel with R15) and the gain is decreased again. At about +2dB, Q3 conducts and R13 parallels with R15 *and* R14 reducing the gain still further. Finally at about +6dB, Q4 conducts and R12 parallels in- circuit to reduce the gain of IC3 to a terminal value.

The points at which Q2, Q3 and Q4 conduct, are set by voltages on a resistor divider chain across ZD2 - VR3 adjusts the voltage at the top of the chain, allowing for zener tolerances.

COMPONENTS LIST

Resistors

R1,27,214,215	1k
R2,3,4,5,6,202,203,204,205,206	47k
R7,8,25,207,208	4k7
R9,26,209	2k2
R10	68R
R11,13	68k
R12	27k
R14	180k
R15,19	120k
R16	39k
R17	56k
R18	470k
R20	22k
R21	82k
R23	3k3
R24	5k6
R25	4k7
R210,211,212,213	10k

Potentiometers

VR1,201	50k 20 turn cermet preset
VR2,3	10k 20 turn cermet preset

Capacitors

C1,201	47u elec
C2, 202	680n poly
C3,4,5,6,203,204,205,206	47p
C7	22u tant

Semiconductors

LED 201,202	TIL212
BC182L	Q1,5,201
BC212L	Q2,3,4
1N4148	D1,2,3,4,201,202,203,204
B2788C12V	ZD1
B2788C5V6	ZD2
ICl,2,201,202	NE531
IC3,203,204,205	741

Miscellaneous

8 pin sockets, cage jack sockets, cage jack pins, 1mm PCB pins, PCB (A and B), Sifam PPM (movement type 24A).

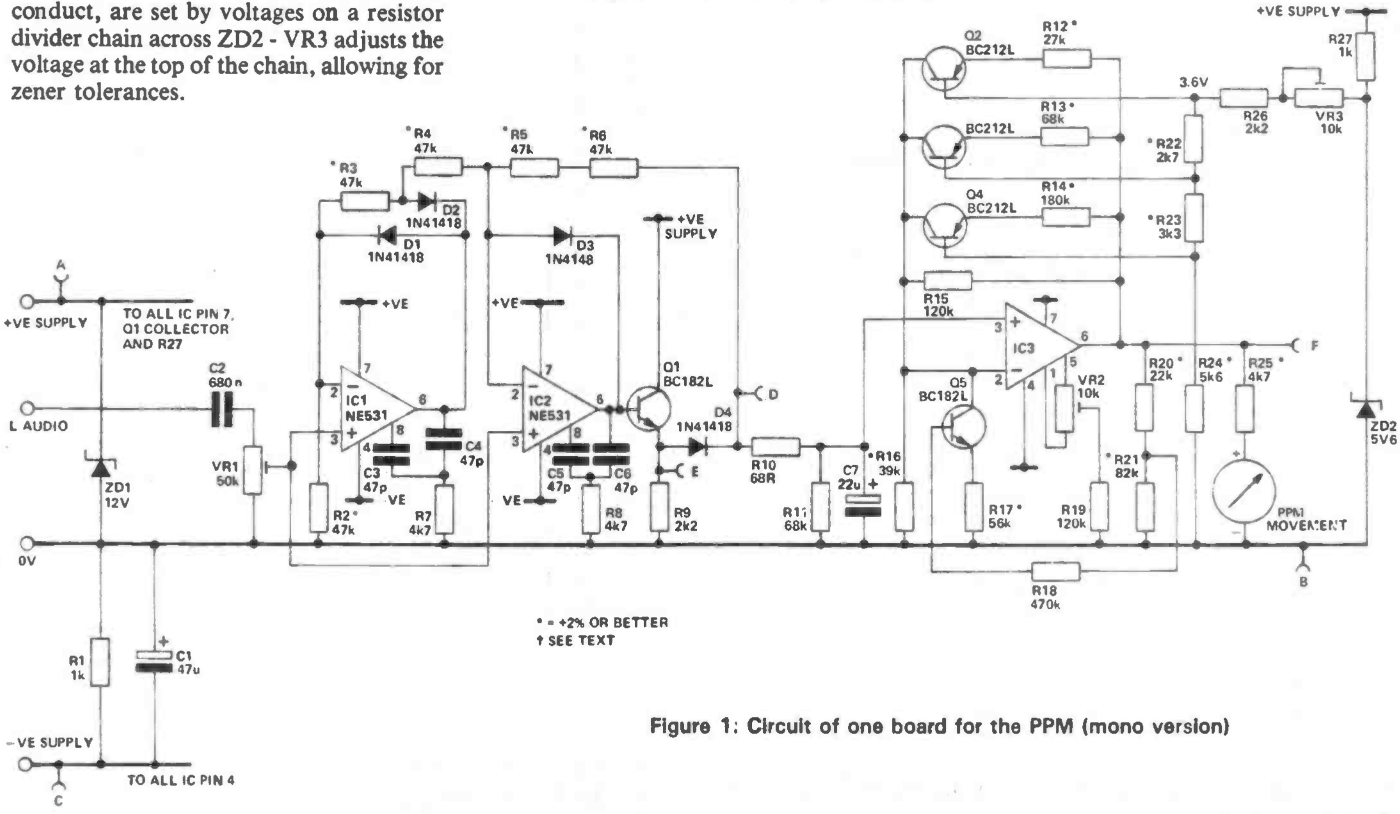
NOTE. The meter movement may be replaced by a bargraph driver and a row of LEDs, though the specification may be altered.

The capacitors C3, C4, C5 and C6 (in combination with R7 and R8) compensate IC1 and IC2 which, because of their high slew rate, would otherwise oscillate.

The stereo adaptor was designed to be used with the mono section already described. So, circuit operation will be considered assuming the boards are connected.

As can be seen, the input and rectifier stages are the same as the mono version. If the voltage on D204 is greater than that on D4, then D4 becomes reversed biased (ie open circuit), allowing C7 to be charged by D204. However, if the voltage on D4 is greater, then it will charge C7 - the voltage on C7 is either L or R, whichever is greatest.

Since only *one* diode conducts, R10 is the same value in the both versions. However, R11 must be increased, for the stereo pair, since the decay time is reduced by parallel resistors R205, 206 and R5, 6. The channel responsible for C7's voltage, is determined by IC203 and IC204. These are used as comparators for the voltages on D204 and D4 - the largest signal being shown by one of the LEDS. To prevent either LED lighting when no signal is present, a threshold is introduced by IC205. The voltage from IC3 is then compared with a standing voltage from potential divider R216 and R217 (the switching threshold is not critical, being around -30dB).



• = ±2% OR BETTER
† SEE TEXT

Figure 1: Circuit of one board for the PPM (mono version)

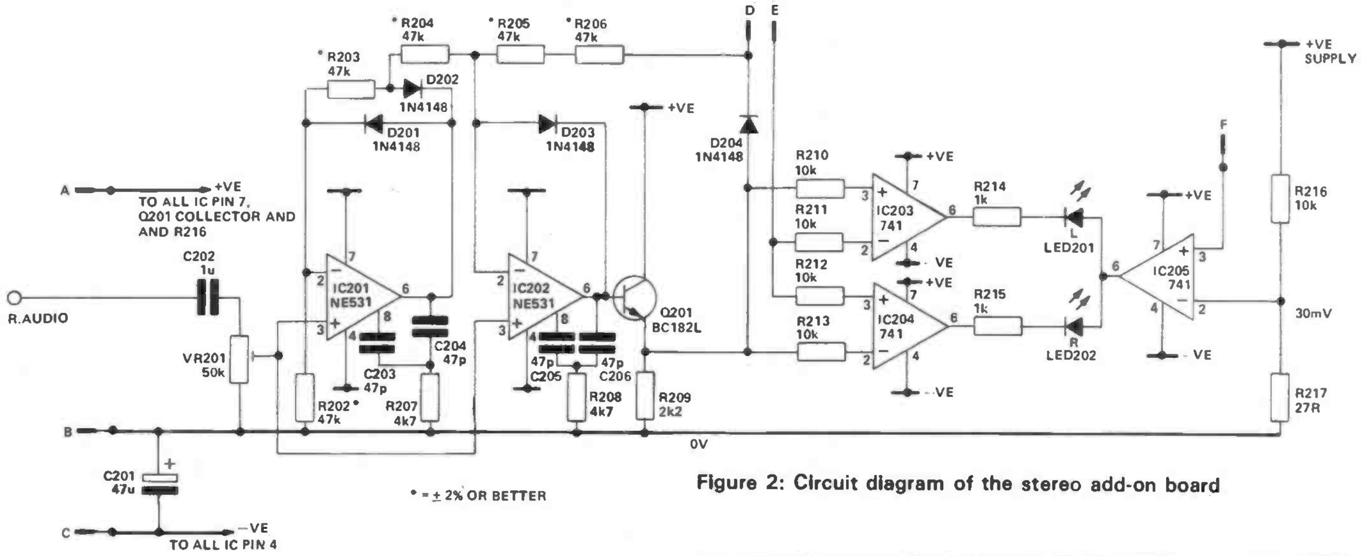


Figure 2: Circuit diagram of the stereo add-on board

PPM MARK	V RMS	dB	ERROR dB
1	0.195	−12	±0.5
2	0.308	−8	±0.2
3	0.489	−4	±0.3
4	0.775	0	±0.2
5	1.228	+4	±0.3
6	1.946	+8	±0.2
7	3.084	+12	±0.5

Table 2: Results obtained from accuracy tests at each PPM mark.

TONE BURST mS	INDICATION dB
100	0 ± 0.5
10	−2.0 ± 0.5
5	−4.0 ± 0.75
1.5	−9.0 ± 1.0
0.5	−17 ± 2.0

Table 3: Dynamic response (attack) to varying period tone bursts (zero crossing bursts of 5kHz sine wave - at +8dB continuous reading - and 10kHz for the 0.5mS burst).

DYNAMIC RESPONSE, DECAY (time taken for meter to fall between +12 dB and −12 dB, when a steady signal is removed): 2.8 + 0.3 secs.
DYNAMIC RESPONSE, OVERSHOOT: < 0.5 dB

Table 4: Other test results (using the procedures indicated).

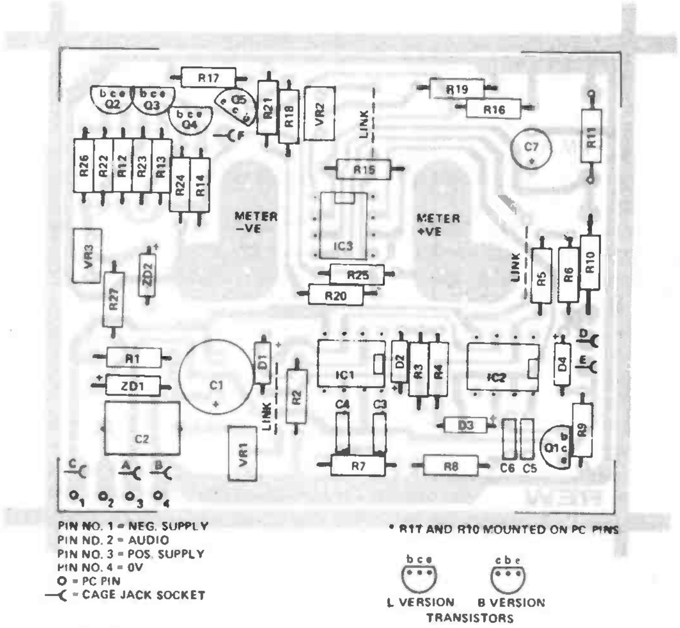


Figure 3: Component overlay for the mono PPM board

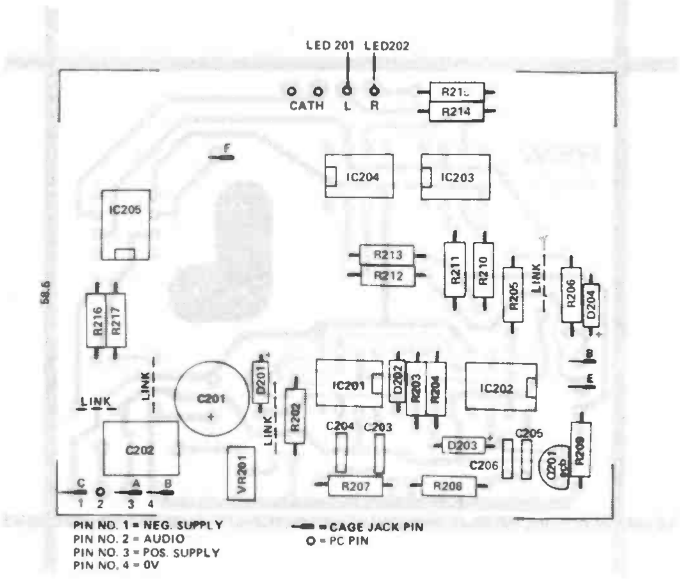


Figure 4: PCB overlay for the extra components required to construct the stereo version.

PPM AND VUM

Calibration of the PPM against an existing VU meter - in a tape machine say - is quite simple. A 1kHz tone should be used to make the VU meter indicate O VU and then simultaneously on the same signal, the PPM should be adjusted to read mark 5 or +4dB. This calibration having been carried out, the VU meter should be ignored and signals monitored on the PPM alone (signals should be allowed to peak up to +8dB or mark 6).

■ R & EW

Your Reactions

	Circle No.		Circle No.
Excellent - will make one	41	Seen Better	43
Interesting - might make one	42	Comments	44

QRV? FER ICOM

IC-R70, The very latest from Icom! £469.

Now that we have tried the R70, we believe that it is going to be a real winner.

The R-70 covers all modes (when the FM option is included), and uses 2 CPU-driven VFO's for split frequency working, and has 3 IF frequencies: 70MHz, 9MHz and 455KHz, with a dynamic range of 100dB.

Other R-70 features include: input switchability through a pre-amplifier, direct or via an attenuator, selectable tuning steps of 1KHz, 100Hz or 10Hz, adjustable IF bandwidth in 3 steps (455KHz). Noise limiter, switchable AGC, tunable notch filter, squelch on all modes, RIT, tone control. Tuning LED for FM (discriminator centre indicator). Recorder output, dimmer control.

The R-70 also has separate antenna sockets for LW-MW with automatic switching, and a large, front mounted loudspeaker with 5.8W output. The frequency stability for the 1st. hour is ± 50Hz, sensitivity- SSB/CW/RTTY better than 0.32 μv for 12dB (S+N)÷N, Am-0.5μv, FM better than 0.32 for 12dB Sinad. DC is optional on the R-70. It has a built-in mains supply.

The IC-R70 measures 286mm x 110mm x 276mm and weighs 7.4Kg., making it a very attractive package indeed. Are you ready for this truly excellent receiver? You must hear it, we know you will be impressed!

IC-25E, The Tiny Tiger £239.inc.

Amazingly small, yet very sensitive. Two VFO's, five memories, priority channel, full duplex and reverse, LED S-meter, 25KHz or 5KHz step tuning. Same multi-scanning functions as the 290 from mic or front panel. All in all the best 2M FM mobile ICOM have ever made.

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

Agents (phone first – all evenings and weekends only, except Scotland).
Scotland – Jack GM8 GEC (031 665 2420)
Midlands – Tony G8AVH (021 329-2305)
North West – Gordon G3LEQ (0565 4040 Ansafone available)

Introducing the NEW IC-740. £699.

This latest transceiver contains all the most asked-for features, in the most advanced solidstate HF base station on the amateur market...performing to the delight of the most discerning operator.

Study the front panel controls of the ICOM IC-740. You will see that it has all of the functions to give maximum versatility to tailor the receiver and transmitter performance to each individual operator's requirements.

Features of the IC-740 receiver include a very effective variable width and continuously adjustable noise blanker, continuously adjustable speed AGC, adjustable IF shift and variable passband tuning built in. In addition, an adjustable notch filter for maximum receiver performance, along with switchable receiver preamp, and a selection of SSB and CW filters. Squelch on SSB Receive and all mode capability, including optional FM mode. Split frequency operation with two built-in VFO's for the serious DX'er.

The IC-740 allows maximum transmit flexibility with front panel adjustment of VOX gain and VOX delay along with ICOM's unique synthesized three speed tuning system and rock solid stability with electronic frequency lock. Maximum versatility with 2 VFO's built in as standard, plus 9 memories of frequency selection, one per band, including the new WARC bands.

With 10 independent receiver and 6 transmitter front panel adjustments, the IC-740 operator has full control of his station's operating requirements.

See and operate the versatile and full featured IC-740 at your authorized ICOM dealer.

Options include:
- FM Module
- Marker Module
- Electronic Keyer
- 2 - 9MHz IF Filters for CW
- 3 - 455MHz Filters for CW
- Internal AC Power Supply

Accessories.
- SM5 Desk Microphone
- UP/DWN Microphone
- Linear Amplifer
- Autobandswitching Mobile Antenna
- Headphones
- External Speaker
- Memory Backup Supply
- Automatic Antenna Tuner

Ask about the new range of CUE DEE antennas, the winners in recent tests!

Thanet ICOM Thanet ICOM Thanet ICOM Thanet ICOM Thanet ICOM Thanet ICOM

174 for further details

QRV? FER ICOM

The World's most popular portables IC-2E £159. IC4E £199.inc.

and now the marine version IC-M12 £199+VAT.

Nearly everybody has an IC-2E, the most popular amateur transceiver in the world, now there is the 70cm version which is every bit as good and takes the same accessories.

Fully synthesized – Covering 144-145.995 in 400 5KHz steps. (430-439.99 4E). **Power output** – 1.5W. **BNC antenna** output socket. **Send/Battery indicator. 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** – 1.5W or 150mW. **External microphone jack. External speaker jack.**

The IC-4E is revolutionising 70cm!

