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The communications and electronics magazine

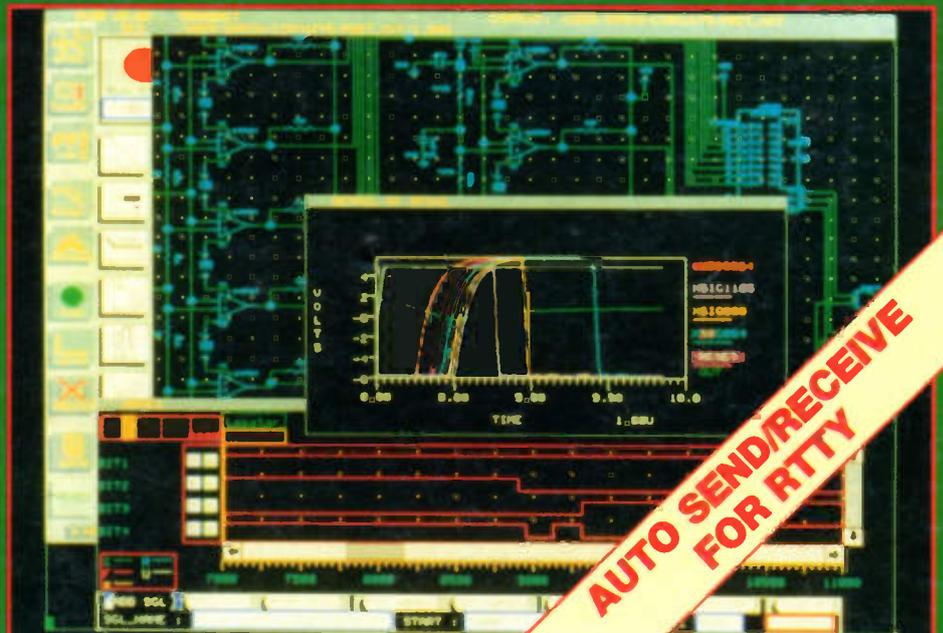
World

**STRAIGHT RXs:
THE GOLDEN AGE
OF RADIO?**

**AERIAL EXTRA:
MULTI-ARRAYS FOR
TV & RADIO**

**LINEAR ICs:
THE LOW-DOWN
ON AMPLIFIERS**

**UNILAB REVIEW:
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YAESU FRG9600/RWC MK3 HF-UHF SERIES

After many months of research and development RWC LTD are pleased to announce their latest HF modification for the Yaesu FRG9600 which now includes LF/HF/VHF/UHF coverage from 100kHz to 950MHz and improved 'S' Meter and a typical receiver sensitivity now $>2\mu\text{V pD HF}$, $>1.5\mu\text{V 60-950MHz}$ all @ 12dB SINAD. (Please contact us for detailed specifications).

We have fitted a High performance HF Front-End made for us by AKD. The new HF section is fitted internally with switching circuits and a small toggle Switch on the rear apron to enable band change whereby the display changes to read actual frequency (100kHz-60MHz). The standard SO239 antenna connector has now been changed for an 'N' connector for coverage from 60-950MHz and an SO239 connector fitted for HF coverage 100kHz-60MHz. (UHF extended coverage is now standard as per our original MK2 modification up to 950MHz).

As an 'N' connector is now fitted to all RWC FRG9600s for VHF-UHF coverage it is possible to use a wide-band discone antenna such as the ICOM AH7000 which is supplied with low-loss coaxial cable and 'N' connectors. A dipole or long-wire antenna can be used for HF coverage with very good results. **This facilitates use of two antennas for all bands.**

All modifications are Fully Guaranteed for twelve months from date of purchase/modification providing our modifications seals are unbroken. See the reviews or s.a.e. for a copy! © RWC LTD 1987

* We reserve the right to change specifications due to continuous development and modification of this product.



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FRG9600 MK2 Model 60-950MHz 'N' connector @ £499.00 + 5.00 carriage. (Modified unit only).

FRG9600 MK3 Model 100kHz-950MHz 'N' connector and SO239 for HF @ £599.00 + £5.00 carriage. (Modified unit only).

RWC Exclusive Base Station Complete HF-UHF Package FRG9600 MK3 Model, Icom AH7000 ant, G5RV HF multiband, PA4C ac-13V dc adaptor, inclusive carriage UK £699.00.

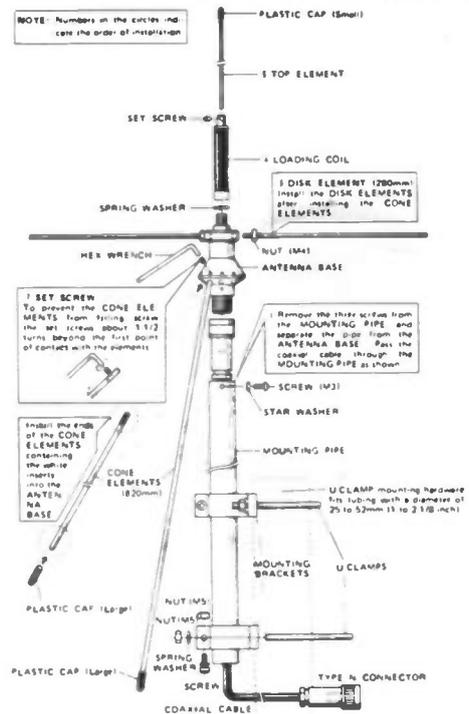
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AH-7000

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SPECIFICATIONS	
Frequency coverage	Receive 25 to 1300MHz Transmit 50, 100, 430, 900, 1200MHz bands
Input power rating	200 watts
Input impedance	50 ohms
Supplied connectors	Type N
Supplied coaxial cable	5D-2V (50 ohm)
Type of antenna	Discone
Length	1.7 meters
Weight	1kg

Icom AH7000 @ £82.50 (inc free carriage UK mainland).

YAESU/RWC FRG9600 Options

PA4C ac adaptor £16.50 inc post.

FIF232C RS232 computer interface @ £75.00 inc post.

Raycom GP900 900-950MHz 3dB, base station ant @ £22.00 inc post.

AM-FM wide & narrow IF filters POA.

RWC 9600 MK2 owners HF mod @ £99.00 inc carriage (send unit).

FRG9600 existing owners HF & UHF mod - 100kHz-950MHz. Send unit carriage paid @ £129.00. (UK owners only.)

YAESU FRG9600 Service Manual (inc Cat Prog) @ £12.50 inc post.

Raycom VHF-UHF Discone 60-600MHz SO239 connector @ £27.50 inc carriage.

RWC Modified Video Unit. 6.00MHz IF video (modified from NTSC) @ £27.50 inc post.

Please call or telephone for other available options.

ASK FOR COLOUR BROCHURE & SPECIFICATIONS



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Safety in the shack

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

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

Whilst every care is taken when accepting advertisements we cannot accept responsibility for unsatisfactory transactions. We will, however, thoroughly investigate any complaints.

The views expressed by contributors are not necessarily those of the publishers.

Every care is taken to ensure that the contents of this magazine are accurate, we assume no responsibility for any effect from errors or omissions.

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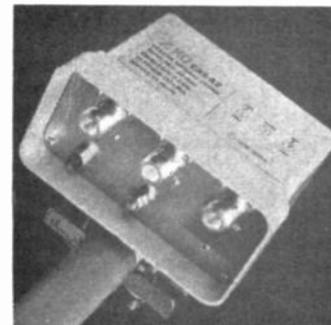
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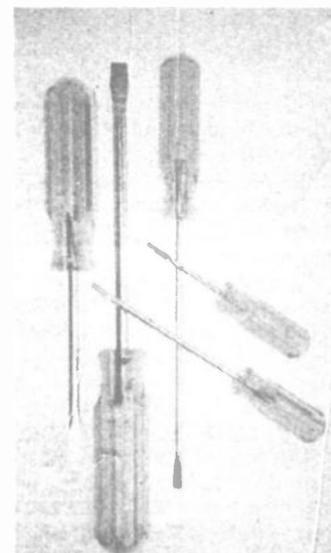
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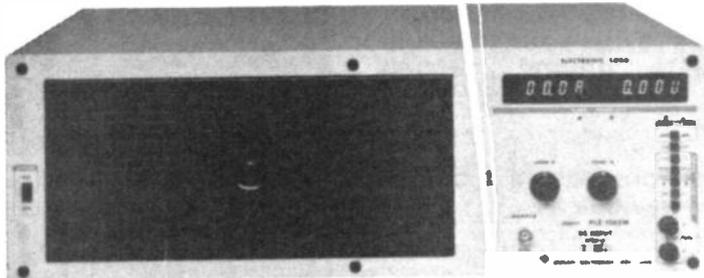
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PRODUCT NEWS

Featured on these pages are details of the latest products in communications, electronics and computers. Manufacturers, distributors and dealers are invited to supply information on new products for inclusion in Product News.

Readers, don't forget to mention **Radio & Electronics World** when making enquiries

HIGH POWER LOAD



Telonic has recently announced the introduction of a new electronic load for static and dynamic testing of dc power sources. The new model PLZ 1002W has a maximum input power rating of 1000 watts at voltages from 3 to 110V and currents from 0 to 200 amps. Two or more loads can be operated in parallel in master/slave mode to increase current capability.

The load, which is fully protected against overvoltage, overcurrent, overpower and reverse polarity is equipped with two 3½-digit meters monitoring input voltage and current. The PLZ 1002W can be selected as either a constant resistor or a constant current load.

In dynamic mode the constant current value can be continuously switched between two selected current levels by an internal oscillator 100Hz-1kHz. This allows the operator to view the transient voltage response of the power source under test on an oscilloscope. The constant current level can also be controlled by an externally applied voltage, permitting control by an IEEE 488 bus via the Kikusui DPO interface.

*Telonic Instruments Ltd,
Boyn Valley Road,
Maidenhead,
Berks SL6 4EG.
Tel: (0628) 73933.*

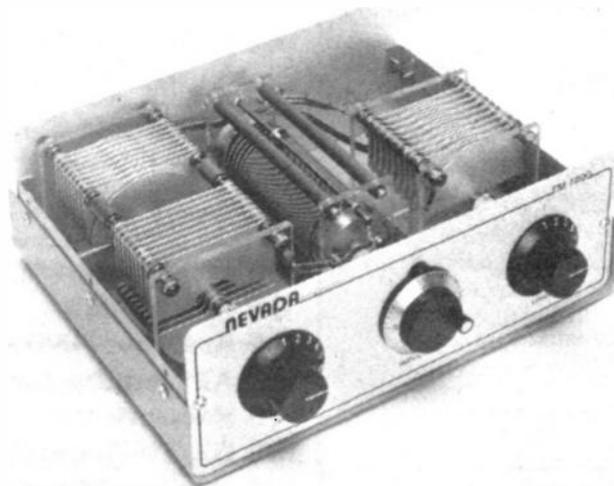
ALL BAND ATU

Telecomms recently launched a 1kW all band ATU, the Nevada model TM1000. The unit is a natural extension of the Nevada series of discrete ATU components, ie the roller coaster, turns counter and variable capacitors that they have released over the last nine months.

The ATU is continuously variable from 1.8-30MHz and uses a transmatch circuit that allows for maximum flexibility. The unit can handle a wide range of antenna impedances.

Priced at just £125 (inc VAT), the TM1000 is within the reach of most radio amateurs. For those who wish to construct the ATU Telecomms are offering the unit in kit form, which includes the empty case, pre-drilled, 2 capacitors, 1 roller coaster and 1 turns counter at a cost of £100 (inc VAT).

*Telecomms,
189 London Road,
North End,
Portsmouth,
Hants PO2 9AE.
Tel: (0705) 662145.*



POWER SENSOR HEADS

New power sensor heads introduced by Cirkit provide a cost effective and rugged way of measuring RF powers in the range 0.5 watt to 75 watts and dc to 2GHz. The only additional equipment required is a standard 200mV digital voltmeter (DVM) and leads.

The new products have been designed for the service engineer or radio amateur who needs to make quantitative measurements of multi-frequency and power transmitter installations where the use of expensive laboratory equipment would not be feasible. The new power heads simply convert a conventional DVM into a broadband absorption wattmeter.

In essence the device is a rugged bolometer. Power is fed to the unit using a coaxial connector, where it is dissi-

pated in a precision 50 ohm termination.

The resistor used for this termination is comprised of a pyrolytic carbon film on a beryllium oxide substrate, ensuring that the value of the resistor does not change with heat and that any heat generated is conducted swiftly away from the film. The majority of the heat is then sunk in the outer case or heatsink of the unit, which is matt black aluminium to ensure good emissivity. A small percentage of the heat (determined by the relative thermal paths in the unit), is allowed to flow through a thermoelectric generator, and the resultant voltage is then scaled to enable a reading of mV to correspond with the input power in watts.

The output voltage can be read directly on a DVM using the 200mV range and is acces-

sed by 4mm sockets fitted on the end of the device.

*Cirkit Holdings PLC,
Park Lane,
Broxbourne,
Hertfordshire EN10 7NQ.*

20MHz OSCILLOSCOPE

The 20MHz dual channel oscilloscope, type HM203-6, available from Levell Electronics, offers value for money at £314 + VAT. This instrument is the latest version of the HM203 series.

Both vertical amplifiers incorporate variable gain controls and maximum input sensitivity of 2mV/div over the full 20MHz bandwidth. A further feature permits display of the sum or difference of two signals. The HM203-6

will trigger reliably with a 0.5 div display height up to at least 40MHz. Using the manual level control combined with the variable hold-off control, even relatively complex signals can be stably triggered.

An active TV-sync-separator for line and frame gives improved TV triggering. The 8 x 10cm internal graticule permits parallax-free viewing over a wide angle and a trace rotation control is included on the front panel. A component tester is incorporated enabling rapid testing of semiconductors and other components.

*Levell Electronics Ltd,
Moxon Street,
Barnet, Herts EN5 5SD.
Tel: 01-449 5028.*

CAE ENVIRONMENT

Rapid Silicon have just introduced a new set of software tools said to be the first in the industry that allow engineers to design and analyse mixed analogue and digital board level designs on an interactive workstation.

Known as A/D Lab, this software system allows designers to draw schematics combining analogue and digital parts, and verify a complete design through virtual oscilloscopes and logic analysers that display analogue and digital waveforms side by side. It offers an integrated analogue-digital database which contains extensive libraries of both analogue and digital components, and incorporates all of the necessary functions to automate the simulation process.

A/D Lab is specifically designed to be user friendly. A simple compilation prepares the database for simulation and enables the user to successively analyse the various stages of the target design using Daisy's proven analogue and digital simulators.

*Rapid Silicon,
Rapid House,
Denmark Street,
High Wycombe,
Bucks HP11 2ER.
Tel: (0494) 26271.*

EDU-LINK

Metascybe Systems Ltd is launching its low cost micro to ICL mainframe link for educational establishments, called EDU-LINK CO3.

EDU-LINK CO3 enables schools, polytechnics, etc, who have taken up the government offer of subsidised modems to use them in order to connect up to their local authority ICL mainframe. The modem in question is the Dacom DSL2123AD. At the ICL mainframe end a protocol converter called Connect CO3, which many local authorities already have, is also required.

The price for the software at only £95 plus VAT is possibly the cheapest way to achieve total ICL terminal emulation with both bulk file transfer and interactive working.

PC-SPORT PLUS

An innovative new portable is the latest addition to the growing range of IBM compatibles from AMT.

Powerful memory features are built into the PC Sport Plus. Conventional memory of 256K can be increased to 640K, and an additional 512K of expanded memory can be added on a separate memory bank, giving extra room for packages such as Lotus 1-2-3 and Framework that support the EMS standard. PC Sport Plus runs at a turbo speed of 8MHz.

Users will find a standard layout with the addition of separate cursor keys, assisting numeric input to spreadsheets. LEDs, ten function keys and a reset button are present too.

An integral 360K disc drive is built into the right-hand side of the computer and an external drive can be connected at the rear. Communications are available with two serial RS232 ports, 25 pin and 9 pin, a useful facility on a portable, allowing use of various modems without a converter lead. The display card is CGA (640 x 200) and allows use of both composite

EDU-LINK CO3 is available on all the more popular micros (Amstrad, Apricot, IBM and compatibles, RML, etc).

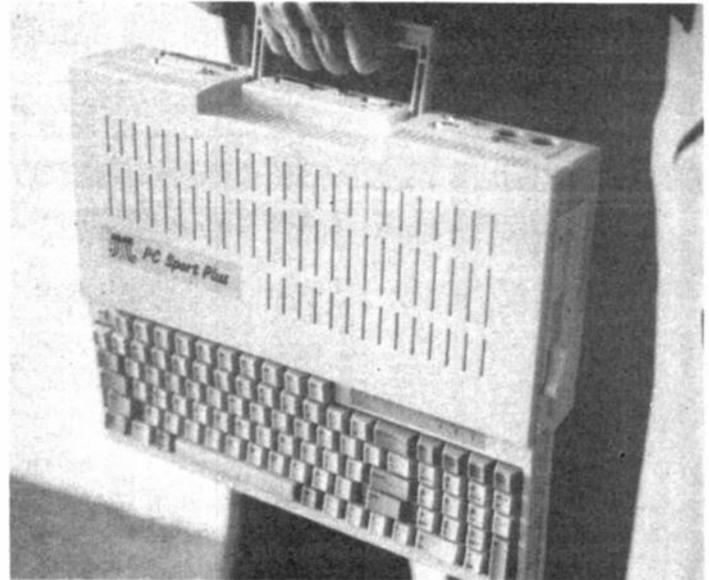
*Metascybe Systems Ltd,
Grant House,
47-53 St John Street,
London EC1M 4AN.
Tel: 01-253 1001.*

SPEEDY PRINTER

Rapid Terminals have announced that a new high speed, low cost replacement for the DEC LQP02/03 letter quality printer is available.