Multimode Mobiles IC-290E £366. IC-490E £445.inc.

290E-144-146 MHz/490E-430-440 MHz. 10 W RF output on SSB, CW and FM. Standard and non-standard repeater shifts. 5 memories and priority channel.

Memory scan and band scan, controlled at front panel or microphone. Two VFO's. LED S-meter. 25KHz and 1KHz on FM – 1KHz and 100KHz tuning steps on SSB. Instant listen for repeaters.

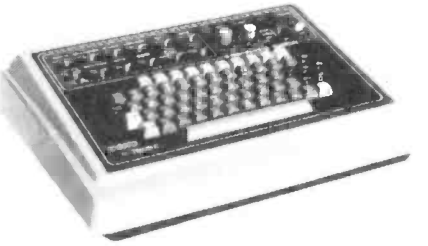
IC-720A Possibly the best choice in HF. £883.inc.

One way of keeping up with rapidly advancing technology is to look at what the IC-720A offers in it's BASIC form. How many of it's competitors have two VFO's 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 really excellent general coverage receiver covering all the way from 100KHz to 30MHz? How many need no tuning or loading whatsoever? and take care of your PA, should you have a rotten antenna. 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 overheating? How many have band data output to automatically change bands on a solid state linear AND an automatic antenna tuner unit?

The IC-720A may be just a little more expensive than some, but it's better than most! Make your choice an IC-720A.

IC-PS15 Mains PSU £99.

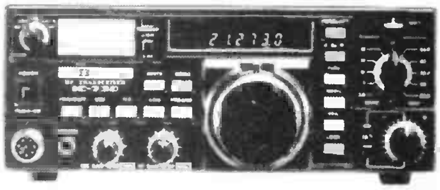
Tono RTTY and CW computers 7000E £500. 9000E £650.inc.



The TONO range of communication computers take a lot of beating when it comes to trying to read RTTY and CW in the noise. Others don't always quite make it!

Check the many facilities offered before you buy – especially look at the 9000E which also throws in a Word Processor. Previous ads have told you quite a lot about these products – but why not call us for further information and a brochure?

IC-730 The best for mobile or economy base station £586.inc.



ICOM's answer to your HF mobile problems – the IC-730. This new 80m–10m, 8 band transceiver offers 100W output on SSB, AM and CW. Outstanding receiver performance is achieved by an up-conversion system using a high IF of 39MHz offering excellent image and IF interference rejection, high sensitivity and above all, wide dynamic range. Built in Pass Band Shift allows you to continuously adjust the centre frequency of the IF pass band virtually eliminating close channel interference. Dual VFO's with 10Hz, 100Hz and 1kHz steps allows effortless tuning and what's more a memory is provided for one channel per hand. Further convenience circuits are provided such as Noise Blanker, Vox, CW Monitor APC and SWR Detector to name a few. A built in Speech Processor boosts talk power on transmit and a switchable RF Pre-Amp is a boon on today's crowded bands.

Great base stations IC-251 £499. IC-451 £599.inc.

ICOM produce a perfect trio in the UHF base station range, ranging from 6 Meters through 2 Meters to 70 cms. Unfortunately you are not able to benefit from the 6m product in this country, but you CAN own the IC-251E for your 2 Meter station and the 451E for 70 cms. Mains or 12 volt supply. SSB, CW and FM.

Thanet ICOM Thanet ICOM Thanet ICOM Thanet ICOM

Thanet Electronics

143 Reculver Road, Herne Bay,
Kent. Tel: (0227) 63859.

BARCLAYCARD VISA

Buy it with Access

Same day despatch if possible

COMPUTING NEWS

Gary Evans looks at a 16 bit computer, computer care and hopes Sony are game for a laugh.

SIXTEEN BIT MACHINES are beginning to dominate the market in all but the consumer sector. The new Comart CP 1000 is an excellent example of such a 16 bit machine. Based on the Intel 8086 6MHz mpu and supporting up to 1 megabyte of main memory, the machine offers a powerful processing package.

5" Winchester hard disks, floppies and up to 14 basic modules, will allow the system to be expanded to 80+ megabytes of on-line storage and to support up to 7 concurrent users.

Operating systems available include CP/M86, MP/M86 and MS-DOS and software packages offering high level languages, financial planning, accounting and word processing applications is available, further software will be announced soon.

Volume production will begin before the end of this year and will initially concentrate on the CP1500 with 128K of RAM, 5" floppy and a 5M byte Winchester. The price will be £3395.

Details from

Comart Ltd.,
Little End Road,
Eaton Socon,
St. Neots,
HUNTINGDON,
Cambridgeshire.

ALIVE AND WELL

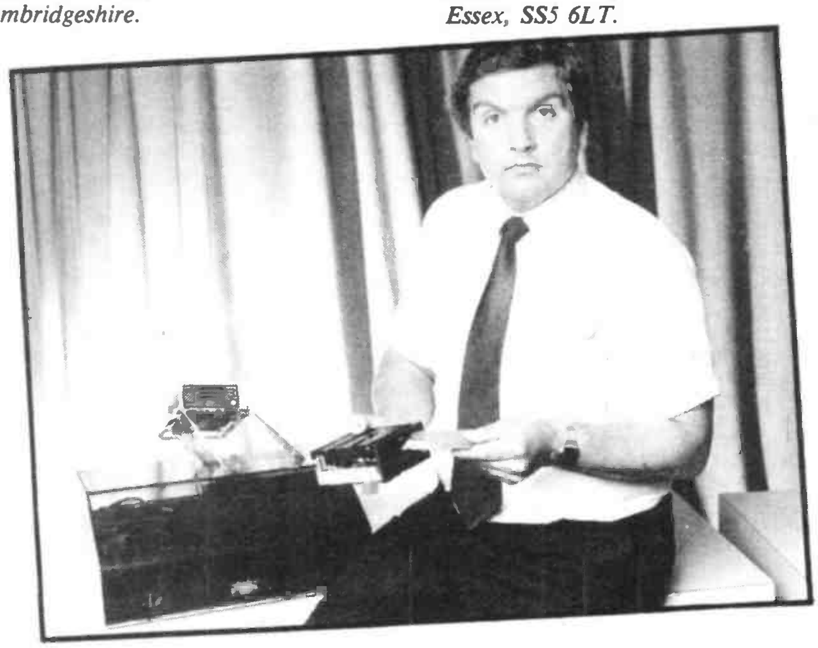
Sales of the ZX81 are still at a healthy level and add-ons for this little money spinner are still appearing at regular intervals.

Latest is a 16K RAM pack from Ground control. Priced at £19.95 the unit fits in with the overall low cost computing concept of the ZX81 and has been designed to overcome the 'wobble' and hence data loss, problems of the Sinclair RAM pack.

An extra £5 will get you a RAM pack with built-in keyboard sounder that can make data entry faster and less of a strain by giving an audible feedback whenever a key is pressed.

Details from:

Ground Control,
Alreda Avenue,
HULLBRIDGE,
Essex, SS5 6LT.



BIB BITS

Bib, the people that help you clean those bits of your equipment that other products cannot reach, have launched a range of computer care products.

We all know the benefits of preventive maintenence, but very few of us are prepared to tackle such tasks if they are at all time consuming. The Bib products make such operations so painless that there really is no excuse for not tackling them.

The photograph shows the current range which should be available from your local computer store.

MICRO FUN

Sony have sent us a story concerning their 3 1-2 inch micro floppy system as featured in their SMC-70 micro. It's now to be made available to OEM customers.

An interesting item, accompanied by a rather strange photo. As we've no room for the caption competition elsewhere in this issue, we thought we'd give computing news readers a chance to exercise their wits.

As a hint, the original caption reads 'Sony micro floppy disk system product manager Robin Allison shows off his wares' can you top that.

Entries to the editorial offices please. The winner of this and last month's competition will be announced in our January issue.

Your Reactions..........	Circle No.
Immediately Interesting	57
Possible application	58
Not interested in this topic	59
Bad feature/space waster	60

R&EW Data Brief

MSL 9362 RS

The MSL9363RS decodes the digitally proportional signals from the MSL9362RS encoder (data brief 1). The 14 pin DIL package decoder has an **AF** amplifier input with an optional low-pass filter (formed by connecting a suitable capacitor on the 'C' input, pin 10).

To decode the signal, the internal oscillator must be set to the same frequency as the encoder's oscillator. The frequency is defined by resistor (Ro) and capacitor (Co) connected to the inputs OSC 1 and OSC 2. By using the same values the two oscillators are synchronized.

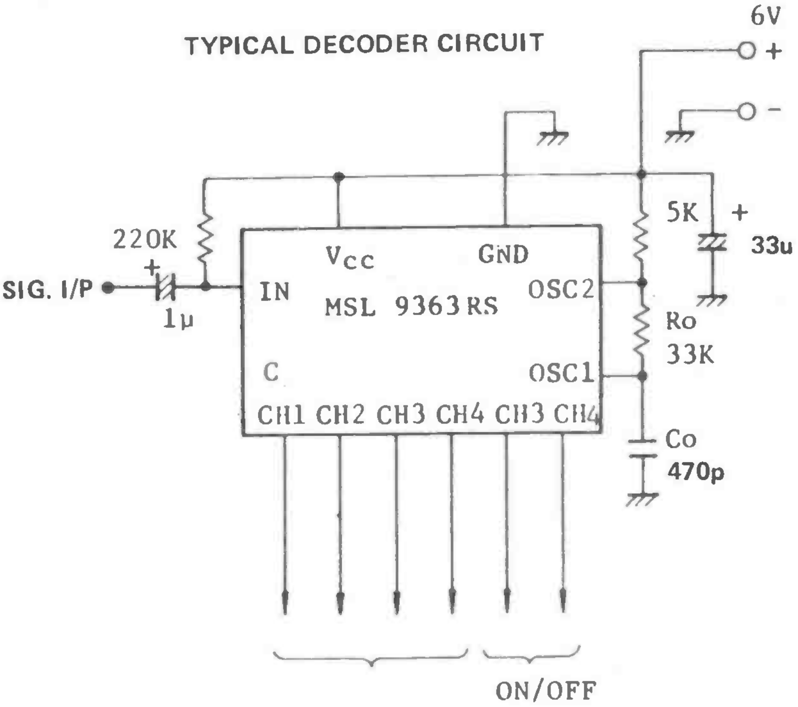
The 4 proportional signals, from the **AF** amp, are defined as the periods between the pulses following the sync pulse. The sync is produced by the signal generator, as a result of the coincidence between the transmitted pulse, at frame frequency, and the decoder's internal oscillator frequency.

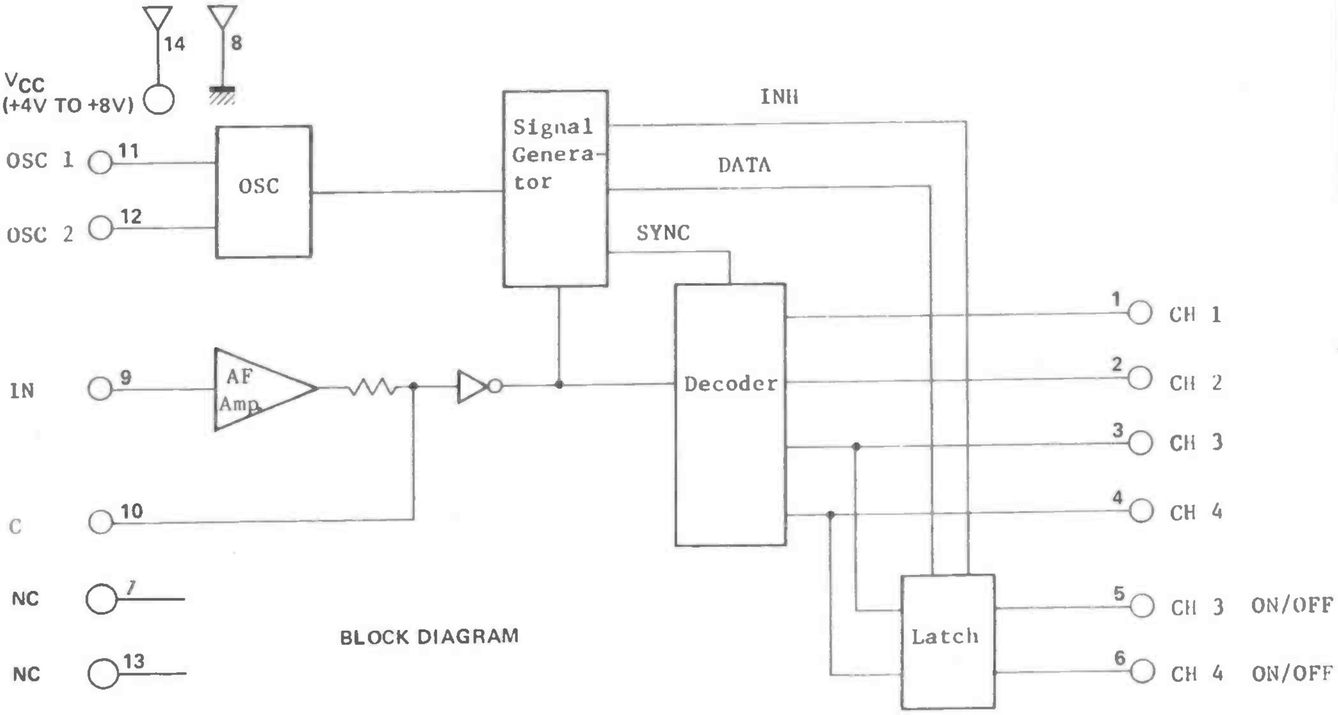
The decoder, then, gives 4 proportional outputs on pins 1 to 4 of the IC. Channels 3 and 4 are also connected to a latch controlled by the signal generator. This latch provides 2 logical ON/OFF functions for switching controls, which gives us two likely modes of operation:

1) 4 proportional channels
2) 2 proportional channels + 2 switching channels.

It is interesting to note that when the 4 proportional channel mode is being used, the ON/OFF outputs are operating simultaneously and could be used if a particular application requires it.

TYPICAL DECODER CIRCUIT





BLOCK DIAGRAM

ELECTRICAL CHARACTERISTICS (Ta=-10~+60°C, TYP: Ta=25°C)

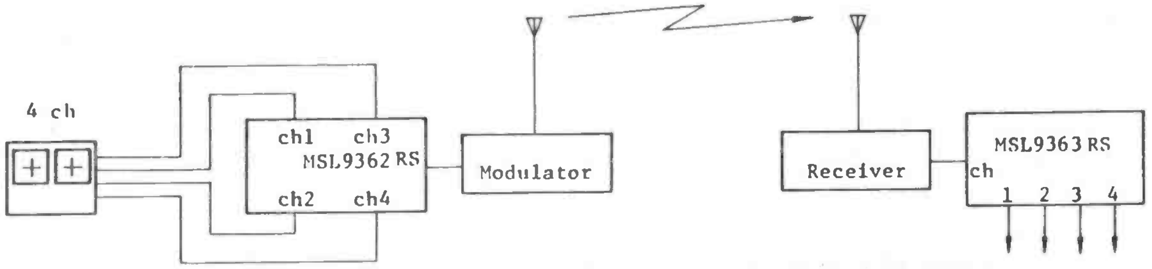
PARAMETER		CONDITIONS	MIN	TYP	MAX	UNIT
Logical "1" Input Voltage	V_{IH}	V_{CC} = 4V	1.5	—	—	V
Logical "0" Input Voltage	V_{IL}	V_{CC} = 4V	—	—	0.5	V
Logical "1" Input Current	I_{IH}	V_{CC}=7V, V_{IH}=7V	0.1	—	1.0	mA
Logical "0" Input Current	I_{IL}	V_{CC}=7V, V_{IL}=1V	—	—	-5.0	µA
Logical "1" Output Voltage	V_{OH}	V_{CC}=4V, I_{OH}=-5mA	1.5	—	—	V
Logical "0" Output Voltage	V_{OL}	V_{CC}=4V, I_{OL}=5mA	—	0.25	0.4	V
Logical "1" Output Current	I_{OH}	V_{CC} = 4V	-8	—	-30	mA
Output Leakage Current	I_{LO}	V_{CC}=7V, V_O=5V	—	—	10	µA
Supply Current	I_{CC}	V_{CC} = 6V	—	16	21	mA

ABSOLUTE MAXIMUM RATINGS

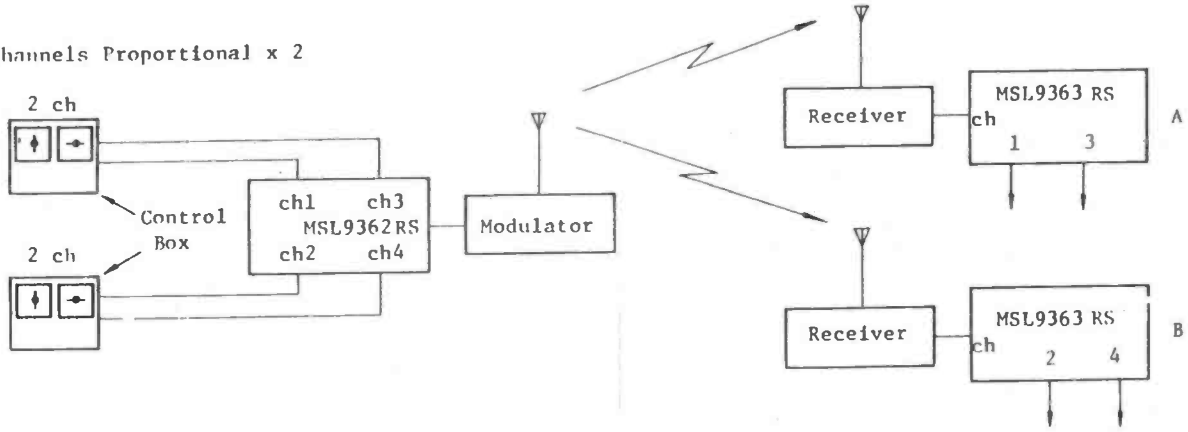
*1 : IN

*2 : CH1 ~ CH4

PARAMETER		CONDITIONS	RATINGS	UNIT
Supply Voltage	V_{cc}	Ta = 25°C	15	V
Input Voltage	V_{in}	Ta = 25°C*1	-7 ~ +10	V
Output Current	Io	Ta = 25°C*2	-30 ~ +30	mA
Power Dissipation	P_D	Ta = 25°C	200	mW
Storage Temperature	T_{stg}	—	-55 ~ +150	°C



2 Channels Proportional x 2



NOTES FROM THE PAST

Centre Tap's column, from 1951, features some views on the value of a practical approach to equipment servicing and some advice on the production of Club Magazines.