Known as the LQP45, the printer employs an expanded daisy-wheel which supports the full complement of DEC character sets, and prints high quality text and business graphics at up to 45 characters per second.

The LQP45 is plug-compatible with all DEC computers, word processors and video terminals and supports most industry standard software packages. A wide range of



video monitors and colour displays. An EGA card is optional.

An eight-bit expansion slot on the left-hand side adds growth potential. An optional 4-slot expansion box is on the way. An unusual feature in PC Sport Plus is specialised circuitry which allows most copy protected software to be backed up.

Other features include a battery backed real time

clock, parallel port for printer and games port for joystick. The PC Sport Plus is priced at £499 + VAT.

With Dos 3.2, 640K RAM and a monochrome monitor, the system costs £703 + VAT.

*Applied Microsystems
Technology Ltd,
249-251 Cricklewood
Broadway,
London NW2 6NX.
Tel: 01-452 0738.*

options are available for the LQP45. These include a stand, three paper handling options and a variety of different daisy wheels. Also available is an acoustic cover which accommodates an LQP45 printer fitted with a single-bin cutsheet feeder or forms tractor.

*Rapid Terminals,
Denmark Street,
High Wycombe,
Bucks HP11 2ER.*

PROTOTYPING CARD

The PC-35 prototyping card from Amplicon Liveline Limited provides an interface to the PC bus, together with space to accommodate up to sixty wire-wrap, dual in-line sockets on a 3,000 hole prototyping area. Power supplies and control signals are provided along the edge of the card. The component side is bordered by a ground connection, the other by +5V.

Eight address decoding

lines are provided for direct interface to peripheral chips, and bus lines A0, A1, reset, IOW, IOR, MEMW, MEMR and D0-D7 are buffered and may be loaded up to ten LSTTL loads. The data buffer is bidirectional, and other bus lines may be accessed with up to two LSTTL loads.

A 58-page manual, included in the price of the PC-35, introduces some of the basic concepts of IBM PC bus interfacing. Examples are simple but useful and include the software programs required to control them. Included also are parallel I/O ports, A to D and D to A converters and a number of test examples designed to enhance knowledge of interfacing to the PC bus.

Priced at £69, the PC-35 will also work in most clones.

*Amplicon Liveline Ltd,
Centenary Industrial Estate,
Brighton,
East Sussex BN2 4AW.
Tel: (0273) 570220.*



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AN745M	3.50	MC1350P	1.75	STK435	7.95	TBA520Q	1.10	TC4A17	2.95	IOA1025H	2.95
AN750	2.50	MC1351P	1.75	TA7237	4.25	TBA530	1.10	TC4A18	2.95	IOA1025H	2.95
BA521	3.35	MC1357	2.35	STK439	7.95	TBA540	1.25	TC4A19	2.95	IOA1025H	2.95
CA1352E	1.75	MC1358	1.55	STK463	11.50	TBA540	1.25	TC4A20	2.95	IOA1025H	2.95
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CA3140S	2.50	MC3401L	2.50	TA7072	2.65	TBA651R	2.50	TC4A24	2.95	IOA1025H	2.95
CA3140T	1.15	MC14106P	2.95	TA7073	3.50	TBA73	1.95	TC4A25	2.95	IOA1025H	2.95
CA3140S	2.50	MC14518EP	7.50	TA7108P	1.50	TBA720A	2.45	TC4A26	2.95	IOA1025H	2.95
HA1137W	1.95	ML231B	1.75	TA7120P	1.85	TBA750	1.95	TC4A27	2.95	IOA1025H	2.95
HA1156W	1.95	ML232B	2.50	TA7120P	1.85	TBA750	1.95	TC4A28	2.95	IOA1025H	2.95
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HA1339A	2.95	MSA5807	8.75	TA7146P	1.50	TBA810AS	1.50	TC4A32	2.95	IOA1025H	2.95
HA1366W	2.75	MSA5807	8.75	TA7146P	1.50	TBA810AS	1.50	TC4A33	2.95	IOA1025H	2.95
HA1377	3.95	MSA5807	8.75	TA7146P	1.50	TBA810AS	1.50	TC4A34	2.95	IOA1025H	2.95
HA1406	2.95	MSA5807	8.75	TA7146P	1.50	TBA810AS	1.50	TC4A35	2.95	IOA1025H	2.95
HA1551	3.50	MSA5807	8.75	TA7146P	1.50	TBA810AS	1.50	TC4A36	2.95	IOA1025H	2.95
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LA4031P	1.95	SL917B	6.85	TA7310AP	2.95	TC4270S	1.50	TC4A44	2.95	IOA1025H	2.95
LA4400	3.50	SL1310	1.80	TA7314P	2.95	TC4650	2.50	TC4A45	2.95	IOA1025H	2.95
LA4420	3.50	SL1327	1.10	TA7321P	2.25	TC4650	2.50	TC4A46	2.95	IOA1025H	2.95
LA4422	2.50	SL1327	1.10	TA7321P	2.25	TC4650	2.50	TC4A47	2.95	IOA1025H	2.95

SEMICONDUCTORS

AA127	0.25	BC182P/B	0.10	BD237	0.40	BF493	0.35	MRF453	17.50	TV106	1.50
AC106	0.25	BC183L	0.09	BD242	0.40	BF493	0.35	MRF454	25.50	TV106/2	1.50
AC128	0.20	BC183L	0.09	BD246	0.75	BF597	0.25	MRF455	17.50	ZRF011	8.50
AC128K	0.32	BC204	0.25	BD379	0.45	BF840	0.23	MRF475	2.65	2N1100	15.80
AC141	0.28	BC207B	0.25	BD410	0.65	BF881	0.25	OC16W	2.50	2N1711	1.35
AC141K	0.34	BC208B	0.20	BD434	0.65	BF888	0.30	OC23	9.50	2N2219	0.25
AC142K	0.45	BC212	0.09	BD436	0.45	BF900	1.50	OC25	1.50	2N2626	0.55
AC176	0.22	BC212L	0.09	BD437	0.75	BF919	1.75	OC29	1.50	2N2905	0.40
AC176K	0.21	BC213	0.09	BD438	0.75	BF928	0.75	OC32	2N3053	0.60	
AC187	0.25	BC213L	0.09	BD510	0.95	BF743	0.35	OC39	4.50	2N3054	0.60
AC187K	0.28	BC214	0.09	BD518	0.75	BFW10	0.55	OC32	5.50	2N3055	0.52
AC188	0.28	BC214C	0.09	BD520	0.65	BFW11	0.75	OC42	1.50	2N3072	0.12
AC188K	0.37	BC214L	0.09	BD534	0.45	BFW16A	1.15	OC44	1.25	2N3703	0.12
AD142	0.80	BC237B	0.15	BD535	0.45	BFW61	0.80	OC45	1.00	2N3704	0.12
AD143	1.25	BC238	0.15	BD538	0.65	BFW92	0.65	OC70	1.00	2N3705	0.12
AD149	0.70	BC239	0.15	BD575	0.95	BFY29	0.30	OC71	0.75	2N3706	0.12
AD161	0.50	BC251A	0.15	BD587	0.95	BFX84	0.25	OC72	2.50	2N3708	0.12
AD162	0.50	BC252A	0.15	BD588	0.95	BFX85	0.32	OC75	1.50	2N3733	9.50
AF106	0.50	BC258	0.25	BD597	0.95	BFX86	0.30	OC81	1.00	2N3773	2.75
AF114	1.95	BC258A	0.39	BD695	1.50	BFX88	0.25	OC84	1.50	2N3792	3.50
AF121	0.80	BC284	0.30	BD698	1.50	BFY18	1.35	OC139	12.50	2N4280	1.35
AF124	0.65	BC300	0.30	BD701	1.25	BFY50	0.32	OC171	4.50	2N4427	1.15
AF125	0.35	BC301	0.30	BD702	1.25	BFY51	0.32	OC200	2.50	2N4444	1.95
AF126	0.35	BC302	0.30	BD703	0.90	BFY52	0.32	OC201	5.50	2N4444	1.95
AF127	0.65	BC307B	0.09	BDK32	1.50	BLY48	1.75	OC205	10.00	2N5294	0.42
AF139	0.40	BC327	0.10	BDK53B	1.85	BR100	0.26	R2000EB	1.45	2N5296	0.42
AF150	0.80	BC328	0.10	BF115	0.35	BR101	0.49	R2009	2.50	2N5298	0.80
AF178	1.95	BC337	0.10	BF119	0.65	BR103	0.55	R2010B	1.45	2N5485	0.45
AF239	0.42	BC338	0.09	BF121	0.39	BR103	0.55	R2322	0.88	2N5496	0.45
AU106	0.95	BC347A	0.13	BF124	0.20	BRC4443	1.15	R2323	0.68	2N5A715	0.55
AY102	0.25	BC379	0.20	BF127	0.35	BRV39	0.30	SKESF	1.45	2N5C495	0.80
BC107A	0.11	BC547B	0.20	BF160	0.27	BSW64	0.95	RCA16029	0.85	2N5C496	0.80
BC107B	0.11	BC547C	0.20	BF173	0.22	BSK60	1.25	RCA16039	0.85	2N5C497	0.80
BC108	0.10	BC547D	0.10	BF158	0.22	BT100A/02	0.85	RCA16181	0.85	2N5C498	0.80
BC108B	0.12	BC548	0.10	BF178	0.26	BT100A/02	0.85	RCA16334	0.90	2N5C789	0.85
BC109	0.10	BC549A	0.10	BF179	0.34	BT106	1.40	RCA16335	0.85	2N5C931D	0.95
BC109B	0.12	BC550	0.14	BF180	0.29	BT116	1.20	RCA16572	0.85	2N5C937	1.95
BC109C	0.12	BC557	0.08	BF181	0.29	BT119	3.15	S2060D	0.95	2N5C1034	4.50
BC114A	0.09	BC558	0.20	BF182	0.29	BU008	1.50	SKESF	1.45	2N5C1096	0.80
BC115	0.55	BC639	10.30	BF183	0.29	BU105	1.95	T6021V	0.45	2N5C1106	2.50
BC116A	0.55	BCY33A	19.50	BF184	0.28	BU108	1.69	T6027V	0.45	2N5C1124	0.95
BC116A	0.55	BCY115	0.30	BF185	0.28	BU124	1.25	T6029V	0.45	2N5C1162	0.95
BC117	0.19	BD124P	0.59	BF194	0.11	BU125	1.25	T6036V	0.55	2N5C1172	2.10
BC119	0.24	BD131	0.42	BF195	0.11	BU126	1.60	T9002V	0.55	2N5C1173	1.15
BC125	0.28	BD132	0.42	BF197	0.11	BU204	1.55	T9011V	0.75	2N5C1307	1.75
BC139B	0.20	BD133	0.40	BF198	0.14	BU205	1.30	T9015V	2.15	2N5C1364	5.00
BC140	0.31	BD135									



DESK-TOP CHARGERS

Ray Withers Communications Ltd have introduced a new range of cost effective replacement NiCad battery

packs, empty cell cases and desk-top chargers for the Icom, Kenpro and CTE ranges of hand-held transceivers.

Two fast charge fully com-

patible models are available for business and professional uses, designated 10AF (10V at 800mAh) and 12AF (12V at 550mAh). These are directly equivalent to the Icom range of NiCads and can be fast charged in the Icom BC35 and BC60 chargers.

The new Raycom NC580 desk-top charger has been designed to charge all Icom type NiCad packs over 400mAh capacity, and has two switchable charging rates.

The empty cell cases have a capacity of up to ten AA/HP7 size cells, enabling users to build a NiCad pack with a number of cells ranging from six cells (7.2V) upwards. This also offers a very cost effective solution for amateur radio enthusiasts.

*R Withers Communications,
584 Hagley Road,
West Oldbury,
West Midlands B68 0BS.
Tel: (021) 421 8201.*

IMPROVED FT767

Ray Withers Communications Ltd have recently introduced a series of modifications for the Yaesu FT767.

The FT767 is a very attractive set, giving many features at an economical price. RWC feel that it is, however, let down by its lack of dynamic range due to synthesizer phase noise.

Extensive laboratory development work has resulted in an add-on PCB modification, improving the dynamic range by up to 20dB. This results in better DX receiving capability in the presence of heavy QRM; very important on today's crowded bands. The modification at present is not available in kit form. Normal warranty is not affected on sets purchased from RWC Ltd.

Latest SMD type 'chip component' technology has been employed in the modification board to provide the required performance and reliability. This mod is now fitted as standard to all FT767s supplied by RWC, and may be fitted at a cost of £49.50 (including return carriage) to models also purchased previously from RWC.

*R Withers Communications,
584 Hagley Road,
West Oldbury,
West Midlands B68 0BS.
Tel: (021) 421 8201.*

ANTENNA SWITCH

The CAS-A2 remote coaxial antenna switch has been designed to enable the remote switching at the masthead of two antennas from one feeder. The unit is fully weatherproofed and of the highest quality, using Greenpar silver plated 'N' type connectors.

It has a low insertion loss and may be used up to 1000MHz with a maximum power of 150 watts

PEP. The unit requires dc at 11-14 volts fed by a supply wire through a fully RF decoupled dc input to the relay.

This unit is initially intended for the 934MHz personal radio band, at a retail price of £59.95.

*Telecomms,
189 London Road,
North End,
Portsmouth,
Hants PO2 9AE.
Tel: (0705) 662145.*

SOLID-STATE AMPS

MED's 6000 series GaAs power amplifiers offer frequency coverage from 2.7 to 6.4GHz in 0.5GHz bands, with saturated CW output power of 1, 5 or 10 watts. Available from Anglia Microwaves Limited, they feature an excellent linearity at low power levels and, for pulsed operation, innovative bias circuit designs reduce quiescent power consumption to virtually zero.

For higher power operation, the MED 7000 series amplifiers use silicon transistors for peak outputs of 25, 50 and 100 watts up to 10% duty and 3.5GHz.

Both series of amplifiers are specified with standard input power of 10mW. Input and output are both isolated with VSWRs typically of 1.5:1. Performance can be guaranteed over a temperature range from -40 to +55°C. Applications for these British designed and manufactured amplifiers include radar, remote sensing, TWT drivers and communications.

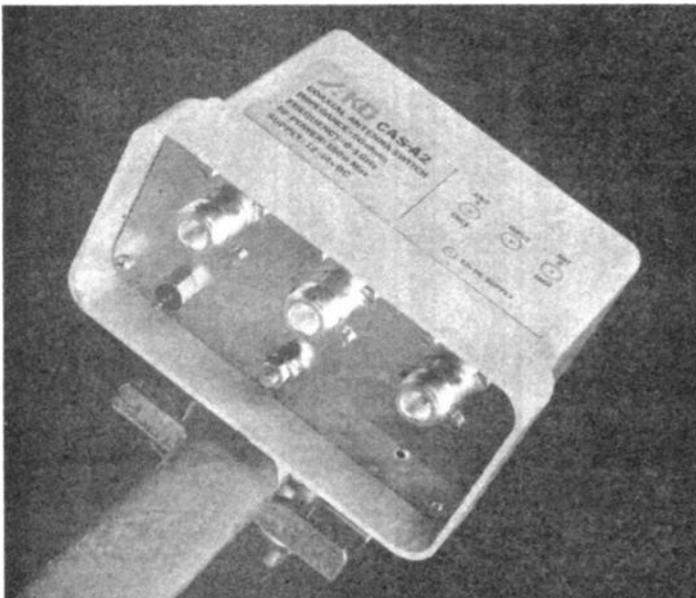
*Anglia Microwaves Ltd,
Radford Business Centre,
Billericay,
Essex CM12 0BZ.
Tel: (0277) 630000.*

UNINTERRUPTABLE PSU

Coutant Electronics Ltd recently announced a new OEM switch mode power supply called the RLU.

The new power supply has both ac and dc inputs and will run continuously at full output from either. When the dc input is supplied from a battery, the output of the power supply will be maintained uninterrupted if the ac mains input fails. Hold up time under these conditions depends entirely on the capacity of the battery employed.

The RLU is compact, measuring just 98 x 85 x 394mm. The standard unit provides outputs of 5, 12 and -12 volts at a total power of 70W and runs from the standard ac mains and/or 24, 36 or 48V dc. However, due to the



programmable nature of Coutant's robotic production line, a wide number of variants can be produced for OEM use.

If operating in its dual-input uninterruptable mode, the RLU takes its power from the ac input and automatically changes over to the dc input if the ac supply fails. On restoration of the ac supply, the RLU reverts to normal operation and the battery connected to the dc input is recharged.

The RLU includes a unique converter design which combines the high power handling capability and good regulation characteristics of a standard converter with the low component count and small size of the flyback converter.

*Coutant Electronics Ltd,
Kingsley Avenue,
Ilfracombe,
Devon EX34 8ES.
Tel: (0271) 63781.*

BATTERY BARGAINS

The Raycom compatible battery pack from R Withers Communications is designed to complement the Icom, Kenpro and CTE line of hand-held transceivers. Higher power output and/or higher ampere-hour configurations are possible using cell combinations not available elsewhere. The plastic and metal components supplied with this kit are designed to match the Icom, Kenpro and CTE transceivers with no modifications.

Also available from R Withers is the Raycom NC580 battery charger, designed to safely recharge the Raycom Model 10AF and Model 12AA NiCad battery packs. This unit provides the correct constant current trickle charge rate to ensure maximum life and performance from these battery packs.

The charge rate has been adjusted so that the battery can be charged continuously with no degradation in cell performance.

*R Withers Communications,
584 Hagley Road West,
Oldbury,
West Midlands B68 0BS.
Tel: (021) 421 8201.*

MARINE DF

The new Regency Polaris 7200 marine direction finder, from Tony Chapman Electronics Limited, covers all international marine frequency channels, plus weather station broadcast frequencies.

The scanning receiver automatically monitors all frequencies for activity or can be set on one frequency. The bearing of the transmission is displayed on a 'compass rose' ring of lights display. These features provide the ability to navigate to another ship easily by tuning to the transmitter of the other ship and steering towards the direction indicated on the ring of lights displayed; plot a position by tuning to two separate known locations such as coastal VHF and a weather station, noting the direction to the shore station's transmitter, using a chart to pinpoint the position; find your



way home without difficulty by tuning to a local marine VHF station or weather station, and aligning the bow to the bearing indicated.

The 7200 marine direction finder is easy to install and is designed for fitting to small ships and boats. The clear and easy to use control unit with

speaker and mounting hood and antenna is built to withstand 100 knot winds.

*Tony Chapman Electronics,
Electron House,
Hemnal Street,
Epping.
Essex CM16 4LS.
Tel: (0378) 78231.*

MODULAR RECEIVERS

Racal Communications Limited has launched the first of a new series of high performance, modular receivers which will cover the frequency range from VLF to UHF.

The RA3700 Series receivers are meant for inclusion in a European communication system. Operating in the HF band, 15kHz to 30MHz in selectable 10Hz or 1Hz synthesized steps, the receivers have been designed and developed for point-to-point communications, radio surveillance, direction finding and for use in computer-controlled systems. The new receivers may be used in fixed or transportable roles on land, at sea or in the air, and operate in LSB, USB, AM, FM and CW modes.

The highly modular design allows the same frame and plug-in modules to be configured to assemble receivers to meet a variety of different applications. The family, which includes single and dual receivers, also has a range of optional modules to enhance the receiver facilities.

The new receivers available today include the RA3701 single receiver, the RA3702 dual receiver, both with front

panel controls, and the RA3703 single receiver and RA3704 dual receiver, both remotely controlled.

Each of the receivers includes a serial ASCII remote control interface with a built-in capability of addressing up to 100 receivers. Slave receivers may be controlled by computer, by the MA3700 control unit, or by the RA3701 and the RA3702 which have built-in controller facilities. All front panel operating functions, except power on/off switching, can be controlled remotely.

Test and repair facilities also feature strongly. The

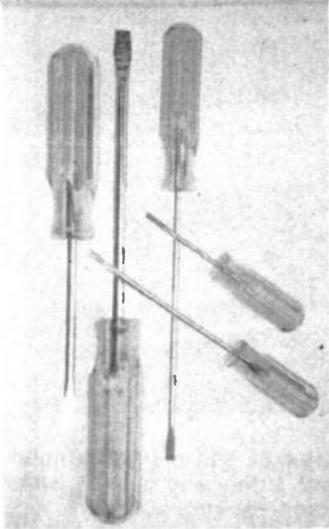
comprehensive built-in test equipment (BITE) may be operated locally or remotely and locates faults to module level. Module test and repair can be carried out to component level with the modules plugged into the receiver, eliminating the need for special-to-type test equipment. Modules can be changed on site by the operator; no realignment is needed, and repair time is consequently low.

*Racal Communications Ltd,
Western Road,
Bracknell,
Berkshire RG12 1RG.*



PRODUCT NEWS

XCELITE SCREWDRIVERS



Cooper Tools have introduced a new range of 5 round blade, fixed handle Xcelite screwdrivers, which can be supplied as individual tools or as a complete set with pouch.

The recommended price for the set is £16.31 (excluding VAT) while the prices of individual screwdrivers range from £1.75 for the smallest ($\frac{1}{16}$ in blade) to £4.83 for the largest ($\frac{5}{16}$ in blade).

Cooper Tools Ltd,
Sedling Road,
Wear,
Washington,
Tyne and Wear NE38 9BZ.
Tel: (091) 416 6062.

ANTI-STATIC DESOLDERING

Cooper Tools recently introduced two anti-static models to add to their Weller manual desoldering pump range.

Featuring fine 0.07in (1.9mm) diameter and general use 0.12in (3.2mm) diameter anti-static desoldering nozzles, the DS-AS-100 and DS-AS-110 allow one-handed operation, in conjunction with a soldering iron, to remove by suction all the solder from around components requiring replacement on circuit boards.

Cooper Tools Ltd,
Sedling Road,
Wear,
Washington,
Tyne and Wear
NE38 9BZ.
Tel: (091) 416 6062.

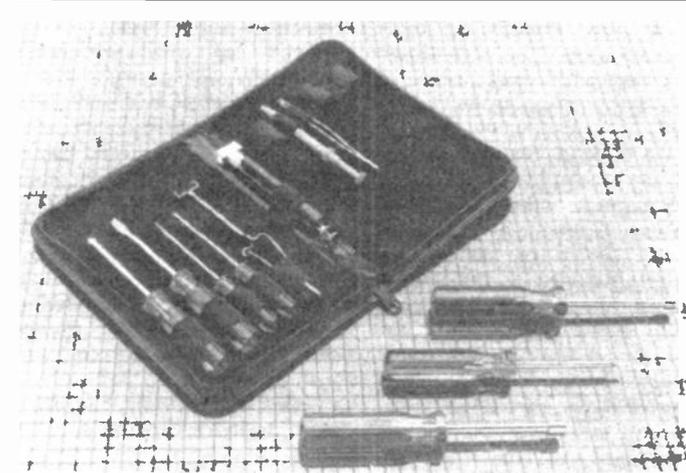
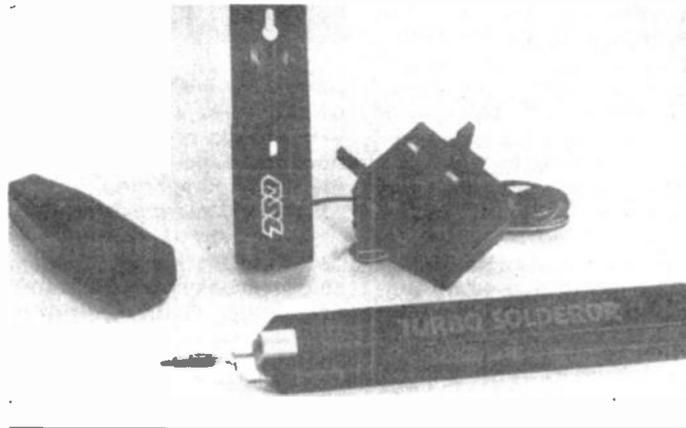
RECHARGEABLE

Cirkit recently introduced a new rechargeable soldering iron, which is ideal for soldering CMOS and other static sensitive devices and for site work where no mains supply is available.

Rated at 12W with fast warm-up time and small 2mm diameter tip, the unit comes complete with mains charger, wall-mounted socket and a 12V car charging lead which is connected via the vehicle's

cigarette lighter. Up to 200 standard joints can be made from one charge of 12 hours. Featuring an illuminated tip, for which spares are readily available, the soldering iron also has a safety hood for protection during operation.

Cirkit Holdings PLC,
Park Lane,
Broxbourne,
Hertfordshire EN10 7NQ.
Tel: (0992) 444111.



SERVICE KIT

A new electronic servicing kit including a range of integrated circuit handling tools, as well as screwdrivers and nutdrivers, has been introduced by Global Specialties.

The CSK-8 kit contains an IC insertion tool with pin straighteners for 14-16 pin devices, an extraction tool with pin straightener for 14-40 pin devices, a three-claw parts holder, assembly tweezers, a selection of slotted and Philips screwdrivers, two nutdrivers and a torque screwdriver.

The kit is supplied in a zipped vinyl case measuring 9 x 6 x 1½ inches, and it costs £22.50.

Global Specialties,
Shire Hill Industrial Estate,
Saffron Walden,
Essex CB11 3AQ.
Tel: (0799) 21682.

ELECTRONIC SOLDERING

New from Oryx is the DPU30, a 30 watt electronic soldering station. The unit is housed in an attractive steel box designed for the tough environment of industrial

production. The Oryx DPU30 joins a family of electronic stations, with its main design feature being the lightweight, slim, well-balanced iron that is connected to a digital read-out, solid-state power supply unit.

Operating temperatures are adjustable between 240°C-400°C and controllable to $\pm 2\%$. The station features zero point switching to ensure spike free operation, and temperature overshoot is avoided by a proportional control circuit. The iron has a long life ceramic element with a choice of tip sizes. The unit is fitted with spare tip and cleaning sponge trays.

Greenwood Electronics,
28 Portman Road,
Reading RG3 1NE.
Tel: (0734) 595843.

CRYSTAL CLEAR

ETI recently announced the introduction of the Thermo-Scan liquid crystal thermometer. It utilises the latest advances in liquid crystal technology to bring accurate and easy to read temperature indication to both your office and factory.

The Thermo-Scan is available in two ranges. Firstly the refrigerator thermometer, offering a range of 0°C to 12°C, and secondly the room thermometer, with a range of 12°C to 30°C. Both incorporate °F equivalents.

The Thermo-Scan thermometers offer reliable and economical alternatives to the standard glass thermometers. Each thermometer has been designed for quick and easy wall mounting and the defined simple to read scale ensures precise reading.

The liquid crystals are programmed to change through a spectrum of colours, from black as the temperature changes to green indicating the exact temperature. The cost of each thermometer is £1.25 each exclusive of VAT and postage.

Electronic Temperature
Instruments,
PO Box 81,
Worthing,
Sussex BN13 3PW.
Tel: (0903) 202151.

A/D CONVERTERS

Now available from RR Electronics is a new family of 10-bit microprocessor-compatible A/D converters with parallel/serial output: the ZN503AJ and ZN504E. These combine several innovations on a monolithic silicon IC. This 28-pin device comprises a current switching array (needing no trim), successive approximation logic, 2.5V precision reference, reference amplifier, comparator and 3-state parallel and serial output buffers.

The ZN503/4 has three pin-programmable input ranges. Only two external components are needed for a full 10-bit A/D conversion. No user trims are needed, and its serial output makes the device ideal for high-resolution remote sensing.

*RR Electronics Ltd,
St Martins Way,
Cambridge Road,
Bedford MK42 0LF.
Tel: (0234) 47211.*

MICROPOWER OP AMP

Now available from RR Electronics is the OP-90, a micropower op amp by Precision Monolithics Inc (PMI). Its performance is similar to PMI's industry standard OP-07, but it takes less power and generates less heat by drawing only half of one per cent of the current - less than 20µA.

Input offset voltage is 150µV maximum with a maximum input offset voltage drift of only 2.5µV/C, thus eliminating the need for external nulling. Gain of the OP-90 exceeds 700,000 at 100kohm load, which reduces gain error in high gain applications. Output drive capability of the micropower OP-90 is over 5mA, very high for an amplifier drawing less than 20µA of quiescent supply current.

In addition to its low supply current drain, the OP-90 can operate from a single supply of +1.6V to +36V or from dual supplies of ±0.8V to ±18V. The OP-90 is a true single supply device with both input and output voltage ranges including ground. In single supply applications, the OP-90 enables zero-in, zero-out capability.

The low current and voltage

requirements of the OP-90 make it an ideal choice in battery or solar powered applications. The OP-90 conforms to the standard 741 pinout with nulling to V- and can be used to upgrade existing designs using the OP-20, ICL8021, HA5141, LF441 and OPA21.

*RR Electronics Ltd,
St Martins Way,
Bedford MK42 0LF.
Tel: (0234) 47211.*

Rx/Tx CHIP

A new data communications product from Mullard, the SCC2698 OCTART, is now available from Online Distribution. It is a CMOS LSI device offering eight universal asynchronous Rx/Tx channels on a single chip. There are four dual-channel blocks, each with 10 I/O port lines and a 16-bit counter timer. Interface and configuration logic are common to all blocks.

Data rate is 1Mbit/s. The OCTART has an on-chip baud rate generator which can produce 18 different baud rates, from 38.4K baud to 50K baud. The SCC2698 also has a power-down mode which helps keep power consumption to a minimum.

*Online Distribution Ltd,
Melbourne House,
Kingsway,
Bedford MK42 9AZ.
Tel: (0234) 217915.*

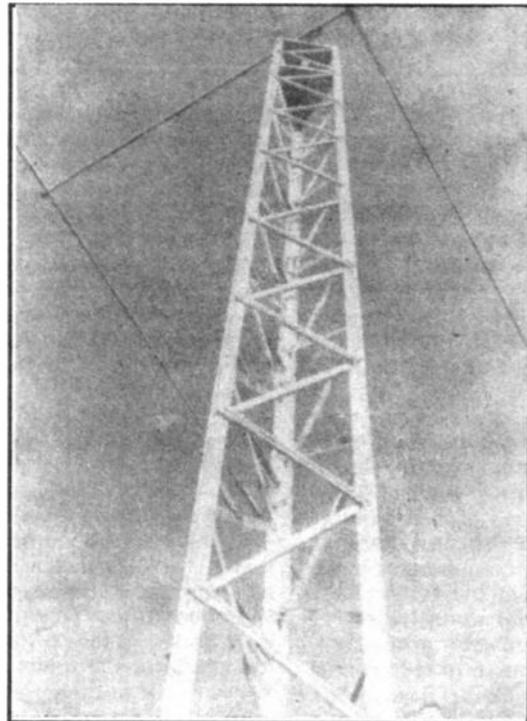
ATTENUATOR SWITCHES

A series of matched, SPST voltage controlled attenuator switches, with 10% bandwidth guaranteed specifications, was announced recently by Anglia Microwaves Limited.

Contained in a 14-pin flat package, the AFT-10X series devices are available with centre frequencies of 30, 60, 63, 70, 115, 140, 160 and 1060MHz. Insertion loss is 1.2dB maximum and the attenuation range of 60dB is controlled from a voltage from 0 to +15V. Control bandwidth is from dc to 100kHz.

*Radford Business Centre,
Radford Way, Billericay,
Essex CM12 0BZ.
Tel: (0277) 630000.*

Western ALUMAST



The **ALUMAST** is a 15in (3.75mm) wide triangular cross section lattice sectional aluminium mast based on a 10ft (3.05m) section length, it is supplied 'knocked-down' in a tubular carton for ease of transport, but can easily be assembled needing no special tools or skills. The system includes top plate with bearing sleeve, rotor plate and a choice of a fixed base frame (FB-1) or one with hinge joints (HB-1) to enable the mast to be pivoted at ground level. Guy brackets are available for use at heights above 30ft.

- * Made from high strength corrosion resistant alloy using WESTERN's EXCLUSIVE 'W' section leg extrusions.
- * Easy assembly using bolts and 'Nyloc' locking nuts for security.
- * Free-standing to 30t (9.15m) with a typical tri-bander plus VHF/UHF antennas.
- * Heights to 200ft (61m) with appropriate guy configurations (ask us for quotes).
- * Lightweight - only 25lb (11kg) per 10ft (3.05m) section.
- * 30ft (9.15m) mast is delivered in a tube only 10ft 6in (3.2m) long, 6in (0.126m) dia.

**A COMPLETE 30FT (9.15M)
MAST FOR
375/PSS/3;HB-1 RMP-1; TP-1**

**£500.25
INC.CARR.& VAT**

	FULL PRICE LIST	
375/PSS/3	30ft mast (3 sections)	£379.50
375/PSS/1	Additional 10ft section	£126.50
HB-1	Hinged base unit	£67.86
FB-1	Fixed base unit	£50.60
RMP-1	Rotor mounting plate	£25.30
TP-1	Top plate with sleeve	£27.60
GB-1	Guy brackets (set of 3)	£25.30

**SEND 2x18p stamps for leaflet or £1 per details
of all antennas, masts, towers.**

Western Electronics (UK) Ltd

FAIRFILED ESTATE, LOUTH, LINGS LN11 0JH

NEWS DESK

BTI in the sky

The final countdown has started for British Telecom's Skyphone, with the award of a £2.6 million contract for the equipment which will automatically connect airline passengers' telephone calls to customers on the ground.

The contract, with E B Communications (GB) Ltd, means that British Telecom International (BTI) has now completed the purchasing of all the major equipment and software required for Skyphone.