A young man fresh from a Technical College, who has recently started in the industry, told me of his surprise to find so much ignorance of mathematics and higher theory among radio servicing engineers. When I pressed the point he admitted that many of them were highly successful troubleshooters. Personally I should be inclined, despite all his theory and advanced maths, to put my money on some of the troubleshooters I have met in a time-limit servicing competition with him - chaps, too, who might easily flounder in the simpler examinations. The highly trained youngster would, of course, track down faults, but he would do so by complex conscious reasoning. The far less technical veteran would probably put his finger on it half-instinctively in much less time.

Such men, and I have met a fair number despite a rather limited acquaintance with servicing engineers generally, are like the green-fingered gardeners. They have a natural flair for it. Many of them can, with particular makes of sets with which they are familiar, spot quite obscure and unusual faults almost instantly. They cannot explain how they do it nor can they teach anyone else. They just have a 'feeling' that a certain thing is not quite right, possibly picked up from some clue such as the form of distortion, the sort of hum, or a trace of melted wax in the corner of the chassis.

When I was with the Services we had one such chap who had previously run a successful one man repair business. If it had been a private firm, and not the army, he would have had the sack before the first week was up. He was hopelessly lost with strange and complicated apparatus, but within a few weeks he was doing the 'sticky' ones - those in the corner over which a lot of time had already been unsuccessfully spent, and had been put aside until we were less busy. Once they got there, by the way, nobody else liked to take them on unless driven to it. He explained it quite simply by saying he had now got the 'feel' of the sets. Most of us will know just what he meant by the 'feel', but it baffles a more scientific description. True to form, he usually did badly on the various courses on which he was sent, and I believe he even flopped in his first attempt on the trade test.

JUST THE TOUCH

This, which for the want of a better term we call 'feel' cannot be logically explained. Almost all of us must have met the craftsman who can accurately judge the quality of materials simply by handling them. Maybe a baker who knows by the look and feel of a handful of flour, just what sort of bread it will make, and how much water it will take to the sack, or the chef who can spot with absolute certainty the tender joint at a glance or gentle thumb pressure. They cannot explain how they 'know', nor can they describe to what extent they depend on sight or other senses.

Similarly, I have seen experienced radio repairers tell the cause of a particular type of background noise simply by listening. The unaccustomed ear can differentiate between intermittent and continuous crackling, or irregular bangs and rumbles, and most of us are able to reduce the cause to a half-a- dozen possibilities. But the real radio green-fingers detects a subtler difference and can identify the form of trouble almost instantly in models he has grown to 'know'.

It seems that unless you are born with the gift you can never learn to do it by instinct, and even if you are born with it, it seems to need quite a bit of practice before it develops. The theorists's instincts are often blunted by too much theory and examination knowledge, and while the text-book gets him there just the same, it takes much longer. Perhaps the man with the natural flair would be slowed down equally if, instead of 'doing what came naturally', he tried to work to a book of rules.

CLUB MAGAZINES

From time to time copies of duplicated Radio Club magazines reach me, and many of them are very good efforts. Unfortunately many of them, after a promising start, soon flicker out of existence. Their failure is invariably due to apathy on the part of the members - not the members who read them but those who should be helping to write them. The stalwarts who set off to an enthusiastic start gradually lose heart after many disappointments in their efforts to get suitable material from their fellow members.

This is a subject on which I can speak with some experience, having in the dim distant past been associated with a radio club magazine which, despite a flying start, flopped after a few issues. A second venture with another club (not strictly radio but an allied hobby) ran for well over 40 issues. Why the difference? It was not just luck - there were very solid reasons for it.

For the benefit of amateur editors, here are some of the lessons learned from the first failure which helped to ensure success the second time. Don't wait for the contributions to roll in, and by that I don't mean for you to keep worrying your fellow members to simply do 'something'. Plan out what you want from them and then worry them if you must. If they are pen-shy soften them up with a little flattery, and if they are tongue-tied, help them to write it. Warm them up on their pet subjects. Every Club has a meter expert, a keen TV builder, a gadget merchant, a high fidelity group, and the fellow who is always trying to build a midget small enough to carry in his vest pocket.

Dates and times of future meetings should be given prominent display, and the more unusual events such as outings, party visits and general notices, should be accompanied by brief descriptions.

Finally, get a good production manager to look after the dupicating side of the magazine. One who has a flair for that sort of thing and who takes a pride in making clear, unsmudged copies with a minimum of waste.

A well-produced, lively Club News Sheet is a great help both in maintaining the Club spirit and stimulating local interest. It also makes the secretary's job easier (and often cheaper) by avoiding the need for him to prepare and send out frequent circulars. If you can persuade local dealers to display publicity copies it can also serve as a first class means of recruitment of new blood.

Another useful idea is to include among the supporting features a review of the leading articles to be found in the current radio journals. Few hobbyists buy them all and they can thus be assured of not missing items of special interest to them. Occasionally editors of professional periodicals are sympathetically inclined to *bona fide* amateur group magazines, and may permit reproduction of extracts of articles in past issues subject to the usual acknowledgement. Don't omit to ask first!

The editor and I are, of course, always interested to see copies of club and group magazines to see any new ones that may come into being as a result of this encouragement.

Reception Reports

Compiled by Keith Hamer and Garry Smith.

There were no shortages of Sporadic-E reception during August and there were several days when openings lasted from early morning until late evening. Signals from the south and south-east predominated and on at least two occasions the Jordanian channel E3 transmitter at Suweilih (104 kW) was seen.

Signals from Spain (RTVE) were noted on the 1st at 0841 BST with the colour test pattern carrying the identification 'rtve GAMONITEIRO 3' on channel E3. Programmes from Eastern Europe were received on channels R1 and R2 at 0900 and at 0947, the 'RAI 1' PM5544 electronic test card was seen on channel IA from Italy.

On the 2nd there were no signs of Sporadic-E(Sp.E) reception although signals were noted due to slightly enhanced tropospheric conditions. Reception included the Netherlands on channels E32 and E29 with a 'TROS' identification caption at 2222. At 2245 an unidentified FuBK electronic test card from a West German transmitter was seen on E48 with good quality colour.

Trophospheric conditions were also present on the 3rd with the Netherlands (NOS) on channel E32 at 0725 using the old PM5540 electronic test card which was followed by the 'EBU Bar' with the identification 'PTT-NL AVVC-HVS'. At 1728, Sp.E activity produced Spain on E3 and Italy on channel IA.

August 4th was a day to remember with two 'exotics' making an appearance. Sp.E reception was first noted during the early afternoon period with Czechoslovakia(CST) on channel R1 using the 'EZO' test card and the East German network of DDR:F on E4. The PM5544 test card from TVP-Poland was seen during the same period on channel R1. At 1623BST, Yugoslavia was noted on E3 from the Belgrade studios with their 'JRT BGRD 1' PM5544 which included a digital clock. At 1627 another PM5544 test card was noted on E3 and at first it was assumed to be a different JRT outlet. As the signal strength increased it soon became apparent that the signal was not coming from Yugoslavia but Jordan as the identification 'JTV AMMAN' could be clearly seen. Unfortunately, reception from the transmitter at Suweilih was soon swamped by JRT although reception reports from other enthusiasts suggest that the Jordanian signal was about for some considerable time. Later in the day, at 1835, the second 'exotic' signal was noted on channel E2 with a programme which included a coloured gentleman speaking. This programme was identified as originating from the Gwelo transmitter in Zimbabwe (ZTV).

At lunch time on the 6th, Hungary was observed radiating the 'MTV-1 BUDAPEST' PM5544 on R1 and on channel E2a, Austria were transmitting the old monoscopic 'Telefunken TO5' test card carrying the identification 'ORF FS 1'. This was also noted on E3 from the low-power (100 watts) outlet at Breitenstein. On E2, the '+PTT SRG 1' FuBK test card was received from the Swiss transmitter located at Uetilberg (60kW ERP). The 'EXO' test card from CST was also noted at this time on R1. The Portuguese FuBK test card was seen at 1816 on channels E2 (from the 40kW outlet at Muro), E3 (Lousa, 60kW) and E4 (Valenca Do Douro, 35 watts!) with the inscription 'RTP 1'. At 1830 the 'Ω OMEGA' clock caption was noted from RTP showing GMT + 1 hour. At 1954 a PM5544 was seen on E4 and this is suspected of being RUV-Iceland since Icelandic test transmissions continue until late.

On August 8th the maximum usable frequency (m.u.f.) rose sufficiently to allow reception from the USSR on channels R3 and R4. Programmes were also received from Spain (E3), Switzerland (E3), Italy (IA) and Yugoslavia (E3).

Reception on the 11th was limited to mainly medium-hop signals from the south-east. The RAI test card was noted on IA and on R1 the CST 'RS-KH' electronic test card appeared. An FuBK test card was received on E2 from West Germany with the inscription 'GRUNTEN' in the central black bar. At 1700 on E3, West Germany (ARD) was again received with the identification caption 'BR DEUTSCHES FERNSEHEN'. This caption originated from Bavarian television.

Sample pages from 'Teletexto', the Spanish version of CEEFAX, were received on the 12th at lunch time on channel E4, and on E3 the black-white-black pattern from Portugal was noted. Reception from Spain continued with the 'LA MUELA 3' colour pattern on E3 from RTVE. The Swiss FuBK test card from SRG was noted on E3 at 1700 BST.

On Friday 13th, signals from Austria appeared at 0731 with the PM5544 on E2a and on E2 Switzerland was observed from the transmitter at Bantiger. At 0830 on R1 the USSR (TSS) monoscopic test card known as the '0249' (see **R&EW**, September 1982) was in evidence, possibly from the 240kW transmitter at Leningrad.

August 15th was a notable, if not a strange day for long-distance television. A few vigilant enthusiasts noted Sp.E activity as early as 0400 BST although Band I was wide open to the south-east even earlier, as one reader reports. The Italian pirate television station, NCT, situated to the north-east of Venice was seen presumably claiming air space on channel IA. The pattern displayed did not carry identification and the caption resembled a football pitch layout from a video game: Enthusiasts with scanners covering Band I frequencies were able to tune in the various Italian pirate FM transmitters operating between 50 and 60MHz. Many OIRT (Eastern European) FM signals between 66 and 70MHz were also present, but reception faded just before 0500. Russian television on channel R2 was received at 0611; this had a very slow-fade characteristic which suggests a very long reception path. Vertical interval identification signals (VITS) were not present. Later in the day (at 0916!) a PM5544 test card from Yugoslavia was received with the identification 'TRV-1 LJUBLJANA'. Also noted on the 15th

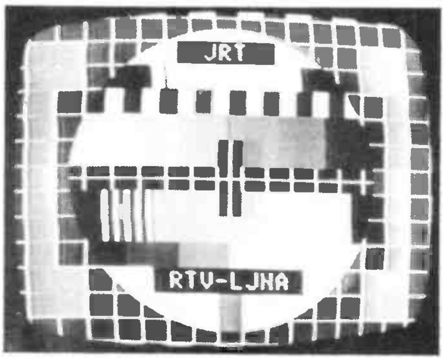


Figure 1: Yugoslavian PM5544 test card from RTV- Ljubljana.

Figure 2: A Cyrillic caption used between JRT commercials.

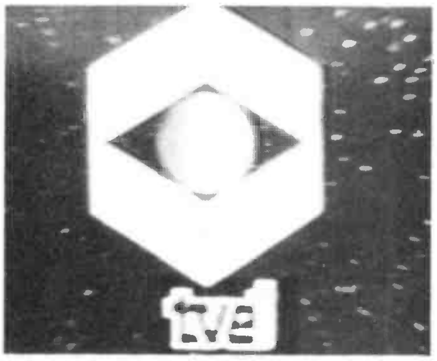


Figure 3: The latest Spanish opening-sequence caption.

were sustained signals from Spain, Portugal, Austria (on channel E4), Italy (with RAI and two further appearances of NCT), the USSR, Hungary (MTV with a frequency-bar pattern and the PM5544) and also an African signal, ZTV-Zimbabwe on channel E2 at 1833. Band I activity was present until well after 2300.

On August 31st, ZTV was again present for a few minutes on E2 from 1820 together with RAI programmes on channels IA and IB. There were also several pop pirate FM radio stations broadcasting between 50 and 60MHz.

FEATURED FORTUNES

Several dedicated enthusiasts have sent us logs for the August period. A typical log is included here from Clive Athowe (Blofield, Norfolk) detailing reception for the second half of August.

15/8/82:

Ch E2,E3 RTP-1 (Portugal) FuBK test card; E2,E3,E4 RTVE-1 (Spain) progs: IA, IB RAI-1 (Italy) progs, also on channel ID via Sp.E. Italian FM radio stations noted up to 107MHz plus RTT (Tunisia) FM radio on 96.5MHz.

Ch F2, F4 TDF (France) prog; R1 EESTI (USSR) tv prog, also R2. E3,E4 JRT (Yugoslavia); R3 TVP (Poland); E2 NRK (Norway) 'NORGE MELHUS' PM5544; E2 BR- 1 (West Germany); E3 JTV (Jordan) with a programme schedule at 1800 BST; IC RTS (Albania) with 'Revista' News prog; E2, E3 YLE-1 progs; R2 TVR (Rumania).

17/8.82:

IA,IB RAI PM5544; R1 TSS 'Letterbox' test card; R1 MTV- 1 PM5544; E3 JRT with 'RTV LJNA' PM5544; R1 TVP; E2a ORF-1 PM5544;R2 CST 'BRATISLAVA' PM5544; R2 TVR 'Telejurnal' News prog;E2,E3,E4 RTVE;E3 RTP.

18/8/82:

R1 TSS(USSR) '0249' monoscopic test card; R1 TVP; E3 unidentified sawtooth pattern to the south-east; R1,R2 TSS News prog.

19/8/82:

R1 MTV; R1 TSS; R1 TVP.

21/8/82:

R1,R2,R3 TSS; R1 EESTI-tv; E2,E3,E4 YLE (Finland) 'TV 1' FuBK; E2 NRK (Norway).

24/8/82:

R1,R2 TSS.

Figure 4: An identification caption transmitted regularly by NRK-Norway.

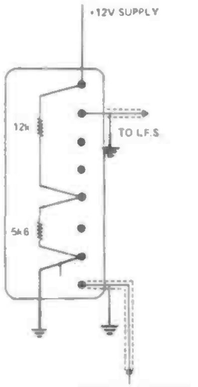


Figure 5: Philips G8 selectivity module connection data.

25/8/82:

R1 TSS colour test card; R2 TSS prog; T1 EESTI-tv prog; E2a ORF.

26/8/82:

E2,E4 RTVE 'Central Control RTVE 09' colour-bar pattern.

27/8/82:

IA RAI; R1 MTV; E2 NRK.

28/8/82;

R1 TSS.

29/8/82:

R1 TSS; R1 MTV; E2a ORF.

31/8/82:

E2,E4 RTVE colour bars; E3 RTVE 'rtve GAMONITEIRO 3' colour test pattern; E2, E3 RTP; IA, IB RAI 'Telegiornale' News prog; E2 ZTV (Zimbabwe) programme via F2-layer propagation.

It may be noted from the above log that even in East Anglia (a DX-ers paradise thanks partly to the terrain, lack of UK transmitters and close proximity to the Continent) there were days when reception was absent. This should give some comfort to other DX-TV enthusiasts who may have been peering at blank screens during the month! Our thanks to Clive for sending his DX log.

CHANNEL WHAT?

Tropospheric reception in Band III and UHF was disappointing during August although the UHF channels seemed rather busy. This was largely due to the IBA Channel 4 test transmissions which most DX-ers regard as the latest obstacle for DX-TV reception. On the other hand it will provide endless hours of fun for our European DX colleagues. Digressing for a moment, the incorporation of a useful function such as a digital clock insert on the Channel 4 test pattern (ETP-1 type) would be extremely welcome to service technicians. It would, in fact, be one of the very few useful tests provided by the pattern. Several Continental test cards already display such information.

OOPS!

In the article 'DX-TV: Getting Started' (R&EW September 1982) we gave connection details for the Philips G8 selectivity module. On the diagram (see page 41), an extra connecting pin appeared from somewhere. The correct data is shown in *Fig. 5*. In case of difficulty in obtaining one of these modules, Hugh Cocks (Cripps Corner, Robertsbridge, Sussex TN32 5RY) can supply but minus the screening cans. An SAE should be sent with any enquiries.