Trials of the new service, with calls connected by the operator, will begin next April on three British Airways 747 airliners, allowing passengers to make international telephone calls during flight.

The equipment will be the first designed to meet the full INMARSAT aeronautical

standards for ground earth stations. It will be installed at BTI's satellite earth station at Goonhilly Downs in Cornwall.

Microwave research

A new antenna and microwave research centre near Rochester in Kent was officially opened in late July.

The ten acre site was chosen because it offers some of the best facilities in the country for testing radio antennas.

BT prices held

Following the announcement that profits for 1986-87 have topped £2 billion for the first time, British Telecom has now declared that it plans to hold charges for its main services for another year.

This decision was apparently prompted by the company's sound trading and

financial position, low levels of inflation and growth in demand for services.

BT have also announced the introduction nationally of a protected service scheme, designed to help the elderly, disabled or any customer who BT considers would be at risk without the use of a telephone. Under the scheme, disconnection for non-payment of the phone bill will be delayed in such circumstances, providing that a relative or friend agrees to help.

Another development, and one which BT feels will make the payment of bills easier, comes in the form of two direct debit schemes. The first is a budget account funded by a monthly direct debit. The payments are monitored and may be adjusted if they are insufficient or excessive.

The second is a quarterly direct debit scheme, where the entire bill is paid in a single bank transaction.

It is not all good news, however. Some charges are to be increased, such as exchange line connection costs, international direct

dialled calls, telephone rental charges and international operator services.

Chinese advances

Over the past 30 years the People's Republic of China has made enormous strides in developing its electronics industry. In 1986 production in this important sector of industry was valued at 30 billion yuan (\$8.1 billion), which represents a 7 per cent increase over the previous year. In the current year a further increase in excess of 10 per cent to 35 billion yuan (\$9.45 billion) is predicted.

In 1986 production of computers of all sizes rose by 16 per cent, while microcomputers achieved an 18 per cent growth. The Chinese are expecting overall productivity to double by 1990. During the seventh Five Year Plan, priority is being given to the development of software, computers, integrated circuits and integrated communications.

AMK Berlin Company for Exhibitions, Fairs and Congresses has now organised Chaitech '88, an event designed to meet the specific needs of exhibitors and interested people in China, offering them a forum for communication. In addition to the trade fair and symposium, other accompanying events are planned such as an Exhibitors' Dialog Forum, a Technology Transfer Exchange and a Personnel Transfer Exchange.

It is hoped that Chaitech '88 will offer the right economic conditions and ideal communication facilities for the establishment of long-lasting commercial links.

AVO and Megger revived

Two of Britain's most successful product brand names in test and measurement technology, AVO and Megger, are being revived as company names, following the management buy-out of Thorn EMI's £35m turnover test and measurement instrumentation business, Thorn EMI Measurement Division.

AVO International has become the new holding company for this international group of seven companies

Fibre optic interfaces

It is now possible to have personal computers located totally independent of their printers (or other peripherals).

By using fibre optics instead of the usual cabling, the risks from electrical disturbances and static electricity are eliminated. The present limit of about seven metres for parallel interfacing is also overcome.

The increase in distance can contribute to avoiding noise and dust problems associated with printers.

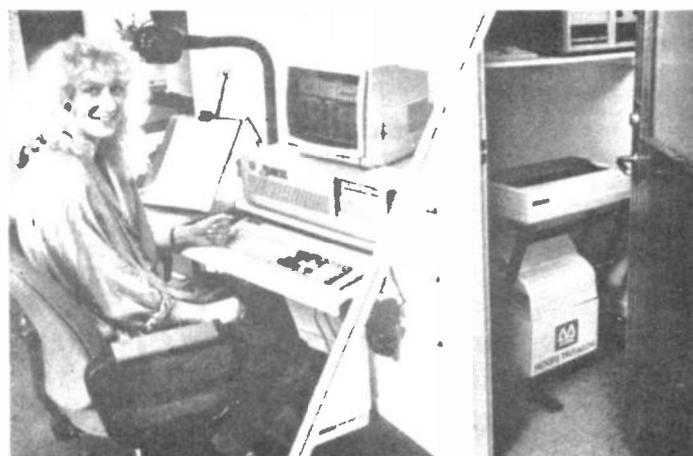
The Swedish company Fiberdata, based in Stockholm, has developed fibre optic parallel interfaces to the Centronics and Data Products standards. The new technique enables data transfer over comparatively long distances, up to four kilometres. The transfer rate

can be as much as 15,000 lines of text per minute, equivalent to approximately 180 A4 size pages.

This also means that it is possible to allow several computers to share one printer, since the seven metre limit imposed by conventional cabling is no longer a limiting factor.

The interfaces for the computer and the printer can both, independent of each other, be set by jumpers to either the Centronics or Data Products standards. This eases interface conversion where necessary.

Fibre optic interconnections are almost totally immune to disturbance, which means that the cable routing can follow any path regardless of sources which are normally considered excessively electrically noisy. This technique also makes it impossible for outsiders to eavesdrop or tap into the connection, since the cable does not generate any electromagnetic field.



with considerable manufacturing and marketing operations spread between the UK, the United States, France and Germany. The British-based group has its headquarters at Dover, Kent.

Megger Instruments Ltd now embraces the Dover-based activities, which have led the world for some 90 years in portable instruments for electrical test and measurement applications. Such has been the international reputation of AVO and Megger products, for example, that they have become industry bywords.

BT retaliates

British Telecom have hit back at a recent National Consumer Council survey criticising BT service and prices.

A spokesman commented: 'This was an opinion poll, not a measurement of service. Moreover, it was taken within a few weeks of the end of the national strike in February. It's hardly surprising that the man in the street had some bad experiences of our services at that time.'

He concluded: 'We know, and acknowledge, that we have a lot to do and a long way to go – but don't forget just how far we've come and just how much we've done. We are determined that the customer should and will come first.'

Parlez-vous computer?

People who cannot speak a word of each other's language will soon be able to talk over the phone using a system developed by British Telecom.

The world's first instantaneous translation of speech by computer was unveiled publicly by British Telecom's Research Laboratories in August. Simple sentences in English were translated into French and vice versa.

The prototype equipment can translate English into German, Spanish, Swedish and Italian and the reverse capability is being developed. This will then also make possible translation between any pair of these languages, such as French-German, Swedish-Italian.

Each speaker has a microphone linked to a Merlin

5200 personal microcomputer. These are connected by a telephone circuit capable of handling computer data. The first participant speaks a sentence in English into his microphone, saying each word clearly and deliberately. The computer repeats the sentence in its own synthetic voice to check that it has understood correctly.

When this is confirmed – by saying the single word 'yes' – the originating computer sends the message to the distant computer which translates and speaks it in, say, French in its own synthetic voice. When the French speaker replies, the process is repeated in the reverse direction.

The system is based on a set of more than 400 phrases in common business use stored in each computer's memory. Although this involves a vocabulary of more than 1,000 words, the computers are programmed to recognise only 100 key words. These are used to identify the appropriate phrases, reducing the word-recognition procedure required.

The system also recognises

spoken proper names – such as John Smith, for example – and makes no attempt to translate them, eg rendering 'Mr White' into 'Monsieur Blanc'. Instead the names are repeated in the original speaker's voice in the translation.

BTEC certificate

The London Electronics College will be launching a new series of updated one year, full-time BTEC National Certificate courses from 21st September 1987.

The subjects available will be:

Electronic Equipment Servicing (TV, VCR and CCTV); Computing Technology (microprocessors, interfacing and datacomms); Information Technology (telecomms, networks, satellite TV and CD); Software Engineering (assemblers, Basic, Pascal, programming and CAD/CAM).

These courses are particularly important for those wishing to update or retrain, either with employer sponsorship (up to £1,000 ATS grant aid) or for those recently taking redundancy.

The college is also a manag-

ing agency for the MSC Job Training Scheme (JTS) and will recruit suitable applicants direct onto the new JTS. This programme involves periods of job training and work experience in industry; employers interested in taking trainees for 3 to 6 months should also contact the college (trainees will receive a full training allowance from the MSC).

Other courses available include a two year full-time BTEC National Diploma and a one year full-time BTEC Higher National (Computing Technology, Control and Robotics).

Short courses from one to three weeks (VCR Servicing and Microcomputer Servicing) are also running. The EITB Certificate of Basic Technician training (Electronic Engineering Applications and Engineering Software Applications) may also be awarded.

For details and prospectus please contact M D Spalding BSc, MSc, P G Cert Ed, C Eng, MIEE, (Principal), The London Electronics College, Penywern Road, London SW5 9SU. Tel: 01-373 8721.

Silence is golden

A silent radio communications system aimed primarily at the growing number of messenger companies in London was launched today.

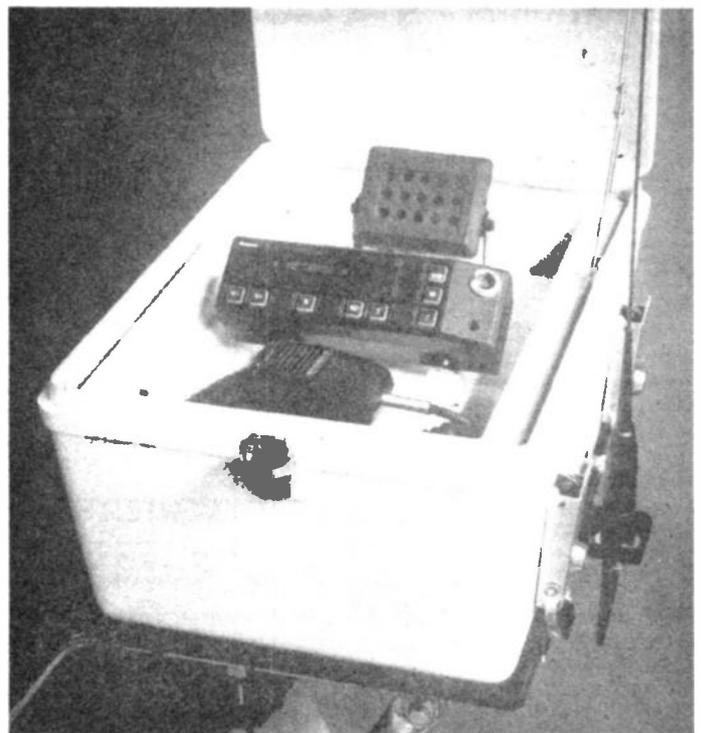
The new service, called 'data Link', uses the latest digital signalling technology and has been developed as a joint venture by Storno Limited and Relcom Communications Limited.

The benefits of the data Link service are that collection and despatch information is transmitted over the radio to the driver with complete accuracy and faster than ever before. Most Londoners will also appreciate the fact that the radio system is silent. When there is a radio message for him, the motorcycle driver is warned of an incoming call by means of a small flashing light on the handle bar. To obtain the details, the driver must dismount from his motorbike, open the top box cover and read the message details from a scrolling visual display

on the Storno radio-telephone.

Similarly, routine messages

from the driver are transmitted silently by using a numeric keypad.



BIO-FEEDBACK ACCESSORIES

A METER MOVEMENT which can be built into your bio-feedback monitor to make it a completely self-contained instrument. Don't worry if you've already drilled the terminal holes - the meter will cover them up!

SENSITIVE METER MOVEMENT ONLY £1.90 + VAT

SPARE ELECTRODES AND GEL

5 sets of electrodes (10 electrode pads) and a sachet of conductive gel, all for **£2.90 + VAT**

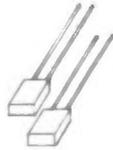


LEDs

RECTANGULAR LEDs

Green rectangular LEDs for bar-graph displays

50 for **£3.50 + VAT**
100 for **£6.50 + VAT**
500 for **£25.00 + VAT**



DIGITAL AND AUDIO EQUIPMENT LEDs

Assorted 3mm LEDs: red, green, yellow and orange. 25 of each (100 LEDs) for **£6.80 + VAT**



BIO-FEEDBACK

FEATURED IN ETI
DECEMBER 1986

A complete parts set for the ETI bio-feedback monitor including meter. Originally offered from limited stocks at £14.55 (without meter), this sensitive GSR monitor has proved so popular that we have decided to make it a permanent feature of our catalogue.



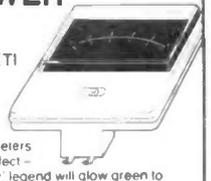
The complete parts set includes case, PCB, all components, leads, electrodes, gel, meter and full instructions.

BIO-FEEDBACK PARTS SET ONLY £11.50 + VAT

HI-FI POWER METER

FEATURED IN ETI
MAY 1987

Measure the output power of your hi-fi with the ETI power meter. The meters can be back-lit for effect - the scale and power legend will glow green to contrast with the red pointer. Two switched ranges give readings of 0-10W and 0-100W.

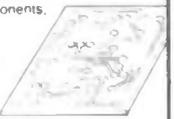


The parts set consists of meter movement, PCB, all components, range switch and full instructions.

MONO POWER METER PARTS SET £3.90 + VAT

STEREO POWER METER PARTS SET £7.20 + VAT

SUITABLE CASE £7.50 + VAT



TACHOMETER AND DWELL METER

FEATURED IN ETI
JANUARY 1987

SPECIAL OFFER



Last few to clear at only **£9.50 + VAT!** (Previously offered at £16.40.) The complete parts set includes case, printed circuit board, all components, plug socket, switches, test leads and clips, meter and full instructions.

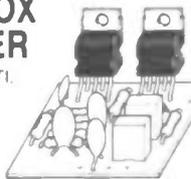
TACHOMETER AND DWELL METER PARTS SET ONLY £9.50 + VAT

Offer applies only until stocks are exhausted.

MATCHBOX AMPLIFIER

FEATURED IN ETI
APRIL 1986

No ordinary amplifiers these. When our first customers took an interest it was for the diminutive size (both modules will fit in a matchbox!) the total disregard for power supplies and speaker impedances, and the impressive power output from these little amplifiers. When they re-ordered it was for the sound quality.



Two amplifier modules were described, both based on the powerful L185V IC. The single IC version will deliver over 20 Watts with a suitable speaker and power supply. The bridge version can provide up to 50W! Although the specified supply voltage and speaker impedance must be used to achieve maximum power, both modules are quite happy to work from any voltage between 12V and 32V, and will accommodate any type of speaker. The bridge version is ideal for giving a boost to car Hi-Fi systems, driving two 4 Ohm speakers in parallel on each channel for best effect.

Both designer approved parts sets consist of a roller tinned printed circuit board and all components. The L185V ICs are also available individually, with a full multi-data sheet giving specifications and suggested circuits.

SINGLE IC MATCHBOX AMPLIFIER SET

100V, 10mA (30ms), £6.50 + VAT

BRIDGE AMPLIFIER SET

100V, 10mA (30ms), £8.90 + VAT

L185V IC with data

100V, 10mA (30ms), £3.90 + VAT

KNIGHT RAIDER

FEATURED IN ETI, JULY 1987

The ultimate in lighting effects for your Lamborghini, Maserati, BMW (or any other car) for that matter. Picture this: eight powerful lights in line along the front and eight along the rear. You flick a switch on the dashboard control box and a point of light moves slowly from left to right leaving a comet's tail behind it. Flip the switch again and the point of light becomes a bar, bouncing backwards and forwards along the row. Press again and try one of the other six patterns. An LED display on the control box tells you see what the main lights are doing.

The Knight Raider can be fitted to any car. It makes an excellent log light or with low powered bulbs it can turn any car's pedal car or bicycle into a spectacular TV age toy.

The control box parts set consists of case, switches, LEDs, PCB components, hardware and instructions. The sequence board includes PCB, ICs, power FETs, components, hardware and instructions.

KNIGHT RAIDER CONTROL BOX ONLY £6.90 + VAT!

KNIGHT RAIDER SEQUENCE BOARD ONLY £11.90 + VAT!

BRAIN WAVE MONITOR

FEATURED IN ETI
AUGUST 1987

ALPHA HOW TO SUCCEED WITHOUT REALLY TRYING

This was the title of a recent QED television program which showed how life can be dramatically improved with aid of alpha training. Alisdair McBeth overcame his shyness with girls, others became more confident, improved their sporting abilities, learned to cope with stress and all without really trying!

Alpha monitors are not new, but good ones are hard to find. To detect a few uV of brain waves in the midst of noise that is tens of thousands of times as great is not easy! The ETI Alpha Monitor is probably the most powerful and effective design to be found outside an EEG laboratory. The sensitive circuit locks on to the all important alpha rhythm and helps you to strengthen and control it. Quickly. Then you put it to work for you, strengthening your confidence and abilities day by day.

Our approved parts set consists of EEG electrodes and headband, case, two PCBs, screening box, top quality PMI amplifiers, all components and full instructions (including training exercises). Assembly time is about five to six hours.

ALPHA MONITOR PARTS SET ONLY £29.90 + VAT!



Complete Parts Sets for ETI Projects

MAINS CONDITIONER

FEATURED IN ETI,
SEPTEMBER 1986

It is astonishing how many people buy or build top-flight hi-fi equipment, and then connect it to a noisy, spiky mains supply. Rather like buying a Ferrari and trying to run it on paraffin, you might think. Expecting crystal clear sound, the poor music enthusiast ends up with a muddy, confused mush and feels that he has somehow been cheated. Is this hi-fi? My music centre sounded just as good!

The domestic mains supply is riddled with RF interference, noise, transient spikes and goodness knows what else. Computers crash, radios pop and crackle, tape recordings are spoiled and hi-fi sounds not quite right. Why put up with it when the solution is so simple? The ETI mains conditioner is the lowest cost upgrade you will ever buy, and probably the most effective!

Our approved parts set consists of PCB, all components, toroid, enamelled wire, fixing ties, fast response VDR, and full instructions.

ETI MAINS CONDITIONER PARTS SET ONLY £4.60! + VAT

*Note: the toroid and VDR supplied are superior to the types specified in the article.



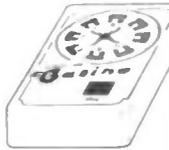
CREDIT CARD CASINO

FEATURED IN ETI,
MARCH 1987

This wicked little pocket gambling machine measures only 3 x 2 x 1/2". It will play all kinds of casino games, including:

- Roulette
- Craps
- Pontoon

Our approved parts set comes complete with case, self-adhesive fascia, tinned and drilled printed circuit board, all components, hardware, full instructions and three different games to play!



CASINO PARTS SET ONLY £5.90! + VAT

Five extra games FREE with every order!

MAINS CONTROLLER

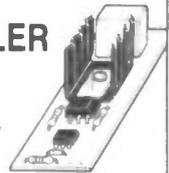
FEATURED IN ETI,
JANUARY 1987

Have you ever wondered what people do with all those computer interfaces? Put your computer in control, say the ads. The Spectroscop has eight TTL outputs. What on earth can you control with a TTL output? A torch bulb?

The ETI Mains Controller is a logic to mains interface which allows you to control loads of up to 500W from your computer or logic circuits. An opto coupler gives isolation of at least 2,500V, so the controller can be connected to experimental circuits, computers and control projects in complete safety. Follow your computer interface with a mains controller and you're really in business with automatic control!

The mains controller connects directly to most TTL families without external components, and can be driven by CMOS with the addition of a transistor and two resistors (supplied).

Your mains controller parts set contains: high quality roller tinned PCB, MOC3021 opto coupler, power triac with heatsink, mounting hardware and heatshrink compound, all components, including snubber components for switching inductive loads, transistor and resistors for CMOS interface, full instructions.



MAINS CONTROLLER PARTS SET £6.20 + VAT!

POWERFUL AIR IONISER

FEATURED IN ETI,
JULY 1986

Ions have been described as vitamins of the air by the health magazines, and have been credited with everything from curing hay fever and asthma to improving concentration and putting an end to insomnia. Although some of the claims may be exaggerated, there is no doubt that ionised air is much cleaner and purer, and seems much more invigorating than dead air.

The DIRECT ION ioniser caused a great deal of excitement when it appeared as a constructional project in ETI. At last, an ioniser that was comparable with (better than?) commercial products, was reliable, good to build and fun! Apart from the serious applications, some of the suggested experiments were outrageous!

We can supply a matched set of parts, fully approved by the designer, to build this unique project. The set includes a roller tinned printed circuit board, 66 components, case, mains lead, and even the parts for the tester. According to one customer, the set costs about a third of the price of the individual components. What more can we say?



DIRECT ION PARTS SET £9.50 + VAT

Instructions are included.

PROJECT BOX

PROJECT CASE WITH PP3 BATTERY COMPARTMENT

ONLY £2.60! + VAT



LM2917 EXPERIMENTER SET

Consists of LM2917 IC, special printed circuit board and detailed instructions with data and circuits for eight different projects to build. Can be used to experiment with the circuits in the Next Great Little IC feature (ETI, December 1986).

LM2917 Experimenter Set £5.80 + VAT

RUGGED PLASTIC CASE

suitable for mains conditioner and mains controller

ONLY £1.65 + VAT



SPECIAL OFFER

Our best selling ioniser kit is now available with an elegant white case.

WHITE IONISER PARTS SET ONLY £9.80! + VAT

Prices shown are exclusive of VAT, so please add 15% to the order total. UK postage is 50p on any order. Carriage and insurance for overseas orders £1.50. Please allow up to 14 days for delivery.

Specialist
SEMICONDUCTORS LIMITED

FOUNDERS HOUSE
REDBROOK
MONMOUTH
GWENT

AMATEUR RADIO WORLD

Compiled by Arthur C Gee G2UK

The AMSAT-UK/University of Surrey Colloquium, held at the university over the weekend from 17th-19th July, was a truly international event, over 180 delegates from 14 countries attending. These included representatives from places as far apart as North America, Brazil, Australia and New Zealand, South Africa and most of Europe.

The proceedings were opened by the president of the Radio Society of Great Britain, Joan Heathershaw G4CHH, when she announced that AMSAT-UK's Hon Secretary, Ron Broadbent G3AAJ, was to be awarded the RSGB's 'Calcutta Key' award - presented for furthering international goodwill through amateur radio - for his work through his activities for the Amateur Radio Satellite Service - an award justly deserved.

Some of the world's leading figures in the amateur radio satellite field were present to give talks on a wide range of subjects, varying from plans being prepared by the amateur radio satellite team in Germany for the Phase 3-D project and in North America for the Phase 4 project by AMSAT-NA, to a most entertaining and informative lecture by the well-known satellite authority, Geoff Perry, of Kettering School fame, on how his team there went about identifying many of the Russian satellites using very basic techniques.

The lectures on the Phase 3-D and the Phase 4 projects, given respectively by Dr Karl Meinzer and by Vern Riportella, generated a lively debate and wide ranging philosophical discussion on whether elliptical-orbiting satellites such as Phase 3 or geostationary systems such as the Phase 4 one should be adopted as the design for the future. Many people saw this as an either/or selection, but those intimately involved in these projects saw them as more or less complementary, not mutually exclusive.

The discussions highlighted the desire, expressed before at the IARU Region 1 Conference in Holland in April last, that special attention should be given to attracting new, young operators into amateur radio and specifically into the Amateur Radio Satellite Service, by the provision of inexpensive but technically interesting projects. The relative importance of amateur radio com-

munications, education, technical advancement and public service to the future of amateur radio also came in for lively discussion.

Last month, we gave preliminary details of the new amateur radio satellites launched on June 23rd last by the Russians. Since then more definite information regarding these satellites has come to hand, and most satellite enthusiasts have by now heard or worked them.

Additional information to that we gave last month is as follows. They both use the electrical power system of the COSMOS 1861 navigational satellite, to which they are attached. So they have no solar panels or batteries of their own. They do, however, have separate antenna systems. There are four of these: 1) A two metre dipole for RS10, which is switchable between transmission and reception; 2) A two metre dipole for RS11, which is also switchable; 3) A 29MHz quarter wave ground-plane type antenna for use with RS10 or 11, which is also switchable for transmission or reception; 4) A similar antenna for RS10 and 11, but for reception only. All the antennas are linearly polarised. The transponders of RS10 can be operated simultaneously with those of RS11, but this mode is not normally used.

Five different modes are designated for each of the two satellites, depending on which combination of frequencies is in use. There is also a series of beacon frequencies and Robot operation is provided for.

The modes are as follows:

RS10

Mode A: 145.860 to 145.900 uplink; 29.360 to 29.400MHz downlink.

Mode K: 21.160 to 21.200 uplink; 29.360 to 29.400 downlink.

Mode T: 21.160 to 21.200 uplink; 145.860 to 145.900 downlink.

Mode KT: 21.160 to 21.200 uplink; 29.360 to 29.400 and 145.860 to 145.900 downlink, on simultaneously.

Mode KA: 21.160 to 21.200 and 145.860 to 145.900 uplink on together; 29.360 to 29.400 downlink.

Beacons on: 29.357, 29.403, 145.857 and 145.903MHz.

Robot on: 21.120 and 145.857 up. Down on 29.403MHz.

RS11

Mode A: 145.910 to 145.950 uplink; 29.410 to 29.450 downlink.

Mode K: 21.210 to 21.250 uplink; 29.410 to 29.450 downlink.

Mode T: 21.210 to 21.250 uplink; 145.910 to 145.950 downlink.

Mode KT: 21.210 to 21.250 uplink; 29.410 to 29.450 and 145.910 to 145.950 downlink, on simultaneously.

Mode KA: 21.210 to 21.250 and 145.910 to 145.950 uplink on together; and 29.410 to 29.450 downlink.

Beacons on: 29.407, 29.453, 145.907 and 145.953MHz.

Robot on: 21.130 and 145.830 up. Down on 29.403MHz.

The 2 metre Mode A uplink receivers on both RS10 and 11 are experiencing interference from the 150MHz navigational transmitter. It is possible, therefore, that the future operation of Mode A transponder may be curtailed.

Sporadic-E

One of the excitements looked forward to by the VHF fraternity each summer is the arrival of ionospheric conditions giving rise to the phenomena known as sporadic-E. This occurs when patchy regions in the E layer of the ionosphere become sufficiently ionised to refract radio waves in the VHF band of frequencies. Until recently this form of propagation was thought to be a single-hop path, with a range of from 500 to 1,000 miles or so, and was usually limited to the 28 and 50MHz amateur bands, sometimes extending to the 2 metre band.

However, evidence has been growing that multi-hop sporadic-E propagation is much more common than has been thought. Since the general release of 50MHz, this evidence has been accumulating fast and the past few months have been remarkable for the sporadic-E openings which have occurred and the DX which has been worked.

The 'open season' seems to have begun in May when it first appeared on 2 metres, with G stations working the USSR and Poland. On 50MHz, almost daily QSOs were made with Norway, Sweden, Finland and with Portugal and Cyprus. In June, contacts with the USA were made on 50MHz and widespread activity with Andorra, Poland, Geneva,

AMATEUR RADIO WORLD

Italy, Malta and Yugoslavia on 50 or 144MHz was reported. July was another good month with openings to the USA, Yugoslavia and Hungary, Austria and Bulgaria.

Sporadic-E openings are thought to be more frequent at sunspot minimum. The Radio Observatory at Boulder, USA, maintains that sunspot minimum occurred in September 1986. It is probable that sporadic-E openings are more related to the geomagnetic minimum, which lags behind the sunspot minimum by about twelve months. This thus coincides with the activity recorded above.

The Rockall saga

During 1985, Mr Tom McLean, sailor/adventurer, spent some time on the island of Rockall. While there he did quite a bit of transmitting on the 14MHz amateur band, in spite of having no transmitting licence. This might have been acceptable in the case of an emergency but he consistently worked other amateurs both in the UK and other countries, using the callsign GR1TM.

He is now active again as a radio pirate using the call 'Skol ten-eighty'. This time he is attempting to row the Atlantic. He is active on the 14MHz amateur band, and the RSGB draws attention to the fact that

any radio amateur making contact with him would be in contravention of their licence.

CW testing

The Morse code test for full amateur radio licence transmitting authorisation has always been a bone of contention with many would-be aspirants to this facility. It is interesting to read what the Radio Regulatory Division of the Department of Trade and Industry says about the continuation of Morse code in the amateur radio service, in its leaflet *Radio Amateur Licensing Information Sheet*.

'Morse will continue to be needed in the amateur service for the foreseeable future. But its use in maritime distress, safety work and commercial traffic is likely to decline towards the end of the century. Many amateurs wish to keep using Morse, believing it the best method of making contact in bad operating conditions. Most countries' radio societies also believe Morse is useful in the self-training of amateurs and in operating an amateur station. Knowledge of Morse can be important to an amateur using a secondary band if a primary user makes contact by Morse to complain of interference'.

The RSGB now provides Morse test

facilities in 65 different areas. These include the Orkneys, Shetlands, Isle of Man and Guernsey. Some of these islands never had their own test facilities in the past, which meant that candidates had to wait for a visit from an examiner or travel to the mainland for a test. Most of the remaining areas so far not covered should be in the near future.

The society has conducted over 2,500 tests to date and visited 71 disabled candidates at their homes.

New callsign prefixes

New callsign prefixes were introduced in France last year and may now be heard on the air. Class A licences, issued to amateurs from 13 years upwards, are designated FA and allow 20 watts of phone on 144MHz. Class Bs are designated FB and allowed 20 watts as above, but CW is permitted from 144.05 to 144.09MHz as well. Class C, available to amateurs from 16 years, is allowed 100 watts phone on 144MHz, and is designated FC. Class D (also from 16 years) permits 100 watts phone and CW on all bands, and is designated FD. Class E is issued after 3 years of holding a Class D licence, and allows 250 watts phone and CW on all bands. It is designated FE or F. The prefix FF is issued to clubs. 

ARE YOU A BUDDING WRITER?

We are particularly keen to receive construction articles, so if you have designed and built a project which you think could be of interest to other readers we would be pleased to receive your contribution. Construction tips and techniques would also be of great interest.

You do not need to be an expert writer to see your name in print. Accuracy in the design of your project is far more important. If you can put your ideas down on paper, typewritten if possible, and illustrate them with clear drawings and photographs where appropriate, the *Radio and Electronics World* editorial team will sort out the style, grammar, spelling, etc.

We will, of course, pay for all articles which are accepted for publication.

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C P I

ATV ON THE AIR

Andy Emmerson G8PTH puts you in the picture

It's a bit of hardware and a lot of software this month, as we discuss some new goodies. Not necessarily to spend your money on, I should add, because ATV is not really a spend, spend, spend sort of hobby. However, if you want to plan this autumn and winter's construction and activity schedules ahead, then some of these items may be of use to you.

FM receive systems

Whether you are working on 24cm or 10GHz, a wideband FM receiver is essential. The only problem is that there is no off-the-shelf product which does the job for us, which is a shame because recent tests by John G3YQC, in conjunction with the GB3RT repeater which he is helping to construct, indicate that significantly better results could be achieved.

There is no problem with creating a good, full bandwidth transmitted signal, but recovering all the quality of that signal at the other end is another matter. Conventional receivers using PLL chips just cannot achieve this, and instead we should look at the use of the wideband units intended for satellite TV. All this will be written up in much greater detail in a future *CQ-TV* (the journal of the British Amateur Television Club).

In the mean time, the availability of these satellite TV units has changed with the demise of Comex of Leicester. I believe the Astec products are now available from Bonex of Acton, while an alternative range of units is being supplied by a well-known ATVer, Phil Seaward.

These three modules, made by Mitsumi, make an excellent and very cost effective basis for an FM TV receiver suitable for both ATV and satellite TV use. The Mitsumi modules have an advantage in that they cover a wider band than the Astec ones and also possess a better threshold performance (according to G3WDG in *CQ-TV* 136, page 52).

The modules comprise a tunable downconverter which shifts 950-1750MHz to 479.5MHz, a fixed frequency changer (from 479.5 to 70MHz) and a video demodulator producing composite video sitting on a 10 volt dc level. The international standard 70MHz IF will also help people using these units with other commercial units.

For amateur applications a 23cm preamp will be necessary to provide a high level drive comparable to that supplied by the low noise block converter commonly used in satellite reception. The units can be supplied from a normal 12 volt source, so there are no problems here.

The Mitsumi units are available as a three-module package - not separately - for £65 (all inclusive) by post from P Seaford, 14 Nevis Close, Leighton Buzzard, Beds: LU7 7XD. A stamped addressed envelope to the above address will get you a data sheet, and also details of a new high performance FM TV receiver under development, which uses the Mitsumi front end and the latest Plessey FM demodulator chip.

Among its features are bandspread coverage for ATV, an S-meter which works (!) and a fully tunable sound IF with loudspeaker output. It will feature a completely built and aligned PCB, so there will be no tweaking problems. I shall be pleased to hear from anyone who has used any of these Astec or Mitsumi modules - tell us how you got on.

Software news

Many of us now have computers in the home, even if they are not in the shack or studio, or whatever you call your ATV den. It seems an obvious step to use the power of the computer to improve our ATV transmissions or video recordings, but tracking down the appropriate program is not always so easy (while writing one from scratch is no easy matter either for most of us). So what follows is a run-down of all the video software I am aware of at the moment.

Inclusion in this list does not mean that I recommend the software - most of it I haven't even seen - but please write in if you would like to recommend (or complain about) a particular program. Please let us know also if any of these firms has changed address or if you can add to the list.

BBC micro

Video-Titler II, from Visioncraft Software, PO Box 135, London N20 0HF, costs £15.75 on 40 or 80 track disc (state which) and includes a proportional-spacing video typewriter, 8 large fonts, drop-shadow and underlining, subtitles in a blue box and a broadcast-style VTR clock which can be customised with your own logo.

A program for ATVers is supplied by the Worthing Repeater Group: it has eight test cards, message pads and a Maidenhead locator calculator. Send £8.50 plus your name, locator and callsign (if you want these built into the program) and whether you want 40 or 80 tracks. The address is Roy Stephens, Treasurer GB3VR, Toftwood, Mill Lane, High Salvington, Worthing, Sussex BN13 3DF.

An alternative is the ATV Software Suite, from Elansoft, 3 Abbotsgrange Road, Grangemouth, Scotland FK3 9JD, for £8.95 on 40 or 80 track disc (state

which). It features two test cards, analogue and digital clocks, Hamfax, colour bars with callsign ident, giant callsign in 3-D and TV typewriter.