RECEPTION REPORTS

Graham Angel of Sheffield has been Dx-ing since May. Already he has received most countries in Europe via SpE. His location is one of the highest points around the city and he can receive many different IBA regions on UHF, although the local YTV relay does tend to introduce cross-modulation problems with some signals. Graham intends to obtain a Sanyo 9300 VCR (fitted with a multi-band tuner) in order to record DX reception.

Ray Davies (Happisburgh, Norfolk) was alerted at 0400 on August 15th and he noted the NCT caption on channel IA. He also saw the Russian '0249' test card on channel R1 around the same time. Ray uses a 26-inch Grundig colour receiver as a DX monitor which also acts as the main domestic set when there is no Dx around. The receiver has been modified to enable both the 5.5MHz and 6.0MHz sound channels to be resolved.

Another enthusiast to participate in nocturnal DX reception was Cyril Willis (Little Downham, Cambs). He too noted the Italian pirate activity of the 15th but almost an hour prior to Ray.

Simon Hamer (Presteigne, Powys) has sent details of recent Sporadic-E reception which includes TSS and other Eastern-bloc countries. During the earlier part of the season, Simon noted weak vision sync pulses on channel R5(93.25MHz) which lies in the Band II spectrum. Channel R5 is often overlooked by TV-DXers due mainly to the severe interference caused by the various FM radio stations. Perhaps with suitable filtering it may be possible to receive the 100kW transmitter at Choumen in Bulgaria on this channel. The only other possibility of receiving this country is via the E3 outlet at Arbanasi but the ERP is only 50 watts! Gone are the days of the late sixties when Bulgaria used channels R1 and R2 with several kW ERP.

Finally, Robert Copeman has written again with details of recent tropospheric reception. Robert lives at Mount Waverley in Victoria (Australia) and comments that slightly improved trop conditions result in the reception of ABRV 8 Cobden Start, GMV 11 and ABGV 5A Alexandra (all three stations located in Victoria), ABGN 11 Verilderie (New South Wales) and ABKT 11 King Island in Tasmania. Via Sp.E activity, Robert has noted TVQ channel 0(46.25 MHz vision) from Brisbane in the state of Queensland. TV-DXers in the UK have received Australian channel 0 signals on several occasions during F2-layer activity. ■R&EW

Your Reactions..........	Circle No.
Immediately Interesting	5
Possible application	6
Not interested in this topic	7
Bad feature/space waster	8

R&EW BOOK SERVICE

Use the reply paid coupon for ordering.

NEW BOOKS

POPULAR CIRCUITS: READY REFERENCE

1982. 216 pages. 275 x 210mm. Paperback.

by John Markus. Stock No: 02-40458 9.50

Most inveterate dabblers share an interest in the way others design circuits, and sooner or later begin to build a collection of photocopied abstracts from books and periodicals.

I was fascinated to find that John Markus' collection of electronic memorabilia, from the last 10 years or so, contains a large number of the very circuits that lurk filed away (in a couple of binders) on the R&EW shelves marked *simply* 'ideas'.

The book is a well indexed and collated, and actually recognizes the fact that life exists in sinusoidal form as well as between logic levels. Markus doesn't go into the theory of the circuits - but that isn't the function of this work.

It's a lot easier than keeping track of a wad of photocopies.

SCHAUM's OUTLINE SERIES: THEORY & PROBLEMS OF BASIC CIRCUIT ANALYSIS

1982. 340 pages. 205 x 275mm. Paperback

by J O'Malley. Stock No: 02-47820 15.95

Although basically a work intended for students of the subject, the style is easily assimilated by anyone undergoing a reasonable attempt at self-teaching. It mercifully avoids higher maths; pitched at about 'A' level standard, but progressing the material just beyond.

Speaking as one who just about remembers Nelkon and Parker, this book seems to be a rather more readable and concise approach.

Each chapter is supplied with many worked examples, plus many problems (and answers) to exercise the concientious reader's grasp of the subject. It's good value for money and an excellent basic reference work for DC and AC circuit analysis. Thevenin rules OK?

TRS-80 COLOUR BASIC

1982. 378 pages. 170 x 250mm. Paperback.

by B Albrecht. Stock No: 02-09644 6.75

The appearance of a rather jaunty dragon illustration, on the cover of this book, must either rate as the lucky coincidence of all time - or a neat piece of inside knowledge. Ostensibly written for the Tandy Colour Computer, all good followers of the micro scene will know that Mettoy's Dragon 32 uses the same CPU (6809) and thus mainly interchangeable software.

The book is presented as a self-teaching guide with self- assessment Q&A sessions in each chapter, capable of taking a novice through the paces of very basic familiarisation ("What is a ROM"), and on to some reasonably advanced concepts in BASIC. It's a bit of a shame that the author doesn't credit the reader, who has got as far as subscripted variables and arrays, with a bit more intelligence than the style implies - but notwithstanding this gripe, the book is tailor - made for the growing band of Dragon fanciers.

The index is easily driven for reference purposes.

ACTIVE FILTER DESIGN

1982. 134 pages. 150 x 225mm. Paperback.

by C Chen. Stock No: 02-09593 6.75

Well, what can you say about this perenially favourite subject? Well, the bad news is that most active thinkers and enthusiasts will not be able to put this book down, without adding it to their collection of active filter reference works.

The good news is that this book outshines the classic Active Filter 'cookbook', in the theoretical analysis of the subject, and helps provide a rounder and more thorough treatment of the subject. As the title implies, the book is all about design, and a few more worked examples might be helpful. Still, the indexing is excellent.

LOCAL AREA NETWORKS

NCC, 1982. 254 pages. 150 x 210mm. Paperback.

by K C E Gee. Stock No: 02-23658 15.00

Not exactly cheap at the price, but nevertheless a valuable, well indexed and well presented collection of thoughts and concepts, in the style of an 'overview' of the subject. It is a British book, covering such subjects as the Cambridge Ring, Econet, plus virtually all the others that have been mooted in connection with micro - computing.

It was interesting to see the very system upon which this is being written, described on one of the pages - Kirk Gee has done a very thorough job with this book and anyone with a serious interest in understanding networking will not begrudge the money.

RADIO BOOKS

AMATEUR ANTENNA TESTS AND MEASUREMENTS
by H D Hooton. Stock No: 02-21466 7.95

BEGINNERS HANDBOOK OF AMATEUR RADIO
by C Laster. Stock No: 02-02156 10.20

CB RADIO CONSTRUCTION PROJECTS
by L Buckwalter. Stock No: 02-20952 3.45

FERROMAGNETIC CORE DESIGN
by M F 'Doug' DeMaw. Stock No: 02-40881 20.45

MICROWAVE DEVICES AND CIRCUITS
by S Y Liao. Stock No: 02-58120 28.50

RADIO HANDBOOK 22nd Edition.
by W I Orr. Stock No: 02-21874 26.70

QUESTIONS & ANSWERS ABOUT CB
by L G Sands. Stock No: 02-20893 3.35

TV ANTENNAS AND SIGNAL DISTRIBUTION SYSTEMS
by M J Salvati. Stock No: 02-21584 8.70

GENERAL BOOKS

ABC's OF INTEGRATED CIRCUITS
by R P Turner. Stock No: 02-21462 4.95

ACTIVE FILTER COOKBOOK
by D Lancaster. Stock No: 02-21168 11.70

BASIC ELECTRICITY/ELECTRONICS BOOKS
All by Training and Retraining

VOLUME 2: How AC and DC Circuits Work
Stock No: 02-21502 7.95

VOLUME 3: Understanding Electronic Circuits
Stock No: 02-21503 7.95

VOLUME 4: Understanding and Using Test Instruments
Stock No: 02-21504 7.95

BASIC ELECTRICITY/ELECTRONICS TROUBLE-SHOOTING COURSE by D R Tomal. Stock No: 02-21590 7.95

BUILDING & INSTALLING ELECTRONIC INTRUSION ALARMS New Edition
by J E Cunningham. Stock No: 02-21465 8.70

CHEAP VIDEO COOKBOOK
by D Lancaster. Stock No: 02-67221 6.45

CMOS COOKBOOK
by D Lancaster. Stock No: 02-21398 10.20

COLOUR TV TRAINING MANUAL 4th Edition
by H Sams Editorial Staff. Stock No: 02- 21412 11.70

COMPLETE GUIDE TO READING SCHEMATIC DIAGRAMS
by J Douglas-Young. Stock No: 02-04244 11.70

DESIGN OF ACTIVE FILTERS
By H M Berlin. Stock No: 02-21539 8.70

DESIGN OF OP-AMP CIRCUITS, with experiments
by H M Berlin. Stock No: 02-21537 8.70

DESIGN OF PHASE LOCKED LOOP CIRCUITS, with experiments by H M Berlin. Stock No: 02-21545 8.70

DESIGN OF VMOS CIRCUITS, with experiments
By R T Stone et al. Stock No: 02-21686 9.45

ELECTRONICS TEC LEVEL II 2nd Ed (Pitmans)
by D C Green. Stock No: 02-01827 5.45

ELECTONICS TEC LEVEL III 2nd Ed (Pitmans)
by D C Green. Stock No: 02-01831 6.00

ELECTRONICS FOR THE BEGINNER 3rd Edition
by J A Stanley. Stock No: 02-21737 7.95

COMPUTER BOOKS

ADVANCED COMPUTER DESIGN
by J K Iliffe. Stock No: 02-01125 19.45

APPLESOFT LANGUAGE
by B & G Blackwood. Stock No: 02-21811 8.70

ATARI ASSEMBLER
by D & K Inman. Stock No: 02-02366 10.05

BASIC PROGRAMMING ON THE BBC MICROCOMPUTER
by N & P Cryer. Stock No: 02-06640 6.45

CALCULATOR CLOUT: PROGRAMMING METHODS FOR YOUR PROGRAMMABLE
by M D Weir. Stock No: 02-11040 7.65

CIRCUIT DESIGN PROGRAMS FOR TRS-80
by H Berlin. Stock No: 02-21741 11.40

COMPUTER DICTIONARY 3rd Edition
by C J Sippl. Stock No: 02-21652 12.45

COMPUTER DICTIONARY & HANDBOOK 3rd Edition
by C J & R J Sippl. Stock No: 02-21632 27.20

COMPUTER GRAPHICS PRIMER
by M Waite. Stock No: 02-21650 11.70

CP/M PRIMER
by S M Murtha & M Waite. Stock No: 02-21791 11.70

CRASH COURSE IN MICROCOMPUTERS
by L E Frenzel Jnr. Stock No: 02-21634 15.45

MOTOROLA DATA BOOKS

THE EUROPEAN MASTER SELECTION 1982
Stock No: 02-14000 4.05

LOW POWER SCHOTTKY TTL
Stock No: 02-29478 6.15

MOTOROLA LINEAR INTEGRATED CIRCUITS
Stock No: 02-08182 7.20

MOTOROLA MEMORY DATA MANUAL
Stock No: 02-02168 5.20

THE EUROPEAN CMOS SELECTION
Stock No: 02-04000 7.55

MOTOROLA RF DATA MANUAL
Stock No: 02-06870 8.05

EUROPEAN HOME ELECTRONICS - INTEGRATED CIRCUITS
Stock No: 02-18182 6.05

EUROPEAN HOME ELECTRONICS - DISCRETE DEVICES
Stock No: 02-28182 6.05

Make all cheques/postal orders payable (in sterling only!) to R&EW Book Service. Orders should be sent to R&EW Book Service, 200 North Service Road, Brentwood, Essex CM14 4SG. Note: All prices exclusive of postage and packing please add 75p for first book ordered, plus 25p for each additional title on same order.

GOULD OSCILLOSCOPES SET A HIGHER STANDARD

The new Gould OS300 Dual Trace 20MHz 'Scope

A tough, professional instrument you can trust – at a price you can afford! ★ Max. sensitivity 2mV/cm. ★ Stepped and continuously variable attenuator and timebase controls. ★ D.C. coupled triggering and "active" T.V. sync separator. ★ 'Add' and 'Invert' for differential measurements. ★ X-Y facility. Built to do more – safely, reliably and for longer.

Ask for our 8-page data sheet for full details and applications information.

GOULD
Electronics & Electrical Products

Gould Instruments Division
Roebuck Road, Hainault, Ilford, Essex IG6 3UE.
Telephone: 01-500 1000. Telex: 263785

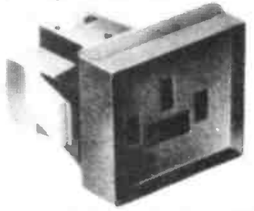
BULGIN Mains Appliance Connectors from AMBIT

1-24	£1·60ea.
25-99	£1·45ea.
100+	£1·32ea.

Stock No. 10-02032 (Bulgin P770),
3 Pole rewirable connector, mates with
10-02021 (Bulgin P780).

1-24	£0·96ea
25-99	£0·87ea.
100+	£0·79ea.

Stock No. 10-02010 (Bulgin P587),
3 Pole rewirable connector, mates with
10-02000 (Bulgin P580/110).



1-24	£0·46ea
25-99	£0·42ea.
100+	£0·38ea.

Stock No. 10-02021 (Bulgin P780),
3 Pole mains outlet, mates with
10-02032 (Bulgin P770). 110 Series
tabs/solder tags.

1-24	£0·46ea.
100+	£0·40ea.

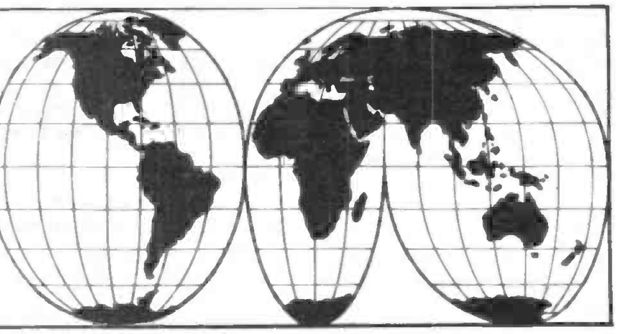
Stock No. 10-02000
(Bulgin P580/110),
3 Pole mains inlet,
mates with
10-02010 (Bulgin
P587). 110 Series
tabs/solder tags.

A new range of appliance couplers, the connectors having an integral moulded bar to prevent cross connection with unsuitable outlets. Rating 6A. 250V.

IEC320, BS4491, CEE22 mains appliance couplers. 10-02010 is also available in side entry form and in versions with moulded-in cable. Rating 6A. 250V.

Ambit International - 200 North Service Road, Brentwood, Essex CM14 4SG
Telephone (STD 0277) 230909 Telex 995194 Ambit G

SHORT WAVE NEWS FOR DX LISTENERS



Frank A. Baldwin

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

Now is the time to tune your receivers to the LF bands and search for those signals from Indonesia. Reception of some of these stations represents a Dx feat of no mean achievement.

Indonesia, formerly the Netherlands East Indies, lies in South East Asia and is comprised of many small islands which straddle the equator for over 4800km, those in the west being of volcanic origin whilst those in the east are of coral. The country is mostly under-developed, only Java showing signs of modern technology, this including oil wells.

For those who wish to try for Indonesia, a few possible 'targets' are mentioned here - with more to come next month. For UK listeners, the best chance of reception is from around 1500 to 1600 GMT, at which latter time most close down. Sign-on is around 2100 to 2200 and this time slot provides a further opportunity to log some of these Dx stations.

For a start, try **4719**, on which channel RRI (Radio Republik Indonesia) Ujung Pandang, the capital of the Propinsi Sulawesi Selatan (Selatan Province of Celebes), which operates from 0830 to 1530 (Saturday 1600) and has a power of 50kW, making it one of the easiest of the Indonesian to log here in the UK.

Then there is RRI Ujung Pandang on **4753**, it closes at 1530 and has a power of 20kW; RRI Medan on **4764** which opens at 2300 and closes at 1700 with a power of 50kW; RRI Palembang on **4856** where it opens at 2200 and closes at 1600 with a power of 10kW; RRI Sorong on **4875** opens at 2100 and closes at 1400.

These are just a few of those most often reported in the SWL press. All of the Indonesian stations relay newscasts from RRI Jakarta at 2300 and at 1500 and at other times throughout the transmission period but these are unlikely to be heard here in the UK. Good luck with the Indonesians.

AMATEUR BANDS

Wandering over these bands can provide some enjoyment and a sense of achievement, especially when a real Dx call is logged. Not that I can make any claims on that score, except possibly for the FR7 on 14MHz, but it did make a change from roving over the various broadcast bands which takes most of the available time.

As usual, a start is made with -

160 Metres (1800-2000kHz)

Working on CW, as with all the bands reported here, Top Band failed to provide much Dx on this reportable occasion. Mid-month did however produce some signals from W. Germany in the form of DJ8WL, DK2QL, DJ2ZX and DL300. Nothing loath, we turn to -

40 METRES (7000-7100kHz)

On the few occasions the digital readout indicated this band was being tuned - or at least the first 50kHz or so - the only signals of note were those mostly from the South American area, notably CO1RA from Cuba, the Brazilians PY1AJK, PY2RRG and PY4BW with the Russian UD6DHC coming in at the tail end. On to better things, the next band visited was the old favourite of most SWL's, 14MHz.

20 Metres (14000-14450kHz)

It was on this band that things started to brighten up somewhat, a start being made by logging CO1HJ from Cuba, FR7CM from Tromelin, KH61J in Hawaii vainly calling CQ Eur but finding no takers, KL7GU in Alaska going it great guns with stateside QSO's, UI80AE from Uzbek busily working Europeans, the Australians VK2ALH, VK2DHF and VK5AUS all calling CQ whilst last but not least the New Zealanders were beginning to come through led by ZL1AAG.

Graeme Caselton, G6CSY, Orpington, tells me he logged NP4AT in Puerto Rico causing a right old pile-up of hopefuls, VK70C in Tasmania and 4N90LY asking for QSL's via YU4EXA.

15 Metres (21000-21450kHz)

Some fun and games here. Graeme noted the Japanese JA0DAF, JA0WRF and JH2LTL, the latter working into HA; 8P6OV on Barbados and on a later occasion the Japanese JA3BOA calling CQ Africa.

For us Chile CE6CWE commenced the proceedings, followed by CX1DZ and CX7DU from Uruguay, FC8TT from Corsica, HC1VU from down there in Ecuador, HK1DBO pounding away in Colombia, LU1DCT and LU4FGO in Argentina, NP4BN and NP4FJ in Puerto Rico, ZC4CWT in Cyprus, tailing off with the South Africans ZS6ANW and ZS6BWD. Not a lot of Dx I must confess but it was the best I could rake up.

10 Metres (28000-29700kHz)

For myself, I failed to get on to this band through sheer lack of available time but Graeme tells me he dug out the following very interesting calls. H5AHF in Bophuthatswana (c/o ZS6), OU1EHB/YB on the Golan Heights, 3X1Z sited in the Republic of Guinea - the only active amateur in that country - and 6W8AR in Senegal.

A good list Graeme and thankyou for your support.

LOTHIANS RADIO SOCIETY

Mel Evans GM6JAG informs me that this society now holds its meetings at the Drummond High School, Edinburgh (off Broughton Street). Meetings are held on alternate Thursday evenings and commence at 7.30pm prompt (clock time). Meetings at the new venue commenced on September 9th, a full programme being planned. Further details may be obtained from Mel Evans GM6JAG, 4 Burdiehouse Street, Edinburgh (Tel: 031-664 5403).

BROADCAST BANDS

The information listed under this heading is correct at the time of writing, the various loggings being offered to readers as a guide to some of the stations that may be heard on the short waves. Every month in this article some attempt is made to interest both the short wave listener and the Dxer. The details presented are therefore a mix of each interest.

The degree of success achieved will depend in some measure on the equipment in use at the receving end and the conditions prevailing at the time of listening. For some of the low frequency band loggings a receiver exhibiting a narrow bandwidth (good selectivity) will be required.

Spain

Madrid on **9765** at 1950, YL announcer presenting a programme of typical Spanish music - ideal for recording enthusiasts - during the English transmission for Europe, timed from 1900 to 2000 and then repeated from 2000 to 2100 daily.

Madrid on **17890** at 1535, OM and YL alternate announcements in the Spanish programme intended for the Americas and featured on this channel from 1530 through to 1900.

Romania

Bucharest on **11940** at 1956, OM (male announcer) with news of internal events in a programme entitled 'Radio Newsreel' during an English programme to Europe, scheduled from 1930 to 2030.

Bucharest also on **17720** at 1511, OM and YL (female announcer) alternate with comments on Romanian affairs in the English transmission for Asian consumption and timed from 1500 to 1530 on this channel.

Bulgaria

Sofia on **11720** at 1958, OM presenting a programme of classical music as part of the English transmission to Europe, scheduled from 1930 to 2000.

Poland

"Radio Polonia", Warsaw on **9675** at 2002, OM with station identification at the commencement of the English transmission for Africa, scheduled from 2000 to 2030. This was followed by a programme review and a newscast, mainly of Polish affairs.

Yugoslavia

Belgrade on **9675** at 2004, OM with a newscast during the English transmission to the Middle East and Africa and scheduled from 2000 to 2030.

Hungary

"Radio Budapest" operating on **11910** at 2007, YL presenting a newscast, mainly of internal events but with some world items during the English programme for the UK and Europe, being scheduled from 2000 to 2030.

Czechoslavakia

"Radio Prague" on **5930** at 2012, OM with a newscast of world affairs in the English transmission to Europe and timed from 2000 to 2030.

Prague on **17705** at 1457, YL with station identification at the end of the English programme for Africa, South Asia, the Far East and the Pacific area and timed from 1430 to 1500.

Netherlands

Hilversum on **17605** at 1503, OM explaining the meanings of various English phrases during the English programme for the Far East and South Asia, being aired from 1430 to 1520. Still Holland as far as I am concerned!

W. Germany

Cologne on **21600** at 1500, YL with station identification at the start of the English programme to Central and East Africa (at least according to their schedule) and timed from 1500 to 1550.

E.Germany

"Radio Berlin International", Berlin on **21500** at 1525, OM presenting the English programme for West Africa. He was wasting his time, most of it was wiped out by the jammer identifying as WD in Morse - obviously a broadcast direct from its diesel motored generator!

Sweden

Stockholm on **17790** at 1518, YL with the programme in French intended for Europe and North America and timed from 1500 to 1530 on this channel.

Kuwait

"Radio Kuwait" on **17650** at 1954, Arabic music and songs during the Domestic Programme radiation on this channel, timed from 0730 through to 2105.

Egypt

Cairo on **17670** at 1540, when radiating a progamme of Arabic music and songs in the Domestic Service which is on this frequency from 1300 to 1900.

Cairo on **17690** at 1524, OM announcer, YL with songs during the Hindi transmission to South and South East Asia, featured on this channel from 1430 to 1530. Into the Urdu programme at 1530 and this lasts until 1700.

Equatorial Guinea

Radio Nacional, Bata, Rio Muni on **5004** at 1917, OM with a talk in Spanish. This one operates in both Spanish and vernaculars and is on the air from 0430 to 0655 and from 0955 through to 2200. The power is 100kW but don't worry if you cannot log radio Nacional on this channel. Try **4925** and you will probably find it there. For reasons best known to themselves they alternate to no known pattern and in addition, the frequencies can vary slightly!

China

CPBS Peking on **15670** at 1131, OM with announcements then YL with a song in the Tibetan programme, part of the Domestic Minorities Language Service, this particular tongue being broadcast from 1100 to 1155.

Radio Peking on **17450** at 1855, OM speaking in the Hausa programme to West Africa which, according to the schedule, is from 1830 to 1900.

Radio Peking on **17700** at 1527, YL with an interesting talk about Chinese history and archaeology, especially dealing with some for the latest digs and finds. All in the English transmission to South Asia, scheduled from 1500 to 1600.

Radio Peking on **11445** at 1847, YL with a talk about Chinese affairs in the Italian programme to Somalia, timed on this channel from 1830 to 1900

Radio Peking on **6665** at 1958. 'East is Red' interval signal on chimes, 'pips' time-check at 2000, OM station identification, 'East is Red' orchestral version - there is a choral rendering which is used by some Chinese stations - at the opening of the Domestic Service 1st Programme, scheduled on this channel from 2000 to 1730.

Ecuador

HCJB (Herald Christ Jesus Blessing) Quito on **17790** at 1949, OM and YL with the English programme for Europe, scheduled from 1900 to 2000. Mainly religious.

Colombia

Emisora Nuevo Mundo Bogata on **4755** at 0439, OM announcer in Spanish, local pops on records. This one operates around the clock and has a power of 1kW.

Radio Guatapuri, Valledupar on **4815** at 0333, OM with a newscast of world events in Spanish. Also operating around the clock R. Guatapuri has a power of 10kW.

La Voz del Cinaruco, Arauca is a good one to go for. Listen on **4865**, where it was logged at 0345 when featuring a talk on internal affairs. The schedule is from 0900 to 0400 and the power is 1kW.

Honduras

La Voz Evangelica, Tegucigalpa on **4820** at 0446, YL with a ballad in English. This one is an old friend, quite often logged and operates to the schedule 1030 to 0300 in Spanish, 0300 to 0500 in English and from 0500 to 0600 in Spanish. The power is 5kW.

Peru

Radio Andina, Huancayo on **4996** at 0451, OM with announcements in Spanish then into a programme of local music and songs. Another regular with me, this one is scheduled from 1000 to 0500 and has a power of 1kW. It is a good marker for Peru, if you can hear this one then others should be audible - providing the QRM is absent!

Surinam

SRS Paramaribo on **4850** at 0342, OM's in chorus with a song in Dutch, YL with a song in the same language. This one operates in English, Spanish, Dutch and Indonesian to the schedule 0900 to 0430 (Saturday to 0530). The power is 10kW.

Brazil

Radio Nacional Cruzeiro do Sul on **4765** at 0330, OM station identification in Portuguese then YL with a local pop song - all colourful stuff! This one operates from 0900 to 0500 and the power is 10kW.

Venezuela

Radio Tachira, San Cristobal on **4830** at 0047, OM with station identification followed by a talk in Spanish. Radio Tachira is on the air from 1000 to 0500 and the power is 10kW.

NOW HEAR THIS

Radio Tingo Maria, Tingo Maria on **4760** at 0412, OM with a song in Spanish, OM station identification at 0416. Off at 0503 after identification and orchestral National Anthem. My first logging of this Peruvian station.

Your Reactions.........	Circle No.
Immediately Applicable	53
Useful & Informative	54
Not Applicable	55
Comments	56

Setting standards

Heaven preserve us from 30k 1W Potentiometers....

ONCE UPON A TIME, when there was only the ECC82 and a handful of other valves in virtually all types of electronic equipment from Q meters to TV sets, an electronic engineer's life was a relatively uncomplicated one.

Then someone spoilt it all by inventing transistors, and latterly, integrated circuits. Far from getting the Nobel Prize for such endeavours, those in the trade whose business it is to try and collate and manage the hopelessly burgeoning ranges of all types of electronic component, would rather the inventors had been on the other side of the universe at the time of the discovery.

Even the most feeble attempts to constrain the imagination of designers seems doomed to failure, when circuits appear that require such pointless things as 30k 1W potentiometers in the lower end of a long tailed pair that could not possibly dissipate more than 50mW, and could quite happily use anything from 22K to 47K. Aarrgh!

Did you know that there are over 5,000 *basic* types of potentiometer available these days? That's not actually counting the permutations of the actual values - simply things like shaft dimensions, fixing, terminations, tolerances, wattages etc.

STANDARDIZING STANDARDS

To top all this, there now seems to be competition between various authorities who have set themselves up to implement 'standards' to see who can produce the greatest volumes of paper, and the most detailed trivia. Most countries now have their own standards and approval systems, frequently one inspired by the military, one by the telecommunications authorities, and one by trade associations, several by broadcasters - and several inspired by some meddling combination of all these. It's good news for paper manufacturers and computer database managers, but no-one else.

However, one of the most persuasive standards in the UK appears to be the one that is based on the availability of parts. The man who designed-in the aforementioned 30k 1W pot probably leaned over his junk box, and spotted this item floating near the top.

'Let's give that a bash', he probably thought.

And so he did, and thereafter it became enshrined on the parts list. One or two famous broadline component distributors have benefitted enormously from the 'line of least resistance' (excuse us) approach to circuit design, and whilst this is not necessarily a pointer to elegant academic design, it is a laudable recognition of the reality of actually trying to find 'standard' parts in this day and age.

.. I KNOW THE ONE YOU MEAN – GOOD QUALITY AND THE RIGHT PRICE.. THAT'S THE ONE WE DON'T STOCK.

THE COUNTRY GIRL

There is some evidence that this omnipotence has gone to the head in some cases, leading to a policy whereby engineers find themselves in the position of Max Miller's famous Country Girl of 'ave it - and like it'. The result is certainly not the most cost effective solution, but one that suits the purveyors of parts very nicely.

Radio & Electronics World tries hard to work to within the constraints of parts that are available *and* cost effective. They may not be from the schedules of BS9000 (do you know how long approval can take, and how much it reflects in the cost of the part?), but they are actually quite suitable for the purpose. At the danger of being tedious, dare we suggest that **R&EW** recognition/approval is a reasonable indication that a part is not only suitable for a 'normal commercial application' within the manufacturers stated limits, but that it represents good value (a judgement based on the combination of quality and cost) into the bargain. Something that no other standard seems to take into account.

In fact, this seems like such a good idea to us, that it may be an area where we can contribute to the confusion existing over the approval of components - and so we aim to take a look at a few selected ranges of components and see if this might not be a useful contribution to the debate. We would naturally be delighted for your branded nominations. This is not a 'distributor survey', but a product survey, so please let us have the component manufacturer's name whenever possible.

OFFERINGS

This publication has always been rather keen on the occasional reader offer - and as the Christmas season approaches, it seems appropriate that we should wheel in a few of the goodies that have passed our way in case loved ones are still trying to think of something suitable to buy for you.

The high quality Japanese auto-ranging digital multimeter offer with this issue is strictly limited to the first 100 orders, although judging by the rate at which the offer stock is being depleted by contributors who drop by, and others with an eye for value, you'd better make your minds up quickly.

The other offer is our perennial NiCad battery bonanza. We have now included a couple of useful accessories in the shape of the battery adapters that allow you to translate various types of battery to help out in an emergency - or to take advantage of the fact that 2.2Ah C cells are actually rather more substantial than consumer (the sort you usually find in the Sunday Supplement ads) D Cells at 1.2Ah, and about the same price!

The battery tester is a marvel of Hong Kong value-for-money. Like the multimeter, to see one is to want one, and most members of staff and visitors have added one to their collections.

BOOKS, BOOKS, BOOKS

Another **R&EW** service that has been popular since we started it, is the Book Department. One of the original planks in our 'launch' platform was that magazines should not get bogged down in material that

NEWS BACKGROUND

is best read in textbooks: so we have tried to provide a useful assortment of books to provide the foundations which any serious enthusiast or engineer is going to need sooner or later.

We have tried to be slightly different in our ranges of titles and our general approach to the method of selection, although in the course of trend setting, it's inevitable but flattering to find others doing the same. We have now started to build up a new series of books from the enormous range offered by Wiley and McGraw-Hill, and we are pleased to say that REWTEL is now being fed with a 'BOOKTEL' database that will help you select exactly the type of book you need. If you don't yet plan for your own terminal - then we will be pleased to give you a printout of BOOKTEL listings that covers titles in the areas you are interested in: watch the book pages for details of the commencement of this service.

The standard REWTEL access technique is ideal for finding books containing the subjects you're interested in - and the page of info we can provide is just about enough to help guide your choice - or so we hope. Whilst we will not be able to afford to carry all the books ex-stock (yet) we have arranged a very expeditious shipping service that means that all the Wiley titles can be ordered from us for delivery in 7 days.

FREE MONEY:
HEADS YOU WIN, TAILS YOU WIN

After the hard sell, now for the hard buy. We occasionally remind you lot that *R&EW* is unique amongst electronics publications in that we actually supply *free* components to applicants with a reasonable proposition for a design project that will eventually be published somewhere. Not necessarily in *R&EW*, although we would naturally like first refusal, just as long as something worthwhile and interesting gets disseminated to as wide an audience as possible. We can help with practical information, books, copies of articles, computer time etc as well as the basic bits.

Apart from the free hardware, we pay an average of £50 per page of project material (including the diagrams etc), and that goes for worthy design ideas, software features etc.

We are pleased to report that there is a steady increase in external submissions, but there is always room for plenty more. If you don't fancy yourself as a writer (or like so many potential authors, claim you do not 'have the time'), then do not despair, since we are frequently required to write the words working from a fairly rough-and-ready set of notes. What we need are:

1) A circuit digram where component values are clearly marked.
2) A complete parts list that agrees with the circuit diagram.
3) A prototype - which need not be the last word, but just adequate for us to engineer a 'presentable' version. In fact, it's quite likely that we will want to incorporate a few changes and features if we haven't been previously involved with the proposed project, so it's just as well to submit the item before you go too far towards a totally refined item.
4) Printed circuit layout. Again we can help here, but it is usually a great deal more satisfactory if you can get to grips with this aspect, since there is no-one as well qualified as the original circuit designer when it comes to the transfer of paperware and prototype lash-ups to a neat PCB. The bits to do it professionally on 2:1 tape system are free from us once you get to this stage of the development, and the skills you will acquire will be invaluable in future endeavours.
5) We would like details of any references (books, articles etc. you have used).

Despite this unprecedented philanthropism, we really don't have enough takers. The scheme would seem to be ideal for college and university projects - yet we have only had a handful of enquiries from these quarters.

We are considering expanding the scheme to support software projects as well (which could entail free access to our computers and peripherals at weekends), and all we ask is a simple outline of your project, stating the following:

a) Your name and address.
b) A summary of the project you wish to undertake, block diagrams will do at this stage.
c) Details of any previous experience that you have had that seems relevant.
d) An undertaking that you will use your best endeavours to complete the project, even if the conclusion is only that the original idea was not feasible!
e) If you are in full or part time education, and intend to use the sponsored project as coursework, a brief note from your teacher/tutor indicating acknowledgement that the project will not interfere with any other formal work.

That doesn't seem like too much to ask, does it? We place no formal limit on the amounts involved, all cases are assessed on merit. If you would rather just get on and submit the project without any 'commitment' from the sponsorship aspect, then remember that we will also be happy to refund you for all components in connection with the project that have been purchased from the **WR&E** catalogue. Just keep the receipts.