The best (and most expensive) software is supplied by G2 Systems. This is of professional quality and the list is too detailed to describe here. Send for their catalogue.

All the following firms supply genlock boards for the BBC micro (G2 and Abbey Audio also supply software):

- G2 Systems, 5 Mead Lane, Farnham, Surrey GU9 7DY. Tel: (0252) 712525.
- Abbey Audio, Graham Randall, Unit 8, Littleton House, Ashford Road, Ashford, Middx. TW15 1UU. Tel (0784) 246818.
- Video Electronics Ltd, Wigan Road, Atherton, Manchester M29 0RH. Tel (0942) 882332.
- Electro-Craft Consultants, Liss Mill, Mill Road, Liss, Hants GU3 7BD. Tel: (0730) 893444.

The VP-170 video presenter is a random access interactive video display device which acts as an add-on for a standard BBC micro. Existing tapes can be used and nothing needs modification, though genlocking can be provided as an extra. It works with your BBC B, BBC B+ or Master, with use of tracker balls and mice optional. Details from Interactive Media Resources Ltd, 170 Penn Road, Wolverhampton. Tel: (0902) 341854.

MSX

The video computer *par excellence* is the Pioneer PX7, which has a superb built-in video and audio mixing system. It is still available at a price which would make it worthwhile having one just for its video capabilities.

In Japan you can buy an add-on from JVC which will give any other MSX computer the same facilities, but as they use NTSC in Japan this gadget will probably not work over here. Anyway, the Pioneer computer should satisfy you at its £199.90 price (available from Videoequip on Leicester 558818 and other Pioneer dealers.) The PX7 gives you the ability to superimpose colour graphics and titles on moving video pictures and also has a built-in stereo sound synthesizer, so you can add explosion, 'whoosh' and 'deedle-deedle' noises to your holiday movies! Pioneer also supply a video art stylus/tablet for £89.

Matching the capabilities of the computer, there is some very good software available. If you buy the computer from Videoequip you get a titler program on plug-in cartridge free of charge. This has 8 fonts (character styles), 2 text sizes and subtitling, up to 200 lines and 100 pages.

An alternative titling program with

ATV ON THE AIR

wiping and scrolling of multi-size characters, costs £8.99 from D Hanson Video, 29 King Street, Heywood, Lancs. A more powerful version, with a font designer, costs £20. Send an SAE for full details.

The ultimate MSX video software, at a price to match, comes from Anglosoft of PO Box 60, Coventry CV1 5SX. Their video titler and display program is reviewed in the current edition of *CQ-TV* and gets a 'really exceptional' rating. Up to 14 lines of broadcast-standard letters and figures can be displayed on up to 200 pages in sequence. Eleven different fonts are supplied and you can also display 'icons' or shapes as well. Eight types of screen wipe are available and a font designer and VTR clock should be in the catalogue soon. The program comes on disc (3.5 or Quick-Disc) for £80 plus VAT, but BATC members get a 25 per cent discount. Considering the capabilities of the program, the price is not unreasonable.

MSX-2

Some Philips and JVC computers have a video interface which enables you to superimpose computer titles and graphics on your video recordings; I don't have all the details but you can get them from suppliers.

New JVC computers in Japan have a frame-grabber facility, which snatches a

video image at the touch of a button and digitises it. The process takes 25 seconds and 12 images can be stored on one 360K 3.5in disc. This has been covered widely in the Japanese *MSX Magazine* and the facility may well make its way to Europe soon.

Commodore 64/128/Plus 4

Video Titles 64 is a highly-praised program by Tony Horwood, which turns a Commodore computer into a high-specification video typewriter. The £39.99 program offers large and small lettering, auto centring if required, smooth scrolling at variable speeds and instant cutting between titles. The supplier is MRVP Ltd, Walton House, Sandwich Road, Eastry, Sandwich, Kent CT13 0DP. Tel: (0304) 614554.

For the lesser sum of £15 you can forego scrolling titles and have Title Master, which offers a wide variety of static titles. Order this cassette (stating which micro you have) from D W Simpson, 5 Berners Road, Sheffield, Yorks S2 2GB.

Sinclair Spectrum 48K

Super Intro, from Hall Video Productions, 147 Gladstone Street, Winsford, Cheshire CW7 4AU, costs £15. It offers large text in various sizes, printing, fading and scrolling at various speeds as well as test card and copyright page,

which can both be personalised. Some hardware options are also available, so send them an SAE or ring them on (0606) 551925.

The ultimate Spectrum video program is from the GB3VR people and has 7 test cards, memo pad, clock with alarm, maps, test tones, union flag, TV typewriter, crosshatch and locator calculator. All this, plus a simpler 16K version on the other side of the cassette, is available for £6 from Roy Stephens, Treasurer GB3VR, Toftwood, Mill Lane, High Salvington, Worthing, Sussex BN13 3DF.

Amstrad CP-464, 664, 6128

Video Titles features multi-colour screen and text, variable speed display, self-centring text and scrolling. You also get a free program to catalogue your tapes.

Price is £10.99 for the 464 tape and £14.99 for 664/6128 disc version, from A C Talbot, 18 Trelawney Parc, St Columb Major, Cornwall TR9 6RR.

Sign-off

That's it for now. I am sure there are also some amateur 'shareware' programs which do some of the things described above, so if you can spread the good news please do so. Any other feedback on ATV matters - and photographs - should be sent to me care of the Editor: I'd love to hear from you! 

In the past month the trade and technical press has covered the subject of PARS in some detail, enabling me to fill in some gaps in last month's report.

Some disquiet has been voiced over a fear that PARS (the digital Personal Advanced Radio System) will supersede our existing 934MHz system. It would do, if some greedy manufacturers had their way, but I don't think that this will happen, not because of government assurances but because I don't believe PARS will ever happen! But though I'm a wicked cynic, there are no grounds for complacency because big business is after our band.

Politics may not normally interest you, but if you don't want to see 934MHz disappear you should read on. Most of what follows is thin on facts and thick on opinion, so make up your own mind and see what you think...

Dutch drop out?

Bad news from the rumour machine, which says that the Dutch, who were due to adopt the Swiss type of personal radio this autumn and give us a chance of some DX, have now decided to hold off until a European-wide PARS specification is ready. If true, I don't think that this makes sense. It is accepted that a truly universal PARS-style radio system is desirable - if it comes off - but this should not stop enthusiasts enjoying a simpler system

NETWORK

934

Andy Emmerson G9BUP

of radio if they want to.

Clearly they must accept that their radios will not be compatible with the eventual standard, but I suspect that the real enthusiasts are quite willing to put up with this. Anyway, we must wait for the official announcement.

PARS - the EEA's aspirations

At the centre of PARS is an agreement between the Department of Trade and Industry (DTI) and the Electronic Engineering Association (EEA), an industry body, to co-operate on a work programme aiming to introduce the new service by the early 1990s. Eleven members of the EEA - British Telecom, GEC Telecommunications, Marconi, Motorola, Mullard, Multitone, Nova Radiotelephones, Philips, Racal, Plessey and Storno - were to participate, though

BT has since dropped out. The proposed system, handling voice and data in the 933-935MHz sub-band, would be a UK first, and the first time such a large group of companies has participated in such an expensive project.

It would also be the first time that all-digital techniques have been used in the UK for trunked voice and data. (Trunking, one of the buzzwords of mobile radio nowadays, is the automatic selection by the radio set of a free channel.) The system does, of course, have considerable export potential and the DTI has undertaken to steer the specification through the Conference of the European Posts and Telecommunications authorities (CEPT).

PARS will offer 77 channels on a trunked basis, avoiding the need to queue on a single channel, and is aimed at providing a high quality voice and data service between mobiles over a 10-12km distance. The government expects that there will be around 250,000 units in use after five to ten years, compared with the 4,000 number of 934MHz users at present.

The EEA's scheming revealed

According to a report in *Communications International*, the system was dreamed up by the EEA some 18 months ago in response to Japanese attempts to break into the European private mobile radio market with PRS.

If this report represents the true thinking of the EEA, it demonstrates a fundamental misunderstanding, since the Japanese PRS sets were aimed first and foremost at the hobbyist, truck driver and one-man business markets – and most definitely not as an alternative to business radio.

The unsophisticated users are the market which PRS has served – very successfully – in Japan and Switzerland, and is a market which the UK business radio suppliers have never considered their own. They do not have the marketing expertise, nor are they prepared to sell sets cheaply enough. Nonetheless, the EEA, representing its members, wanted to keep the Japanese out of Britain and spoil the hobbyist market. It looks as if they have successfully fooled the Department of Trade and Industry – and the Dutch authorities – while there is no guarantee that their PARS offering will ever become a reality.

According to the *Communications International* report, the CEPT has now decided against the Japanese concept (which was cheap and readily available) in favour of the EEA-backed system (which is not available yet and is likely to cost more).

News from Switzerland

Interest in 934MHz is on the increase. While the number of business radio sets rose by 7 per cent last year, Citizen's Band users increased by 9.4 per cent. The number of sets licensed rose from 68,865 to 75,353: of these, 70,508 operate on 27MHz and 4,845 (slightly more than the UK total) in the 933-935MHz sub-band. This latter is still regarded as an operational test in Switzerland, and users have no guarantee that the service will last in the long term (although that doesn't seem to worry them). Over the same period the number of radio amateur licences rose by 3.8 per cent from 4,093 to 4,249, fewer than in the UK.

Activity report

At last, a contributed report! Let's have a few more please... don't be shy! Anyway, this one is from Brian Hollins BH172 in Weybridge, who is one of the early users of the band. Since he came on the air in December 1983 he has made 670 contacts, though if he had stuck with the original Reftec transceiver and dubious aerials and UR67 co-ax, the situation might have been different. Nonetheless, the old equipment got him going and he now uses a Delta-1 together with a PA11 collinear antenna for all-round radiation,

and separate horizontally and vertically polarised 12-element Tonnas for DX work. He sings the praises of the white low-loss co-ax feeder, which he finds as good as H100 but far more flexible and durable.

His situation near the top of a hill gives a little trouble from cellular interference, though this is less of a problem during lifts. Most operators in the south London/Surrey area are very good, though there is one 'wally' at Crystal Palace who would please everyone else by changing back to 27MHz or getting off the air altogether.

Since last December Brian has put out a regular news broadcast, which can be heard on Monday evenings on channel 8 at 2030. This contains news of 934 get-togethers, amateur rallies and reviews of the various radio magazines. The current barometer readings from Volmet are also broadcast. This sounds like fun; I wonder if similar things happen elsewhere in the country?

Le fin

That's all for this month: I look forward to receiving your activity reports to include in next month's column. How about including your QSL card for a 'gallery' section? 

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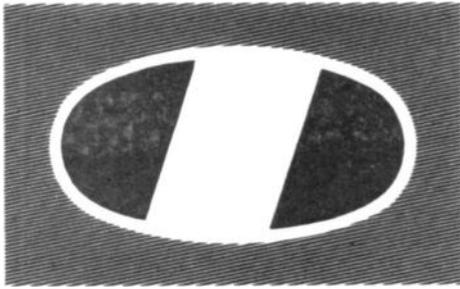
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Tech Talk from



ICOM

Reduced size yet high performance HF antennas are becoming increasingly popular among today's radio amateurs, and ICOM is proudly responding to those needs with a deluxe antenna system. The AH-2. This all band and fully automatic antenna package is especially designed for luxury style mobiling portable activities such as vacationing or operating from environmentally sensitive areas such as apartments.

Mobiling in top fashion hasn't been more attractive, and ICOM's "all in one" design boasts numerous advantages over conventional mixed components type setups. Whether pursuing fixed station or mobile activities, the flexibility and convenience of this fully remote controlled and automatically tuned antenna opens new horizons in limited antenna HF operations. Since the AH-2 system is packed with unique features and is a relatively new idea, we would like to discuss its innovative designs in a step-by-step manner.

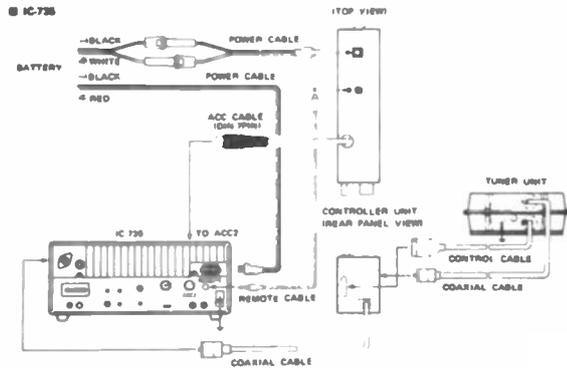
There are five components in the ICOM AH-2 system. The package can be purchased complete or minus the mobile mount and whip for auto of fixed station use as desired. The full system consists of a small rig-attached control unit, a remote actuated and microprocessor controlled antenna tuning unit, an approximate nine-foot stainless steel whip, a universal and heavy duty auto frame mount, and an interconnecting cable set.

An optional OPC-137 cable interface is available for the IC-751 or IC-745 HF transceivers. When using the system's stainless whip operation on all amateur bands between 3.5 and 30 MHz is possible. When the radiating whip is replaced with a random wire 40 feet or longer 1.8MHz operation is also possible. During operation, you merely select a band and frequency, push the remote unit's "tune" button, and one of over 260,000 LC combinations is digitally selected for optimum transmit antenna performance. Tuning actions require only ten watts of RF power, and the resulting SWR is 1.5:1. Usual tuning time is less than six seconds. The antenna tuning unit's microprocessor stores that LC data in one of eight internal memories, so that information is recalled in less than two seconds when the HF transceiver retunes a preselected range. An additional microprocessor in the rig attached remote control unit handles automatic transceiver tune mode switching and RF power output control.

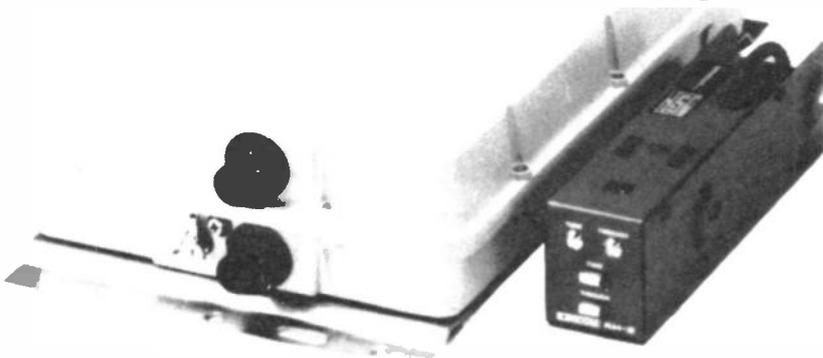
Notice the tuner's capabilities are used during both transmit and receive. Its four sensors (impedance, phase, forward and reflected power) are designed to optimize both single longwires and whips or random wires shorter than 1/4 wavelength, a difficult task for many automatic tuners. Notice also the precise use of microprocessor selected fixed capacitors rather than motor driven variables. This overall concept provides superb antenna tuning and the highest possible performance.

The system's whip and mount truly gives new clarity to the terms "universal" and "heavy duty." They can be quickly installed on a TV mast, boat or car. The mount's bracket bolts to an existing hole in an auto's rear frame, a very strong pipe bolts into the bracket, and the antenna's base section bolts to the pipe's remaining end. The pipe's length is fully adjustable to fit various cars. The antenna base section, incidentally, stands 15 inches tall and weighs approximately nine pounds. "Rugged" is truly an understatement.

Whether assembled as an all-band mobile system or employed in fixed station use when large arrays are unfeasible, ICOM's dual microprocessor controlled AH-2 will keep you communicating in high style. ICOM is bridging new areas in communications and wants you to enjoy this leading edge in modern technology.



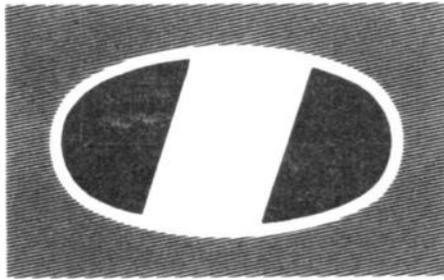
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If you are a licensed Amateur or short wave listener ICOM have a complete product range from HF to Microwaves to suit your needs. Should you have difficulty in locating your nearest ICOM stockist contact us at the address shown at the bottom of this page.

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Linear Integrated Circuits: Amplifiers

by David Corder

In the final part of this occasional series I hope to give an insight into the many types of integrated circuit amplifiers, together with some examples of uses. I shall concentrate on audio amplifiers rather than op amps since these have had plenty written about them.

1) Audio amplifiers

a) TBA820M

This audio amplifier chip is encapsulated in an 8 pin DIL package. It has a wide supply voltage range, no crossover distortion and requires few external components. The circuit is ideal for use as a low power output stage for any circuit. In addition, the bandwidth of the amplifier may also be controlled by one resistor (R_f), which sets the gain, and one capacitor (C_f), which sets the bandwidth. The important parameters are summarised in *Table 1*.