■ **R & EW**

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

EVENTS: MOBILE RALLIES November 1982

November 6th	North Devon Mobile Rally	Memorial Hall, Bradsworthy	K J Nicholls, C8MX1 Tel: 040 924 202

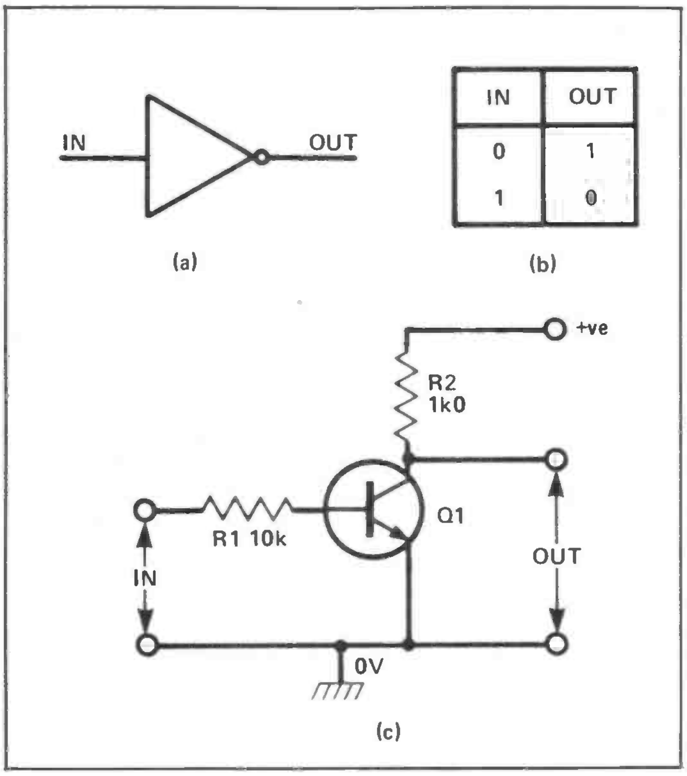
November sees two Hobby Electronics shows both in London and within days of each other. Both should be worth a visit and watch out for R&EW at the Electronic Hobbies Fair stand. Details of the two shows are as follows:

November 10-14	Breadboard	The Royal Horticultural Halls Vincent Square, London, SW1.
November 18-21	Electronic Hobbies Fair.	Alexandra Pavilion, London.

Data File

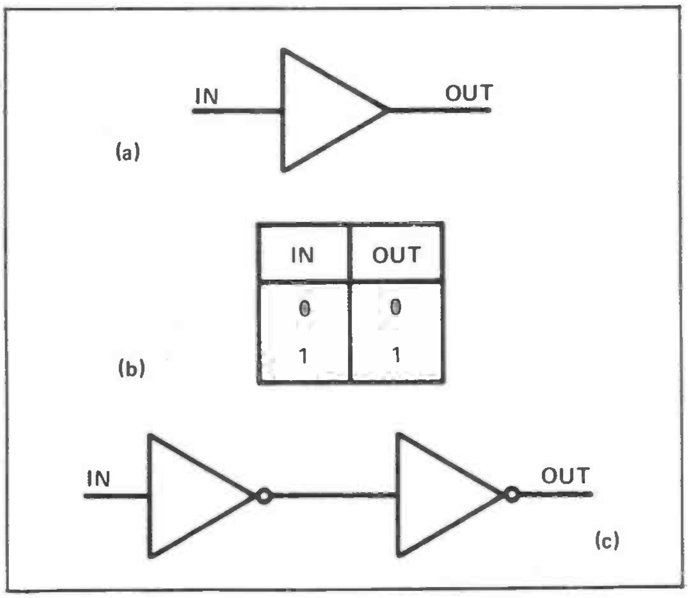
No. 13

Digital inverters, buffers and logic gates can be built in either IC or discrete form. Which type should be used in a particular application? Ray Marston answers this and many other 'logic' questions in the next few pages.



IN	OUT
0	1
1	0

Figure 1: (a) Standard symbol and (b) truth table of a digital inverter, with (c) a resistor-transistor version of the unit.



IN	OUT
0	0
1	1

Figure 2: (a) Symbol and (b) truth table of a non- inverting buffer stage, which can be made by (c) cascading two inverter stages.

PULSE INVERTERS, BUFFERS and GATES are the most basic elements used in digital electronics. When designing complex digital circuits, it is often necessary to work out the most economic or cost-effective method of implementing these elements. Sometimes it's best to use discrete components (diodes-resistors-transistors) to make an element, and at others it's best to use a dedicated CMOS chip. How do you make the choice? We'll expain that in the next few pages.

The best known logic gates are the OR, NOR, AND, NAND, EX-OR and EX-NOR types. Less well known is 'majority' logic which, as the name implies, gives an output only when the majority of an odd number of inputs are high. Majority logic is useful in 'voting' and pseudo-intelligent applications, such as decision-making in robotic and security systems. We give comprehensive details of all these types of logic in the present edition of 'Data File'. Read on.

BUFFERS AND INVERTERS

The most basic type of digital circuit is the simple pulse inverter. *Figure 1a* shows the standard circuit symbol of the inverter, and *Fig. 1b* shows its truth table; *Fig. 1c* shows a discrete resistor-transistor version of the inverter. In digital circuits, input and output signals are either at zero or logic-O values, or at the full supply-rail voltage or logic-1 value. Thus, in *Fig. 1c*, when the input is low (at logic-O) the transistor is cut off and the output is pulled high (to logic-1) via R2, and when the input is high the transistor is driven to saturation and the output is pulled to zero volts. The importance of the *Fig. 1b* truth table is that it illustrates this information in short-hand form.

The standard inverter is the most versatile of all logic elements. It can be used to convert an OR gate to a NOR type, or vice versa, or to convert an AND gate to a NAND type or vice versa. A pair of inverters can be used to make a bistable, monostable or astable multivibrator, etc. Usually, a practical inverter has an input impedance that is high relative to its output impedance, and can be used as an impedance 'buffer'.

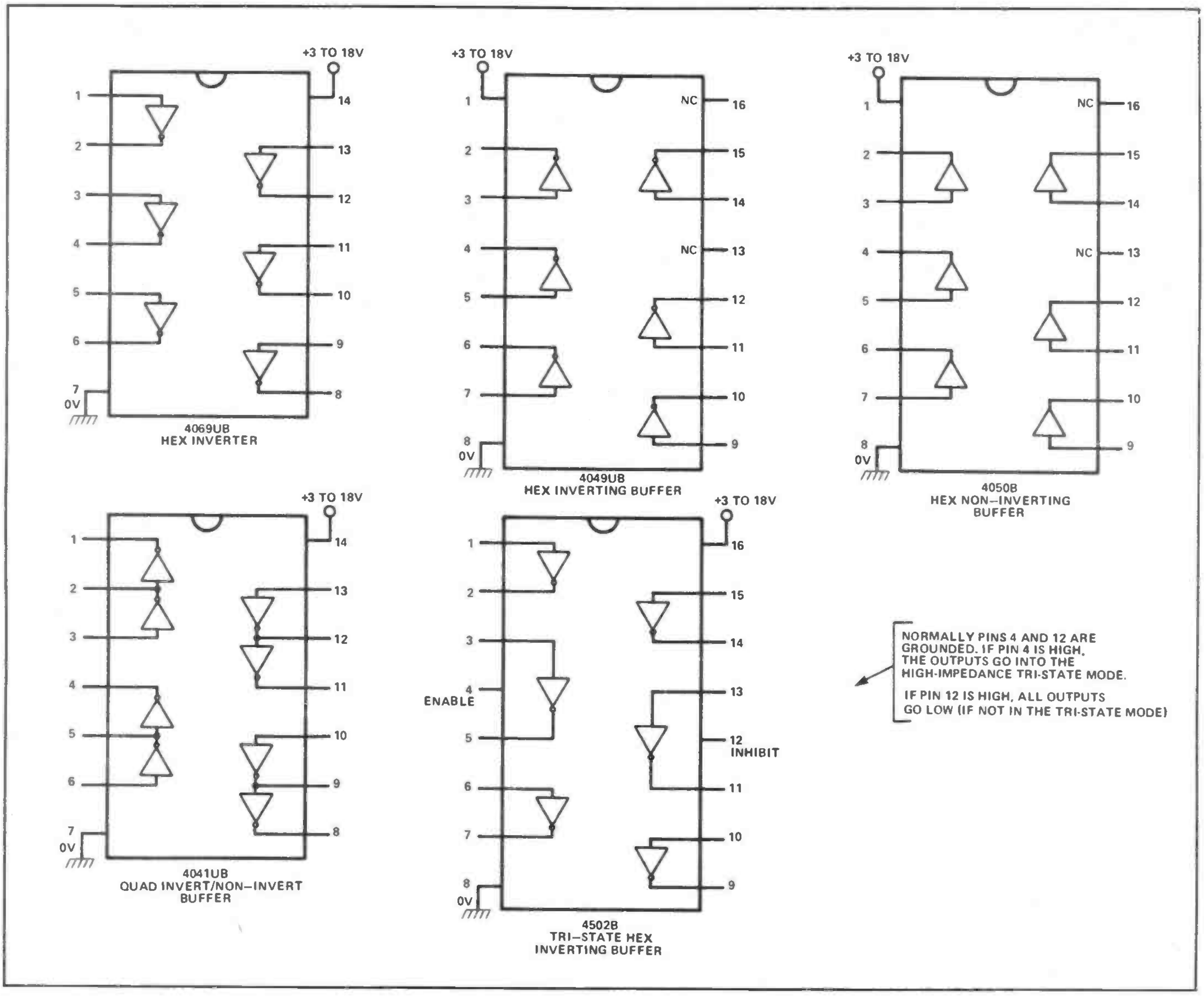
Not all buffers are of the inverting type, and *Fig. 2a* shows the standard circuit symbol of a non-inverting buffer stage, which can be made by cascading two inverting elements as shown in *Fig. 2c*.

Inverters and buffers are available in dedicated CMOS IC form, and *Fig. 3* gives details of five popular examples. The 4041, 4049 and 4069 types use the unbuffered (UB) low-gain form of CMOS construction, and the 4050 and 4502 use the high-gain buffered form of construction.

The 4069UB is a simple general-purpose hex inverter, housed in a 14-pin package, and has 'standard' output drive capability. The 4049UB hex inverting buffer and the 4050B hex non-inverting buffer, on the other hand, have high output drive capability and are specifically intended to drive TTL loads; they can accept input signals far greater than the supply voltage, so can be used to give signal-level translation between CMOS and TTL circuits.

The 4041UB also has high output-drive capability and can be used to drive TTL, but cannot accept input signals greater than its supply voltage. The device is a quad invert/non-invert buffer. If, for example, an input is applied at pin-3, an inverted output is available at pin-2 and a non-inverted output at pin-1.

The 5402B is a hex inverting buffer capable of driving TTL loads, and has a tri-state output which can be selected via pin- 4; when pin-4 is low the IC gives normal inverting operation, but when pin-4



NORMALLY PINS 4 AND 12 ARE GROUNDED. IF PIN 4 IS HIGH, THE OUTPUTS GO INTO THE HIGH-IMPEDANCE TRI-STATE MODE.

IF PIN 12 IS HIGH, ALL OUTPUTS GO LOW (IF NOT IN THE TRI-STATE MODE)

Figure 3: Five popular CMOS inverter and buffer ICs.

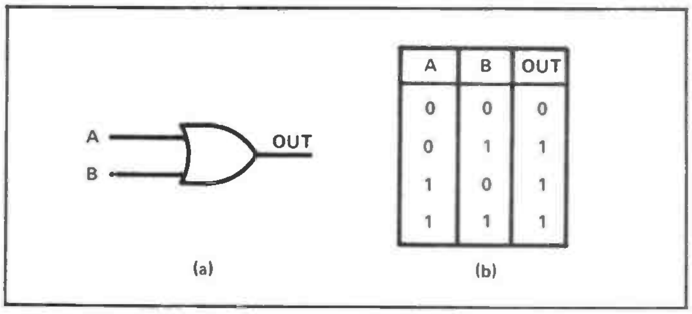
is high all outputs go into the high-impedance tri- state mode. The IC also has an INHIBIT control terminal (pin-12), which is normally held low but which drives all outputs to ground (in the 'normal' mode) when pin-12 is taken high.

The basic guidance rules for using inverters and buffers in practical circuits are simple. If you need a large number of stages, use as many dedicated ICs as necessary. If you get to the point where you are short of just one or two stages, see if you can make them from spare stages of existing logic ICs (we'll show how later) or, failing that, consider using simple resistor- transistor stages of the *Fig. 1c* type.

OR & NOR GATES

Figure 4a shows the standard symbol of a 2- input OR gate, and *Fig. 4b* shows its truth table. As indicated by its name, the output of the OR gate goes high if any of its inputs (A OR B, etc) go high. The simplest way to make an OR gate is to use a number of diodes and a single load resistor, as shown in the 3-input OR gate or *Fig. 5*. The diode OR gate is reasonably fast, very cost effective, and can readily be expanded to accept any number of inputs by adding one more diode to the circuit for each new input.

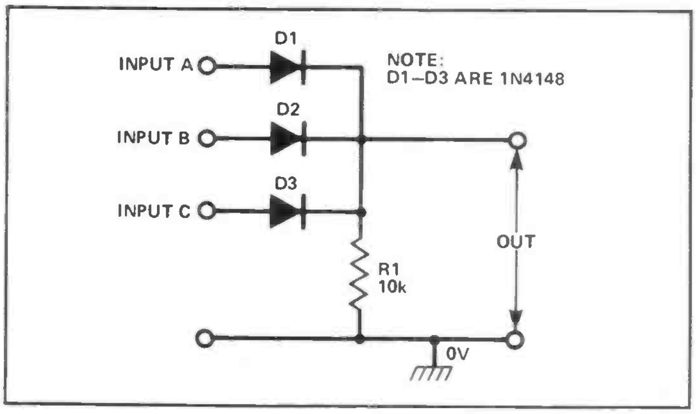
Figure 6a shows the standard symbol of a 2-input NOR gate (which functions like an OR gate with an inverted output) and *Fig. 6b* shows its truth table. *Figure 7* shows how a diode OR gate can be converted to a NOR type by feeding it's output through a transistor or IC inverter stage. *Figure 8* drives this lesson home by pointing out that an OR gate can be made from a NOR gate plus an inverter and a NOR gate can be made from an OR gate



A	B	OUT
0	0	0
0	1	1
1	0	1
1	1	1

(a) (b)

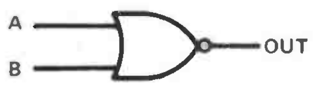
Figure 4: (a) Symbol and (b) truth table of a 2-input OR gate.



NOTE: D1–D3 ARE 1N4148

Figure 5: 3-input diode OR gate.

▶



A	B	OUT
0	0	1
0	1	0
1	0	0
1	1	0

(a) (b)

Figure 6: (a) Symbol and (b) truth table of a 2-input NOR gate.

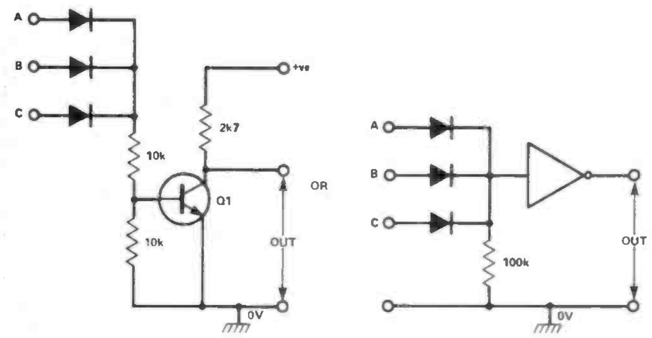


Figure 7: The diode OR gate can be converted to a NOR type by feeding its output through a transistor or IC inverter.

plus inverter. *Figure 9* shows that a NOR gate can be made to act as a standard inverter, and an OR gate can be made to act as a non-inverting buffer, by either grounding all but one of the inputs or by connecting all inputs in parallel.

Figure 10 gives details of three popular CMOS OR gate ICs, the 4071 quad 2-input type, the 4076 triple 3-input type, and the 4072 dual 4-input type. When using IC OR gates, note (*Fig. 11a*) that the effective number of inputs can be reduced by grounding all unwanted inputs, or can be increased (*Figs. 11b* and *11c*) by adding more OR gates (either integrated or discrete) to one of the inputs.

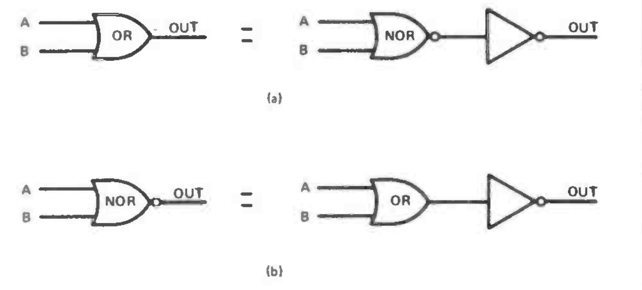


Figure 8: An OR gate can be made from a NOR gate, or vice versa, by taking the output via an inverter.

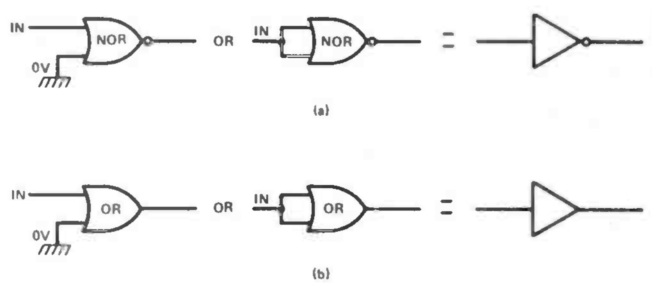


Figure 9: A NOR gate can be converted to an inverter, and an OR gate can be converted to a non-inverting buffer.

Figure 12 gives details of five popular CMOS NOR gate ICs. The 4001, 4025 and 4002 are quad 2-input, triple 3-input and dual 4-input devices respectively. The 4000B contains two 3- input NOR gates and a single inverter, and the 4078B is an 8- input gate that gives an OR output at pin-1 and a NOR output at pin-13. Note that, since a NOR gate is equal to an OR gate with an inverted output, the effective number of inputs of a NOR gate can be increased or reduced by using the techniques that have already been shown in *Fig. 11.*

Figure 13 illustrates a simple example of logic design using OR and NOR gates and inverters, the aim being to design a simple low-power tone generator (using a PB-2720 acoustic transducer) that can be activated via any one of four inputs. Look first at *Fig. 13a.* At first sight, the design seems to call for the use of a 4-input OR gate, with its output feeding to a gated tone generator. A suitable tone generator can be made by connecting a 2-input NOR gate and an inverter in the standard astable configuration shown, but this astable is gated on by low input signals, so (in *Fig. 13a*) the required

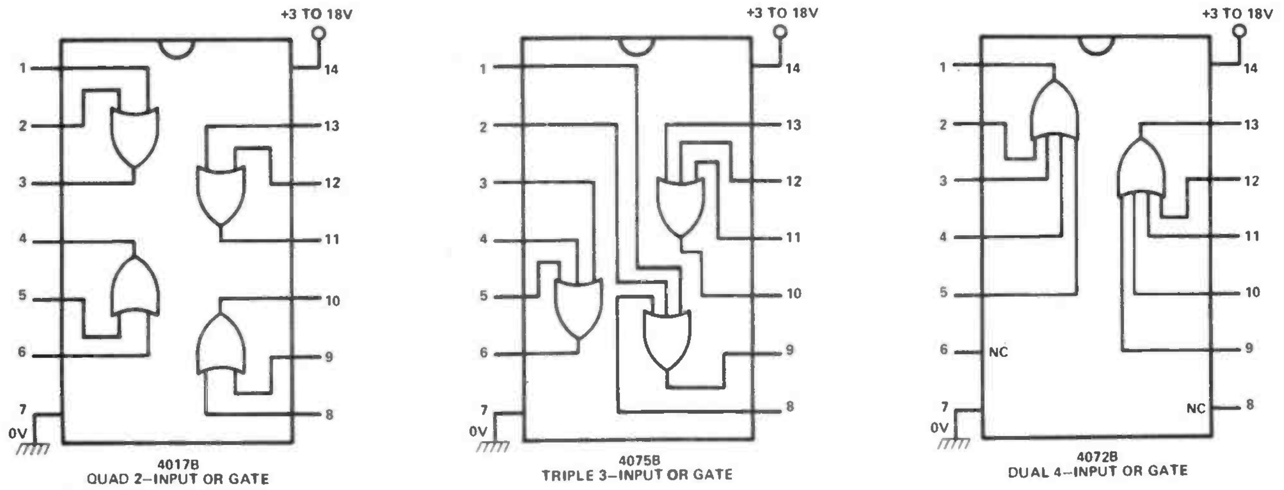


Figure 10: Three popular CMOS OR-gate ICs.

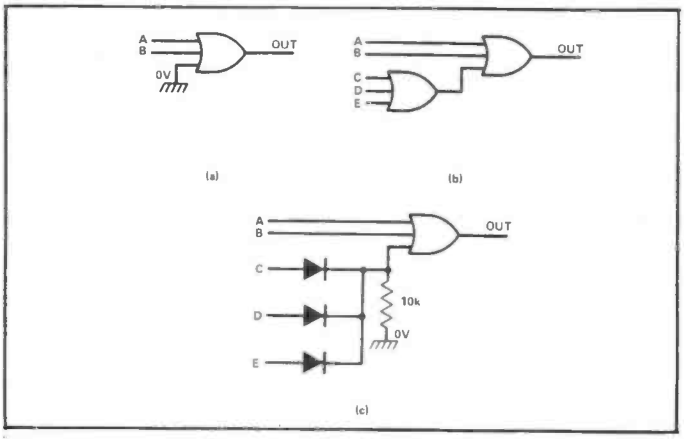


Figure 11: The effective number of inputs of a CMOS OR gate can be reduced (a) by grounding all unwanted inputs, or increased (b or c) by adding more OR gates to one of the OR inputs.

circuit action can be obtained by interposing an inverting stage between the output of the 4-input OR gate and the input of the astable. The *Fig. 13a* design thus calls for the use of three ICs.

Figure 13b shows a simple rationalisation of the *Fig. 13a* circuit which enables the IC count to be reduced to two. Here, the 4-input OR gate plus inverter of *Fig. 13a* is replaced by a 4-input NOR gate, and the inverter section of the astable is made from a 2-input NOR gate with its inputs shorted together.

Finally, *Fig. 13c* shows how the design can be further rationalised so that it uses only a single IC (a triple 3-input NOR gate) and a couple of diodes. Here, the astable is made by converting a 3-input NOR gate to a 2-input type by shorting two of its inputs together, and by shorting all three inputs of another gate together to make an inverter, and the input gate of the circuit is converted to a 4-input type by connecting a 2-input diode OR gate to one of its inputs.

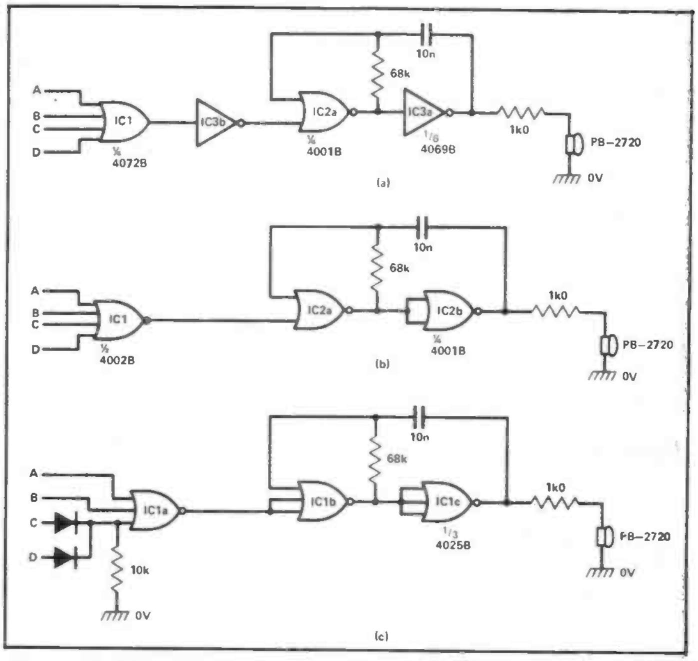


Figure 13: Low-power tone generator activated by any of four 'high' inputs. The 'over-designed' version shown in (a) uses three CMOS ICs, but the rationalised design shown in (b) uses only two CMOS chips. In (c) the design is further rationalised so that it uses only a single IC.

Continued next month

■ R & EW

Your Reactions

	Circle No.		Circle No.
Immediately Interesting	112	Not Interested in this Topic	114
Possible Application	113	Bad Feature/Space Waster	115

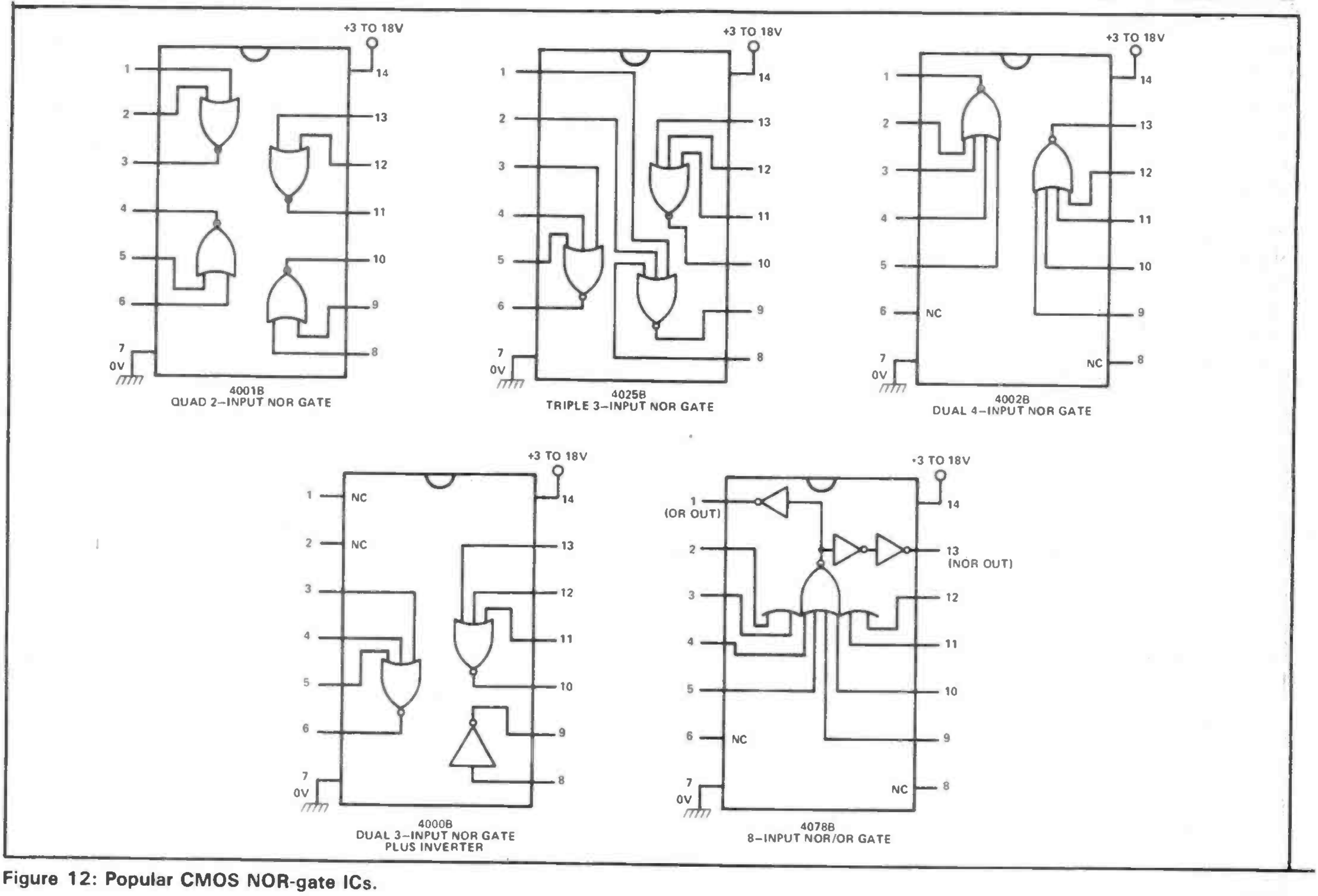


Figure 12: Popular CMOS NOR-gate ICs.

CLASSIFIED ADS

REPAIR THAT OLD BLACK AND WHITE TV

with the aid of the best seller

"TV FAULT FINDING"

(more than 200,000 copies sold)

5th Edition
Edited by J R Davies
132 pages

Over 100 illustrations, including 60 photographs of a television screen after the appropriate faults have been deliberately introduced.

Comprehensive Fault Finding Guide cross-referenced to methods of fault rectification described at greater length in the text.

Price ONLY £1.50 (inc P&P)

Make remittance payable to:
RADIO & ELECTRONICS WORLD DATA PUBLICATIONS
45 Yeading Avenue,
Rayners Lane.
Harrow, Middlesex HA2 9RL

FT101ZD, FAN, mic and SP901 ext. speaker, £395. Sony ICF2001 receiver, £95. GM4DHJ, Phone: 041-889-9010.

FRG7 Fitted FM £150. 2M-FM 2400, hand held base charger, mobile charger, spare Nicads, microphone case £250. Multimeter £15. A- o.n.o. G8SBU, Fareham, Hampshire. Phone: 0329-232799.

CB SPARES. P.A. transistors, chips, crystals, etc. S.A.E. for List. C.F. Shorto Electronic Services, 25 St. Helens Road, Wymouth, Dorset, DT4 9DY.

V.H.F. TRANSMITTER Tuneable 88MHz - 174MHz £8.50. Available ready built £12.00. Free price list of professional equipment, RFamps, and C.B. spares. S.A.E. Linelink Electrical Engineers Ltd., 35 Marmion Avenue, Chingford, London E4 8EP.

PROJECT BOXES. Aluminium, steel, plastic. Also Veroboard and accessories. Send s.a.e. to: G6LLZ, 14 St. Peters Road, Wisbech, Cambs.

SEND S.A.E. FOR LISTS OF NEW COMPONENTS at silly prices; i.e. TBA950, 2SC2029, 2SC2078 £1.80 each. Briandene, Fackley Road, Teversal, Sutton-in-Ashfield, Notts.

CHARTS AND ABACS. Set of five with instructions for quick calculations of Ohms Law, inductance, capacity, resistance, etc. Only £5.00, including postage from: G.W. Services, 1A Grosvenor Crescent, Dartford, Kent, DA1 5AP.

R.S. 3U instrument case, sub rack kit modules, card fronts, runners plus 2 edge connectors. Ideal for test equipment or micro. £25. Phone: 0279-504212.

HAMS, SWLS, BUYING OR SELLING GEAR. Send for details of a unique new service for buying and selling. S.A.E. please. Stanton, EMR, 35 Upper Tything, Worcester, WR1 1JZ.

SUPERB SPEC. COUTANT 20A D.C. Power supply cont. rated 6 to 30V. Output 1000+ VA. As new £65. collected. Telephone (0533) 55 2809 evenings/weekends.

S/HAND MOBILE RADIOS for sale. High band and low band. Westminsters, Cambridges, Vanguards and many others. Box No. REW30.

TRIUMPH DOLOMITE SPRINT 1977. Taxed to December 1982, M.O.T. May, 1983. Sundym glass, Westabo Sun Roof, cloth interior, overdrive and radio. Yours for **£1,395**. Tel: Brentwood (0277) 214406 after 5.30.

AERIALS: TELEVISION, RADIO, CB, (91-elem. wide band UHV DX aerials), Masthead amplifiers, poles, brackets, towers and CB radios. London's cheapest! AAC Ltd., 132 Hermon Hill, London E18. Telephone 01-530-6118.

POWER MOSFET 4-400W Driver Module 50 x 50 x 30mm with instructions. £7.00. Vicelec, 30 Crosby Road, Southport, Merseyside, PR8 4TE.

AUDIO: VIDEO: DATA TRANSMISSION. Professional grade cables from **TRANSOUND/FILOTEX.** Made by Europe's premier cable manufacturers. Example: EHEA shielded twin-twisted 'easy strip' audio cable (once used you will use no other (100 metres £25.00. Total which includes p&p and VAT (UK only). CWO. For data sheets, large quantity discounts, exports, etc. SAE to: Transound International Electronics Ltd., PO Box 148, Welwyn Garden City, Herts. Or telephone 043-879-262.

G4BVS COMPUTERISED MORSE TRAINER for Apple II (48K DOS 3.3). Sophisticated program allows comprehensive structured training in both receiving and transmitting morse code in various modes/speeds/pitches. Automatic scoring and instantaneous visual fully G4BVS/REW, 22 Highland Road, Amersham, Bucks HP7 9AX, or £9 to include disk.

T&J ELECTRONIC COMPONENTS Quality components, competitive prices. Send 45p cheque or postal order for illustrated catalogue, 98 Burrow Road, Chigwell, Essex IG7 4BH.

PRINTED CIRCUIT BOARDS & LABELLING Designer and manufacturer to freelance and industrial users. Try me for: Conventional signal and double sided PCB production (non PTH) hand produced artworks and photography. Quickly made prototypes. Self adhesive process printing. - G.N. Slee, 78 Derry Grove, Thurnscoe, Rotherham, South Yorkshire, S63 OTP. Phone: (0709) 895265.

AVO VALVE Characteristic Meter 163. 4 years old. Immaculate condition. Current price £1400.00 plus. Will accept reasonable offer. Phone Swansea 0792-69841.

ZIPPY ELECTRONIC Send for free price lists on answering machines, cordless telephones, CB's and accessories, all electronic components. Credit cards accepted. 8 Spring Close, Bradpole, Bridport, Dorset. Telephone (0308) 56539.

RF3100L Panasonic double superhet, 32 wavebands, synthesised PLL, crystal controlled. Brand new. £165. Phone Edwards, Chard, 046-06-2848.

CLASSIFIED ADS

FOR SALE ZX81 with over £50 of software, some 16K. £50 ONO. Phone Holyhead (0407) 4603.

SMA PLUGS DC-18GHz £6.50. SMA Flange socket £5.50. SMB Plugs DC-4GHz £1.80. SMB Bulkhead socket £0.92. Add 20p p&p and 15% VAT. Randmill Ltd., 88 Arborfield Close, Slough, Berkshire.

RANK TX/RX RADIOS, pair of pocket size professional units, 4 channels PMR band incl. charger, handbook. £55. Phone Cheltenham (0242) 581667.

FRENCH B/W TV PHILLIPS TP412 with preamp and aerials for Brest. £40. Telephone St. Austell (0726) 3608.

MTL HUNTRON TRACKER 1980 model for repair centres, computer servicing. Good condition. £400 ONO. Box No. REW29.

FRG-7 with 2400Hz SSB filter £140. Microwave modules, receive converters for 70cm, 2m, 4m £22 each, or receiver and converters, as one lot £200. L J Devaney, phone 01- 579-2424, x2565, day time only.

JOIN THE INTERNATIONAL SW LEAGUE. Free services to members including QSL Bureau. Amateur and Broadcast Translation, Technical Identification Dept. - both Broadcast and Fixed Station, DX Certificates, contests and activities for the SWL and transmitting members. Monthly magazine MONITOR containing articles of general interest to Broadcast and Amateur SWLs, Transmitter Section and League affairs, etc. League supplies such a badges, headed notepaper and envelopes, QSL cards, etc. are available at reasonable cost. Send for league particulars. Membership including monthly magazine etc., £9.00 per annum UK overseas rates on request, Secretary, 88, The Barley Lea, Coventry, W. Midlands.