Table 1

Bandwidth	R_f	C_f
5kHz	120R	1500pF
5kHz	33R	390pF
10kHz	120R	470pF
10kHz	33R	100pF
20kHz	120R	220pF
20kHz	33R	47pF

Table 2

Parameter	TBA820M	LM380	LM377	LM831	TDA2002	TDA1520A
Supply voltage	3.16V	10-22V	10-20V	1.8-0V	5-28V	15-50V
Peak output current	1.5A	-	-	-	3.5A	4A
Short circuit current	-	1.3A	1.5A	-	-	-
Output power	2W (12V/8 Ω) 1.6W (9V/4 Ω) 0.2W (3V/4 Ω)	2.5W (18V/8 Ω)	2.5W(20V/8 Ω) per channel	0.22W (3V/4 Ω)	6.5W(18V/4 Ω) 5.2W(14V/4 Ω)	20W (33V/4 Ω) 20W (42V/8 Ω)
Sensitivity	60mV ($R_L = 120\Omega$) $P_0 = 1.2W$ 16mV($R_L = 120\Omega$) $P_0 = 1.2W$)	100mV	100mV (gain = 51)	20mV	55mV (gain = 100)	260mV (P_0 16W, components as in diagram)
Input impedance	5M Ω	150k Ω	3M Ω	25k Ω	150k Ω	1M Ω
Distortion	0.8% (P_0 0.5W R_L 120 Ω) 0.4% (P_0 0.5W R_L 120 Ω)	0.2% (8 Ω /2W)	0.1% (2W/8 Ω)	0.25% (3V/50mW)	0.2% (gain = 100, P_0 3.5W)	0.01% (P_0 16W)
Supply rejection (100Hz ripple)	42dB (8 Ω , C, 47 μ F, R_L 120 Ω)	38dB (C = 4.7 μ F)	70dB	46dB	35dB (gain = 100)	60dB
Channel separation	-	-	70dB max	52dB	-	-

ised in *Table 1*. Some examples of controlling the bandwidth are given in *Table 2*.

Figure 1 shows the pin-out of the IC and *Figure 2* shows the circuit operating as a power amplifier with the load connected to the supply. It is also possible to connect the supply to ground, although additional components are required to provide bootstrapping. C_1 increases the supply ripple rejection of the amplifier, and may be omitted for battery operation. The resistor R_1 and capacitor C_2 form a Zobel network, which helps to ensure stability. *Figure 3* shows a novel but useful application for the TBA820M. It operates as a dc to dc converter. The IC operates as an oscillator at around 40kHz, which feeds a voltage doubler and smoother. The maximum output power is 1.5W.

b) LM380

This IC has overall features similar to the TBA820M. The notable differences are that it has a typical output power of at least 2.5W, and its voltage gain is internally set at 50. Thus, parameters such as frequency response are less easy to control; however, fewer components are needed to make a complete amplifier. An identical circuit, the LM384, will operate to higher supply voltages

and produce a greater power output.

The LM380 is short circuit proof and has internal thermal limiting. It is most commonly available in a 14 pin DIL package (pin-out shown in *Figure 4*), although it is also available in an 8 pin DIL package as the LM380N-8. In the 14 pin package, the centre three pins on each side are for heatsinking, and where large output powers are used the IC should be directly soldered to a PCB in the manner shown in *Figure 5*. If possible, a clip on the IC heatsink should also be used. No damage will occur as a result of overheating due to insufficient heatsinking, just a reduction in output power as the protection circuitry starts to operate. The most important parameters are summarised in *Table 1*.

Figure 6 shows a typical application of the IC as an audio amplifier. As in the TDA820M circuit, there is a Zobel network on the output (R_1 , C_2) to help ensure stability. C_1 increases the ripple rejection of the IC, as with the TBA820M. The addition of a 4.7 μ F capacitor increases the supply ripple rejection by around 30dB. Again, it is not required for battery operation. However, for battery operation the TBA820M is more suitable due to its lower quiescent current consumption.

Figure 7 shows two LM380 ICs operating as a bridge amplifier, an application to which they readily adapt due to the existence of both non-inverting and inverting inputs. The signals presented to the speaker are in antiphase, and a far greater power output is produced (theoretically, 4 times the normal).

The next two circuits reflect the versatility of the LM380 and are the result of some experimentation. The first shows the LM380 operating as a voltage regulator. It is used as an error amplifier in a basic regulator circuit, having the advantage that no external power transistor is required. In addition, the current

Table 3

Supply voltage	9 to 40V
Supply rejection	120dB
Channel separation	60dB
Supply current	10mA
THD (gain = 60dB)	0.1%
Open loop gain	100dB

and overheat protection of the IC are passed on to the power supply. A heatsink will have to be used in nearly all applications. The drop-out voltage appears to be about 4 volts.

The second circuit (Figure 9) shows the LM380 acting as a supply splitter, a circuit where an op amplifier and two power transistors would be used. Here it is operating as a unity gain voltage buffer. The output is short circuit protected, and is therefore ideal for experimenting with op amplifiers.

c) LM377

All the ICs described so far have been single channel only (mono) devices. However, the LM377 is a dual power amplifier. It has an improved pin for pin replacement, the LM1877. The IC will provide 2W per channel into an 8ohm load. It has both short circuit and overload protection built in. The circuits require very few external components. The IC comes in a 14 pin DIL package and, as in the LM380, the middle three pins on each side are intended for heatsinking on a PCB (see Figure 10).

The fact that it is a dual amplifier means that it is ideal for both stereo amplifiers and one chip bridge amplifiers. Again, the important parameters are summarised in Table 1. Figure 11 shows a basic stereo amplifier based on the LM377. C1 should be kept large to preserve channel separation. The gain is set by the ratio of Ra to Rb. Here it is 50; however, as the gain is increased the

Table 4

Supply voltage	18V max
Input voltage	15V or supply voltage, whichever is least
Operating temperature	0 to 70°C
Supply current	1.7mA
Input resistance	1M

Table 5

Device	Features
NE5534A	Low noise, wider bandwidth
CA3140	High input impedance (MOSFET)
LF13741	741 with JFET inputs (high impedance)
LF351	Low noise, low distortion, high input impedance
LF441	Low supply current (1/10 of 741) high input impedance
L1458C	Dual 741
LF442	JFET 1458C, low supply current
TBA221G	741 in surface mount package
TBA222	741 with 22V power supply

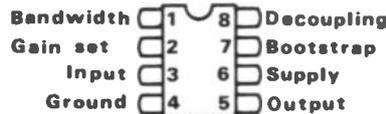


Fig 1

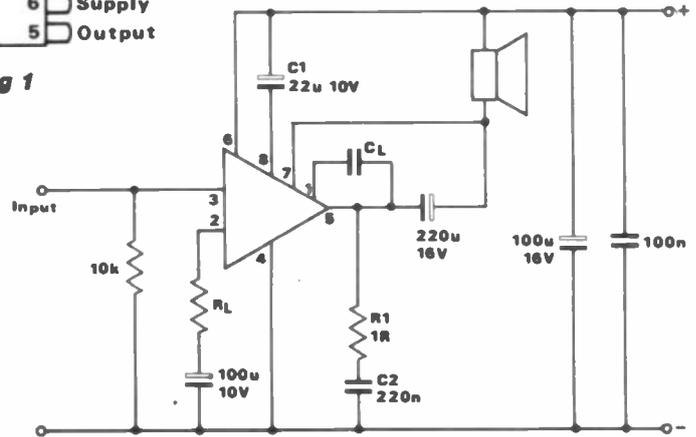


Fig 2

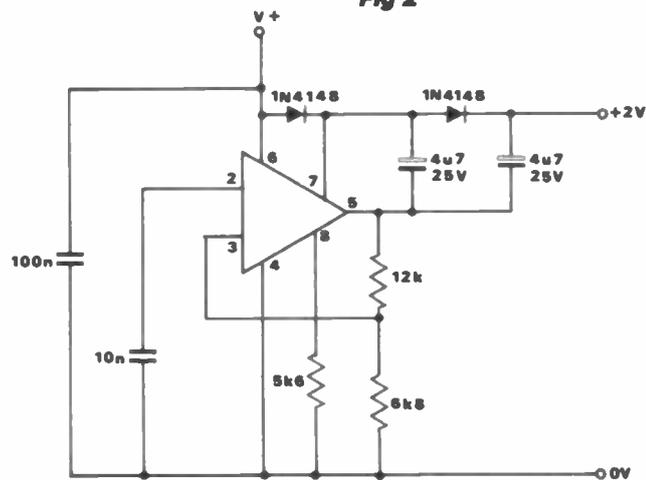


Fig 3

distortion also increases.

d) LM831

Whilst all of the previous integrated circuits have been capable of producing considerable power output, the LM831 has an input of only around 220mW. However, it can produce this at a supply voltage ranging from 1.8V to 6V. It also has very low AM radiation, low noise and low THD (total harmonic distortion). The LM831 is a dual amplifier, thus stereo or bridge operation is possible. It is available as a 16 pin DIL package (see Figure 12 for pin-out), or a 20 pin small outline surface mounting device. The parameters are summarised in Table 6.

Table 6

Supply voltage	36V max
Input current	1mA max
Bias current	2mA max
Input resistance	26K
Peak output current	500µA

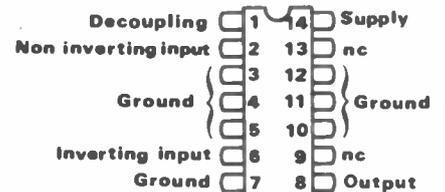


Fig 4

Figure 13 shows a typical application circuit for the LM831 as a high quality stereo amplifier. The bandwidth is 50Hz to 20kHz, power output is 220mW per channel and it has a dynamic range of more than 80dB. It is designed for 4 ohm loads. The circuit is ideal for providing loudspeaker reproduction for personal stereos, since its power supply requirements match those of nearly all personal stereos.

Alternatively, a small mains power supply and regulator could be used to supply both the amplifier and the personal stereo. C1 may be increased up to 10,000µF, larger values improving low battery performance. C2 filters the supply, and larger values (up to 470µF)

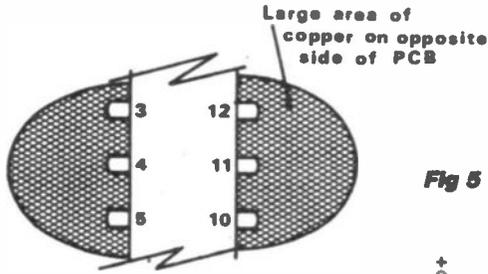


Fig 5

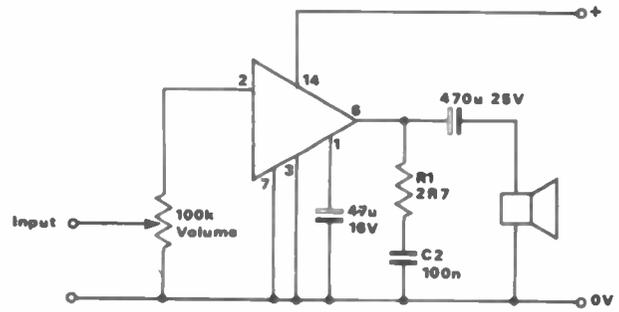


Fig 6

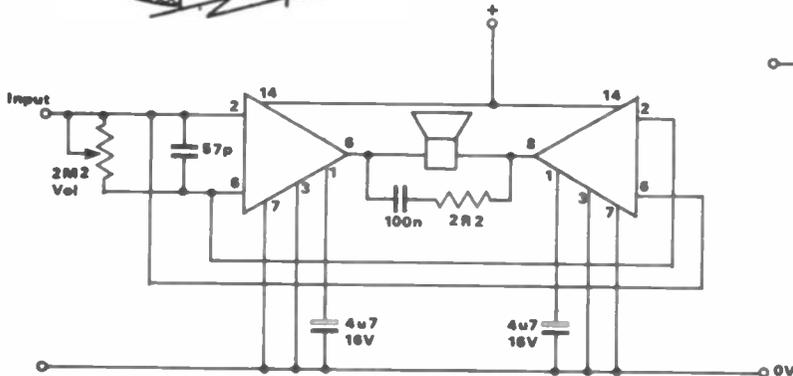


Fig 7

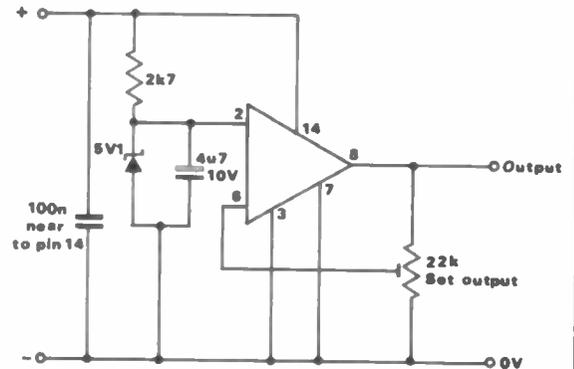


Fig 9

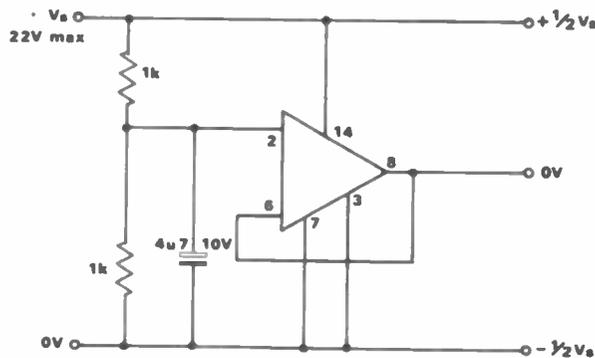


Fig 10

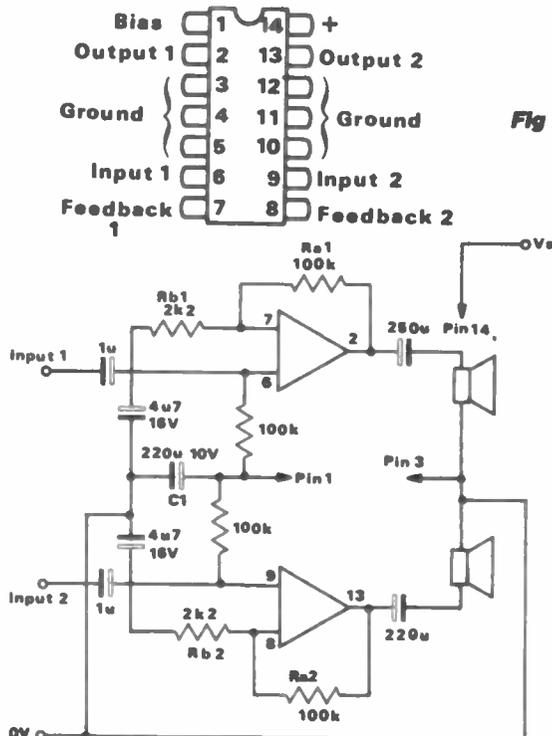


Fig 11

improve performance. The LM831 may be used as a bridge amplifier to produce higher power for mono operation. However, this is probably less useful than the previous circuit. The TBA820M could be used in these applications when the supply voltage is greater than 3V, although the LM831 has the advantage of a lower minimum supply voltage and fewer external components.

e) TDA2002/LM383

These two ICs are similar products, the LM383 being an improved version of the TDA2002, with lower noise and a wider frequency response. They provide a much greater power output than the previous devices. For example, with a 16V supply and a 4 ohm load the output is 6.5W. The device will also drive a 2 ohm load to a greater power output. It is encapsulated in a 5 pin power package; the pin-out is shown in Figure 14. Both gain and bandwidth may easily be set. Again, Table 1 has the important parameters in it. The IC contains overvoltage, short circuit and thermal protection.

Figure 15 shows a typical amplifier circuit. R1 and R2 set the gain. However, R2 should be kept at 2.2 ohms to retain good supply voltage rejection. Thus, R1 should be chosen according to the formula:

$$R1 = (\text{GAIN} - 1) \times R2$$

R and C set the bandwidth and their values should be determined by:

$$C1 = 1/(\text{BANDWIDTH} \times 2 \times R1) = 3.142$$

$$R3 = 20 \times R2$$

A Zobel network is included on the

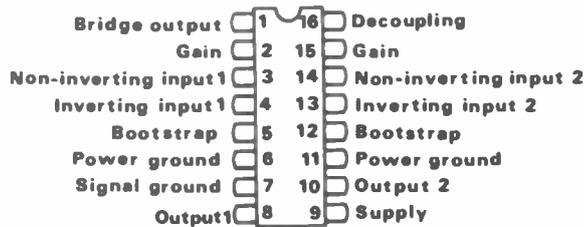


Fig 12

output. In order to ensure stability, it is important that the 0V connection marked X from the loudspeaker is connected by a separate low resistance wire to the power supply. C2 also helps to ensure stability.

f) TDA1520A

There are occasions when a very large output power is required from an audio amplifier. Until recently there was a lack of ICs that could manage large outputs. Now there are two, the LM1875 and the TDA1520A. Since the latter is cheaper, I shall concentrate upon it. The TDA1520A is capable of producing 20W output power at low distortion and is classed as hi-fi. The IC is fully overload and short circuit protected and comes in a 9 pin SIL package, its pin-out being given in Figure 16. The important parameters are in Table 1. Figure 17 shows a typical circuit for use with this IC. R3 sets the input impedance. R1 and R2 set the gain. C1 helps ensure stability by removing any RF that might be present at the input.