THE RADIO AMATEUR INVALID AND BLIND CLUB is a well established Society providing facilities for the physically handicapped to enjoy the hobby of Amateur Radio. Please become a supporter of this worthy cause. Details from the Hon Secretary, Mrs R E Woolley, 9 Rannock Court, Adelaide Road, Surbiton, Surrey KT6 4TE.

RADIO & ELECTRONICS CONSTRUCTOR back issues for volume 34, Sept 1980 to Aug/Sept 1981, all twelve issues in handsome Cordex Binder with title on spine for only £5.60 plus £1.60 for p&p. From Data Publications, 45 Yeading Avenue, Rayners Lane, Harrow, Middx HA2 9RL.

AIRCRAFT COMMUNICATIONS HANDBOOK (Europe) including UK Spot MF,HF,VHF,UHF. Frequencies, military and civil airports, air traffic control centres, weather reports, broadcast times, beacons, long range stations, callsigns, maps, etc. 384 pages £7.50, post & packing £. PLH Electronics, 97 Broadway, Frome, Somerset.

WRITE FOR R&EW We pay good rates to authors for articles covering the latest developments in electronics, communications, video and computing. If you have an idea for a project or a feature write, with brief details, to the Editor at the usual editorial address.

SMALL ADVERTISEMENTS

Advertisements must be prepaid and all copy must be received by the 4th of the month for insertion in the following month's issue.
The Publishers cannot be held liable in any way for printing errors or omission, nor can they accept responsibility for the **bona fides** of Advertisers.
Where advertisements offer any equipment of a transmitting nature, readers are reminded that a licence is normally required. Replies to Box Numbers should be addressed to: **Box No....., Radio & Electronics World, 45 Yeading Avenue, Rayners Lane, Harrow, Middlesex HA2 9RL.**

CLASSIFIED ADVERTISEMENT ORDER FORM — PLEASE COMPLETE BELOW

Write Your Ad. Below In the boxes - one word per box please. Underline words required in Bold type. Your name, address, and/or telephone number, if to appear, must be included in the boxes and must be paid for. Telephone numbers count as two words. Please use BLOCK CAPITALS.

—Advertisements are accepted on the understanding that the details stated comply with the conditions of the Trade Description Act,1968.

—Whilst every care is taken to ensure accuracy, we do not accept liability for inaccuracies should they occur.

—Cancellations must be notified by telephone or in writing by the 6th of the month preceding publication.

			£2.00
£2.04	£2.16	£2.28	£2.40
£2.52	£2.64	£2.76	£2.88
£3.00	£3.12	£3.24	£3.36
£3.48	£3.60	£3.72	£3.84
£3.96	£4.08	£4.20	£4.32

RATES

All cheques should be made payable to Radio & Electronics World.

12p per word - minimum charge £2.00

Tick this box if you require a box number charged at 30p ☐

I enclose remittance of £ : p

NAME .... ADDRESS ....

.... POSTCODE ....

Post your completed form to RADIO & ELECTRONICS WORLD, Classified Ads., 45, Yeading Avenue, Rayners Lane HARROW, Middlesex.

THE LAST WORD.

Two stories concerning those keepers of the telecommunications monopoly, the newly born British Telecom, née the GPO. The first concerns a visit to the most phallic of London's tourist attractions, the Post Office, sorry, Telecom Tower. The excuse for the visit was the handover of various sound and vision links to the new Channel 4 TV set up which, by the time you read this, will be offering a nightly dose of radically different TV programmes. These, judging by the promotional material that has appeared to date, consist of soap operas, court room dramas, historical plays and news - if this sounds much the same as the offerings of the present networks, fear not for there will be a difference. We can exclusively reveal that the reason that music drowns out the soundtracks of all the clips from Channel 4 programmes, is that ITV's intellectual channel will consist of material spoken exclusively in Franglais, a language that has found wide acceptance among thinking readers of the 'Sun'.

Back to the BT Tower, however, and the hand over of the Channel 4 distribution system. The hand over itself featured speeches from the big white chiefs of Telecom and, via the new network, Channel 4's Jeremy Isaccs from their Charlotte St studios. You may have guessed that this was destined to be a boring affair as indeed it was. As the hard stuff was being held over until after the ceremony, there was a general wish to get things over with.

The offer of a tour around the switching centre at the end of the speeches was taken up by most of the technical journalists present, including the **R&EW** representative - we like to show willing - and off we went to the switching room.

Here the mysteries of pushing switches at the correct time were explained (a large clock is the secret behind BT's success in this area) and our guide indulged in a gentle bit of back slapping pointing out that the general public were not aware of BT's role in our country's TV networks. At this point the **R&EW** person pointed out that the Telecom's staff threat to pull the plug on BBC and ITV during any industrial dispute, meant that many of the public were aware of BT's involvement. The guide glared and ignored the question.

The very next day, as part of the TUC's day of action/inaction campaign, most papers carried an item about the threat from BT engineers to pull the plug out during prime time TV. Point made.

One other titbit of information was that the restaurant at the top of the tower (nearer the end of the universe than most eateries) might re-open in the near future. It was closed some time ago as it was thought to be too tempting a target for bombers and other nasty people.

A number of ideas for reopening the venue were considered - a conference centre would be ideal but for the fact that the circular shape of the tower, and its central service shaft, would make any presentation/discussion, almost impossible.

The idea most in favour was a fast food joint, with an external lift for ferrying customers up the side of the building. Who's for a Buzby Burger?

FLYING HIGH

Nothing to do with electronics this, but a warning for those of you who have not taken to the skies yet. Judging by the image projected by the airlines, airtravel is a sophisticated form of travel, a cut about land bound transport in all senses of the word.

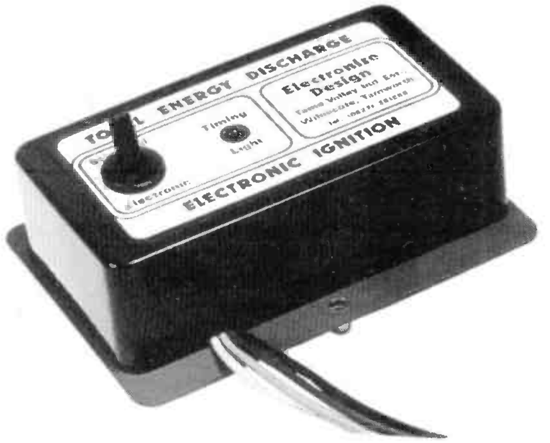
In fact, according to one member of the **R&EW** staff, flying is a very overrated experience. The feeling on take off was said to be somewhat akin to sitting on board a rather overcrowded London transport bus whose driver had positioned said vehicle at the start of the M1 prior to flooring the accelerator and hoping to God that the thing took to the air. Of course the bus won't take off and a plane, usually, will. At any rate, flying was thought to be very much a thing for the birds.

Advertisers' Index

Ambit International	20
Audio Electronics	8
Beckman Instruments	19
Blackstar	69
BNR + ES	60
Breadboard	39
Bulgin	85
Burns	19
Cambridge Learning	9
E.I. Chessell	6
C.Q. Centre	62
Electrautom	6
Electronics Hobbies Fair	62
Electronize Design	I.B.C.
Enviromental Equipment	Insert
E.C.O.	87
Garex	7
G.S.C.	29
Gould Instruments	85
H. Lexton	4
Microwave Modules	47
O.E.L.	28
Opus Supplies	23
P.M. Electronics	40
Polmark	60
Randam Electronics	19
S.E.M.	43
Sinclair Research	2-3
Special Products Distribution	43
Thandar Electronics	I.F.C.
Thanet Electronics	76/77
Wilmslow Audio	43 & 87
Wood & Douglas	28

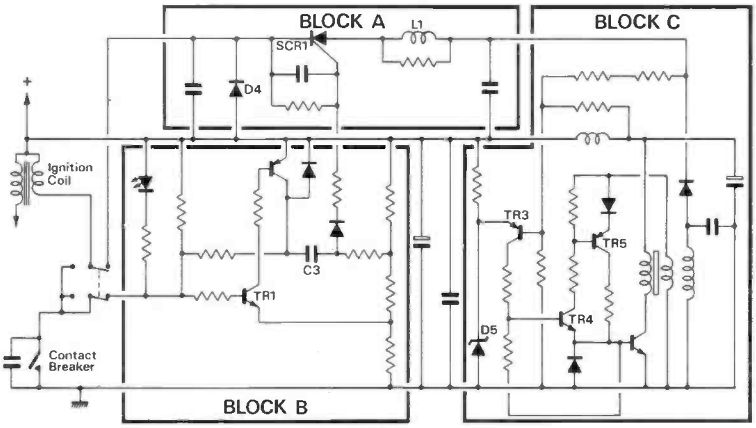
electronize

ELECTRONIC IGNITION KITS



Two years ago we launched the Total Energy Discharge System, we knew it could outperform any competing system and the sales have proved just how good it is. With thousands of systems sold in over 30 countries around the World, from the cold of Norway to the tropical heat of Singapore, the system is an outstanding success.

THIS IS WHAT MAKES TOTAL ENERGY DISCHARGE SO GOOD—



Circuit Diagram

The discharge circuit in block A is the heart of the system. It looks simple but outperforms any other by far. A 2 µF storage capacitor (twice the usual size) charged to + 370 volts, is discharged into the ignition coil primary by SCR1, providing a high energy pulse of the correct polarity. Long after the storage capacitor is discharged, the current in the ignition coil is sustained by 'flywheel' diode D4, preventing energy flowing back to the capacitor and giving 3½ times the spark energy and duration. Instead of relying on the effects of coil 'ringing', inductor L1 commutates the SCR, giving complete freedom from the usual latching problems and allowing the storage capacitor to be recharged whilst the discharge current is still flowing in the coil.

Block B is the trigger circuit and provides faultless spark timing. The emitter of TR1 is biased from the supply to provide a variable trigger threshold, allowing triggering with the supply down to about 3.5 volts but rejecting noise and signals from contact shuffle and vibration. Capacitor C3 and its associated resistors provide a variable inhibit period, after the contacts close, which filters out extreme contact bounce on 4 cylinder engines yet still allows 8 cylinder operation to over 7500 rev/min. In effect the longer the contacts stay open the longer they must remain closed before the next spark can be triggered. (Be warned:- untimed sparks can seriously damage your engines health).

Block C is the inverter, the power behind the spark. It's a 'ringing choke' type. Well designed, this type can not only be regulated and charge the capacitor from zero volts, effectively a short circuit, but is also more efficient than the traditional push-pull type. Even though it provides around 3 times the power, it still doesn't need the usual finned heat sink. Transistors TR4 and TR5 regulate the invertor output, by controlling the amount of feedback, and are in turn controlled by TR3 which compares the voltage on the storage capacitor with the reference zener D5. The output voltage is set by the zener voltage so the full output is available over the whole supply voltage range, a powerful spark is produced even with the battery down to 4 volts.

These are the more obvious features, there are many more details like the absence of 'spikes' and low $^{di}/_{dt}$ and $^{dv}/_{dt}$ applied to the SCR, which together with top quality components make Total Energy Discharge not only a top performer but far more reliable.

This advanced circuitry gives all the well known advantages of the best capacitive discharge systems:

Peak Performance; Improved Economy; Fires Fouled Plugs; Accurate Timing; Smooth Performance;

PLUS

Super Power Spark; Better Starting; Optimum Spark Duration; Correct Spark Polarity; L.E.D. Static Timing Light; Low Radio Interference; Designed In Reliability.

Information disclosed above does not imply any freedom from patent or copyright of Electronize Design.

Electronize Total Energy Discharge Ignition is suitable for use with:

ALL	6 and 12 volt negative earth vehicles fitted with a conventional contact breaker and coil system.
ALL	Ballast resistor (cold start/low voltage) systems.
ALL	Voltage triggered electronic tachometers. (Some older current impulse types (Smiths pre 1974) require an adaptor)
ANY	Number of cylinders up to & including 8.

SPECIFICATION

(using a typical ignition coil)	TOTAL ENERGY DISCHARGE	ORDINARY CAPACITIVE DISCHARGE
Spark Power	140W	90W
Spark Energy	36mJ	10mJ
(stored energy)	135mJ	65mJ
Spark Duration	500µS	160µS
Output Voltage		
clean spark plug	38kV	26kV
fouled spark plug	26kV	17kV
Voltage Rise Time to 20kV	25µS	30µS

You can buy your Total Energy Discharge system as a ready assembled and tested unit ready to fit to your car or as a comprehensive kit of parts containing everything required, even a length of solder and a tube of heat sink compound. The kit comes complete with detailed, easy to follow instructions which enable even a beginner to assemble a kit in just a matter of hours.

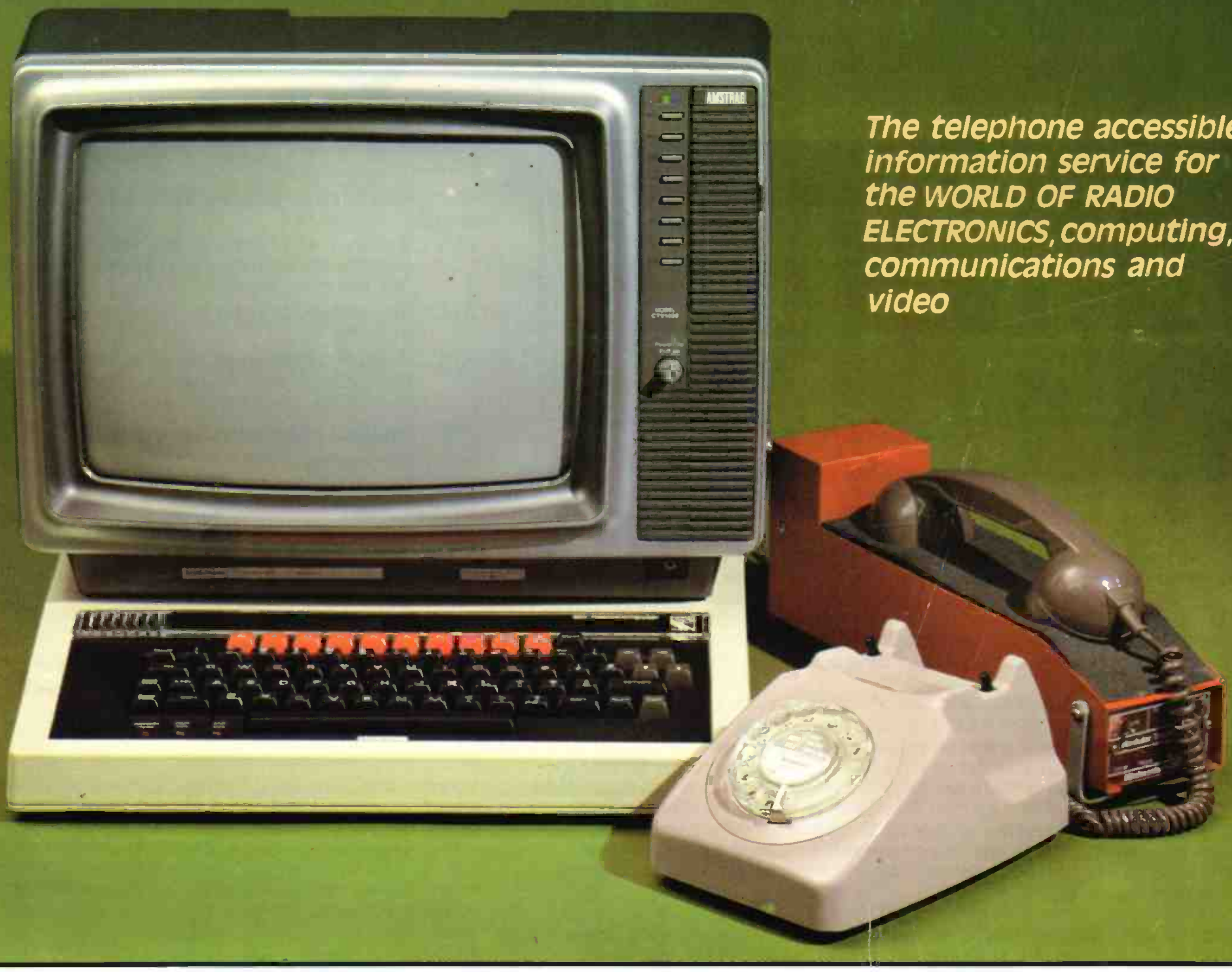
The same top performance system is also available, in ready assembled or kit form, to suit cars and motorcycles fitted with twin ignition systems.

STANDARD UNIT Assembled and Tested	**£26.70**
STANDARD UNIT KIT	**£15.90**
TWIN OUTPUT UNIT Assembled and Tested	**£36.45**
TWIN OUTPUT KIT	**£24.55**

All systems are available direct from the manufacturer. Prices include VAT, postage and packing £1.00 extra. Access and Visa cards are welcome, just write or telephone quoting your number.

ELECTRONIZE DESIGN
Dept H · Magnus Rd · Wilnecote
Tamworth · B77 5BY
tel 0827 281000

SOMEDAY, ALL COMPONENTS WILL BE SOLD THIS WAY!



The telephone accessible information service for the WORLD OF RADIO ELECTRONICS, computing, communications and video

- *Catalogue support information, news, bulletins, electronics news.
- *Ordering by 'phone (soon to be on-line)
- *Free access to 'public' areas. £10pa gets you into the 'special' features.

REW
TEL

The 24 hour service will commence when the phone lines are available!
Meantime 6pm/9pm and daytime when phone usage permits on (0277) 230950.