Again, a Zobel network is provided on the output. To ensure stability, lowest distortion and lowest noise, it is important that the output should be kept well separated from the inputs, as well as keeping the supply lines away from the inputs. The point marked X should be connected via a separate heavy duty wire to a common 0V point on the power supply to help prevent earth loops from occurring.

The IC requires very good heatsinking

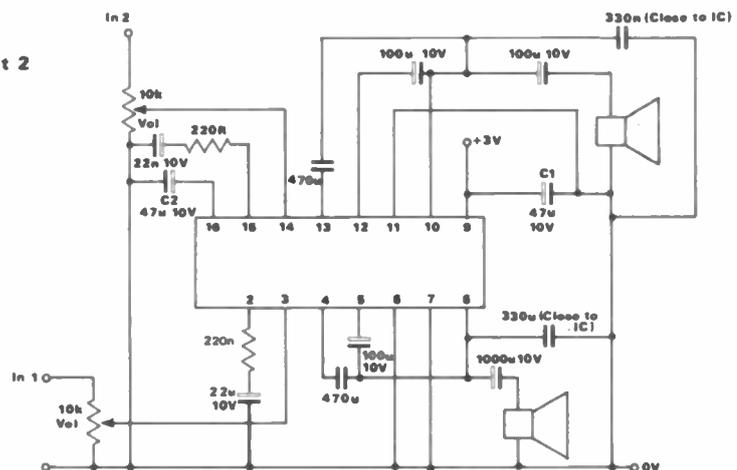


Fig 13

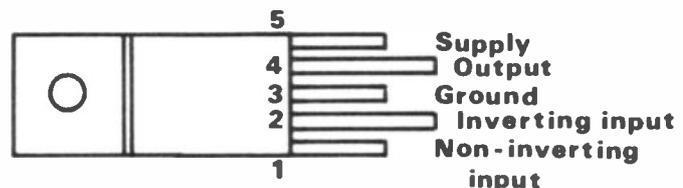


Fig 14

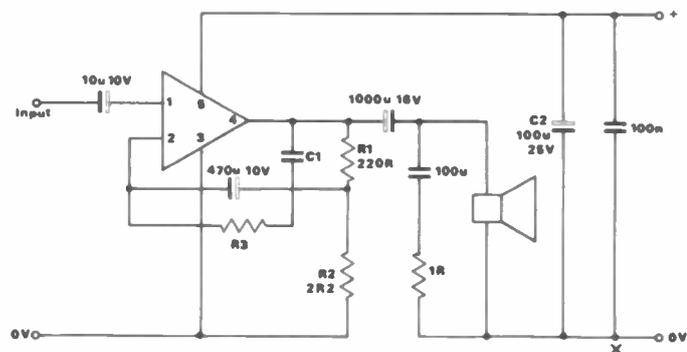


Fig 15

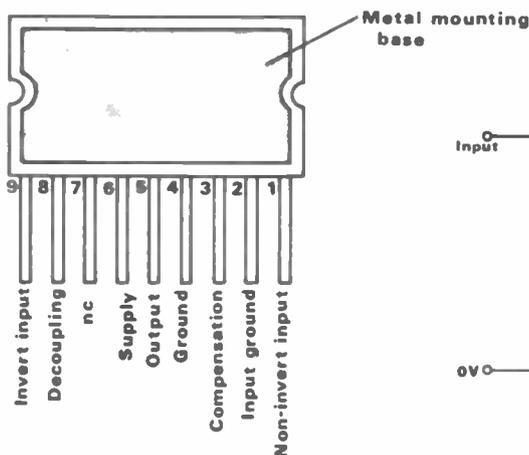


Fig 16

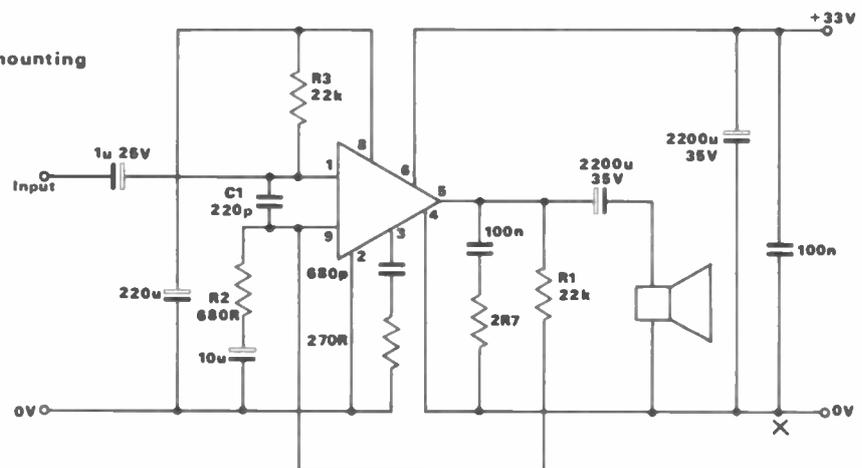


Fig 17

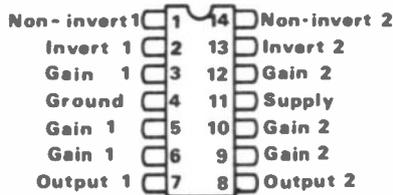


Fig 18

if it is to develop anything near full power. The heatsink should preferably have a temperature rise of less than 2 C/W. In the circuit shown, the metal part of the package is at 0V. Thus no insulating washer is required and the IC may be bolted directly to the heatsink, with only some heat transfer compound between.

g) LM382 dual preamplifier

This IC contains two low noise preamplifiers, each section being fully independent. One of its most useful features is an internal resistor network, which allows different gains and frequency responses to be easily selected. It is encapsulated in a 14 pin DIL package, the pin-out being shown in Figure 18. Table 3 summarises its most important parameters. The output of the IC is fully protected against short circuits.

Figure 19 shows the LM382 operating as a preamplifier with selectable gain. Pins 2, 3, 5 and 6 are the gain controlling pins connected to the internal negative feedback loop of resistors. By connecting these pins to ground via capacitors of a suitable value, the gain and frequency response may be set. In this circuit no alteration to the frequency response is required, just selectable gain. With C1 only connected, the gain is 40dB; with C2 only connected, the gain is 55dB; with both capacitors connected the gain is 80dB.

Figure 20 shows the LM382 acting as a RIAA equalised preamplifier. In this circuit, some alteration of the frequency response is required, thus further components are needed. In Figure 21, the LM382 is acting as a tape head preamplifier with NAB equalisation. In each of the above circuits the pin numbers are given for one channel only.

2) 741 op amplifier and similar devices

This standard operation amplifier is made by several manufacturers and several improved versions are also available.

The basic 741 is overload protected on both the input and output, and is available in 7 pin and 14 pin packages. The pin-out for these two versions is shown in Figure 22. Table 4 summarises its most important parameters.

There are many different uses for op amps and it would be pointless to describe them all. Instead, just one demonstration circuit for the 741 acting as a comparator, which is also useful in

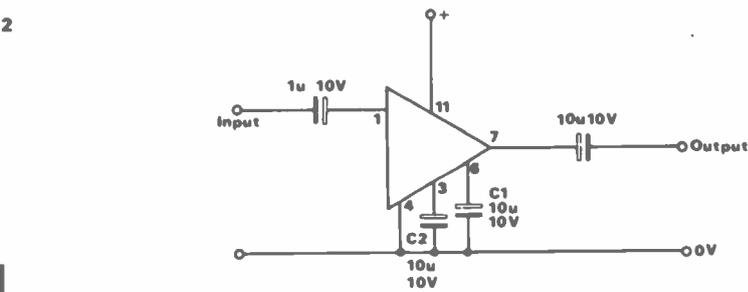


Fig 19

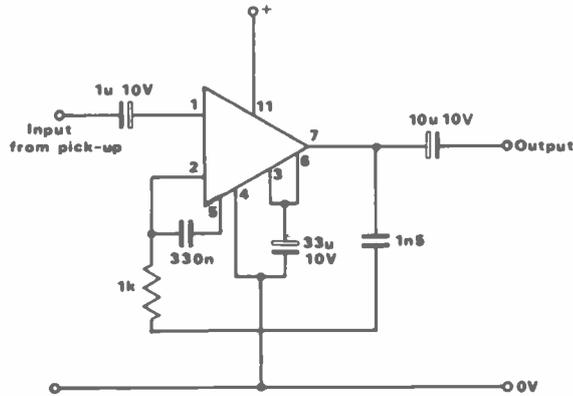


Fig 20

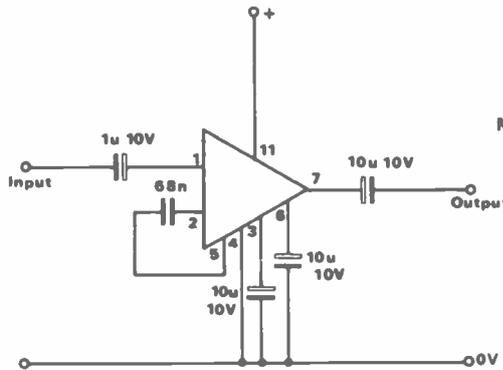


Fig 21

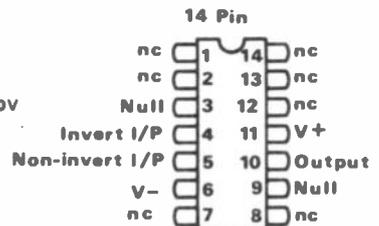
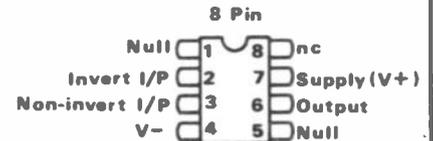


Fig 22

its own right, is shown. The circuit is designed to protect moving coil meters from overload, and the diagram is shown in Figure 23. If the voltage across the meter exceeds the reference voltage the output goes high, switching on the relay and removing current to the meter. D1 protects the 741 against excess input voltages. In the circuit shown, the maximum overload voltage that the circuit can be set for is 1.6V. By lowering the value of R1, this may be increased and vice versa.

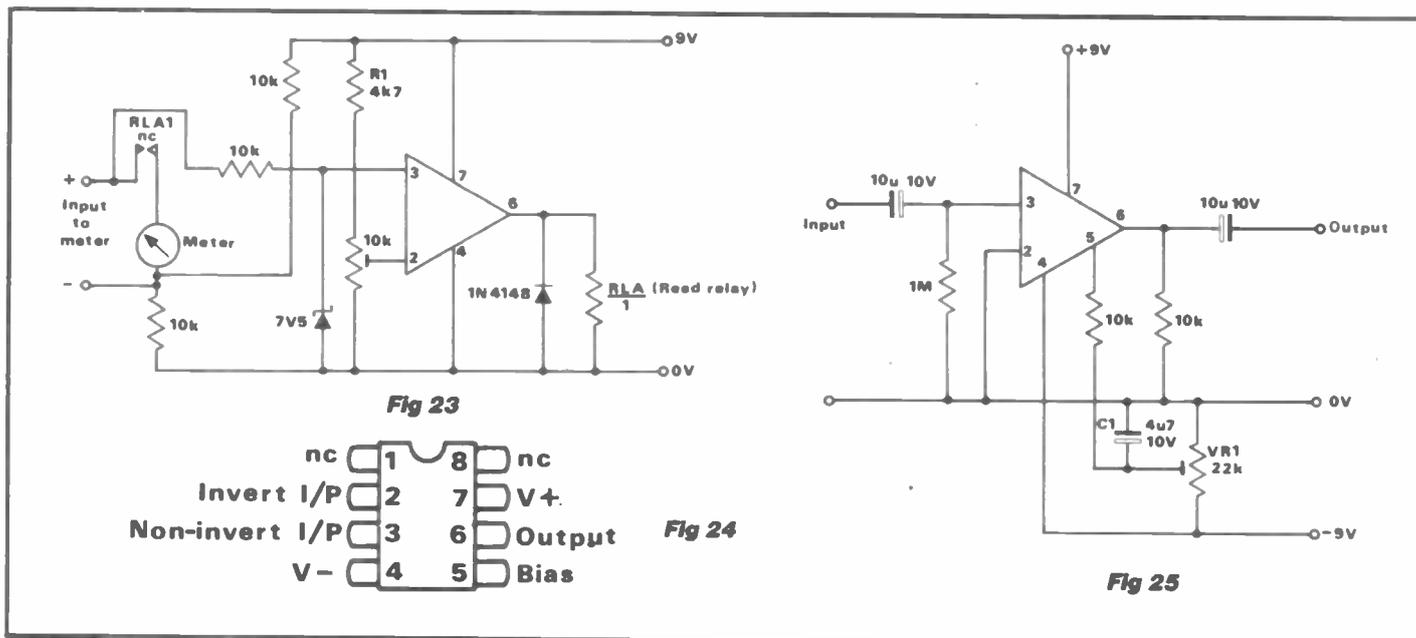
As previously mentioned, there are many op amps with pin-outs or functions similar to the 741, intended as improved replacements. Table 5 lists these, with their most important differences.

3) TCA3080

This is a novel form of op amplifier that has an output current proportional to the voltage difference between its input pins.

There is also a bias input, which controls the gain of the IC. It is encapsulated in an 8 pin DIL package, the pin-out being shown in Figure 24. The IC is protected against short circuits on the output. Table 6 summarises the important parameters.

The presence of the bias control makes the IC very versatile. A typical application is shown in Figure 25. Here the IC is acting as an amplifier whose gain is controlled by a dc voltage. C1 smoothes the control voltage to remove



crackle from the control and ripple from the supply. Thus, the circuit may be used as an audio volume control that can be operated by a separate dc voltage. Alternatively, a second signal may be applied instead of the dc by removing

VR1 and C1. An interesting sound effect is then produced!

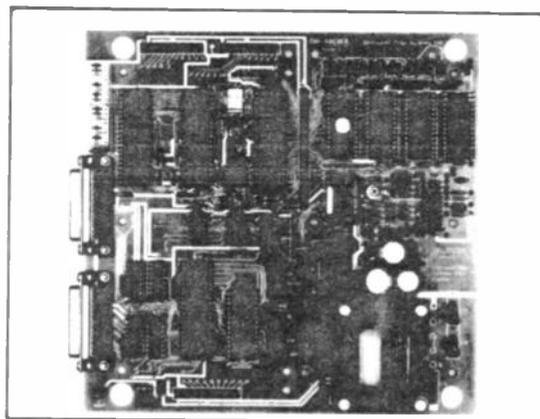
The IC is also suitable for sample and hold applications. A storage capacitor is connected to the output. Whilst the voltage applied to pin 5 via a resistor is

low (-Vs), the output voltage follows the input. However, if the pin is connected to 0V, the input is isolated and the capacitor voltage held. A high impedance buffer must be used between the capacitor and the output.

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UNILAB SCHOOLS

SATELLITE PROJECT

Part One: NOAA Weather Satellite Ground Station Package

By Alan Pickard

This review concerns the weather satellite receiving system from Unilab. Part 2 (which will appear in the December issue) will cover their UoSAT receiving system. Both systems are intended for use with the BBC B, B+ or Master 128 micros. In addition, a monitor (colour if possible), printer (Epson preferably), disc drive and cassette recorder are required.

The NOAA satellite series

This series of weather satellites, which is also known as TIROS (Television Infra-Red Orbital Satellites) transmits weather pictures at 120 lines per minute. The two satellites accessible by the Unilab system are the NOAA-9 and NOAA-10. These transmit signals at 137.62MHz and 137.5MHz respectively. NOAA stands for

National Oceanic and Atmospheric Administration.

Both a visible and an infra-red image is provided of the Earth's surface which is being overflown by the satellite. The NOAA satellite carries out polar orbits giving two sets (every twelve hours) of 3-4 usable passes per day. The area covered (and receivable in Britain) extends from Greenland to the Mediterranean and from the mid-Atlantic to the Urals.

The NOAA satellites carry out polar orbits, which means that they travel from the South Pole to the North Pole over Britain (when overhead) and, as each complete orbit takes about 100 minutes, about 15 orbits occur every 24 hours. As the Earth rotates (anti-clockwise), each orbital path must shift by $360^\circ/15 = 24^\circ$. In

other words, each pass is effectively 24° west of the previous one. At certain times during the twenty-four hour period, the NOAA satellite may not be in a convenient reception position, regardless of what picture it is taking! Generally speaking, NOAA-9 provides about five usable passes during each 24 hours, and NOAA-10 5 or 6.

Unilab system outline

The NOAA Weather Satellite Ground Station package is detailed as follows:

Weather satellite receiver, with leads;
Weather picture interface, with leads;
Satellite antenna, with phasing harness;
Coaxial cable, 10 metres with connectors;
Weather-Pack-1 picture software (40T disc, sample cassette tape, manual);
Sat-Pack-1 orbital prediction software (40T disc, manual);
Schools Satellite Project Master Manual.

Apart from the BBC micro system (detailed later), everything required for a fully operational ground station is provided. Figures 1 and 2 show automatic reception and loading of picture signals.

Ground station package

Before looking at the system components in detail and then describing its operation fully, I must say that I am impressed with the review system I have

Fig 1 Automatic reception of NOAA signals

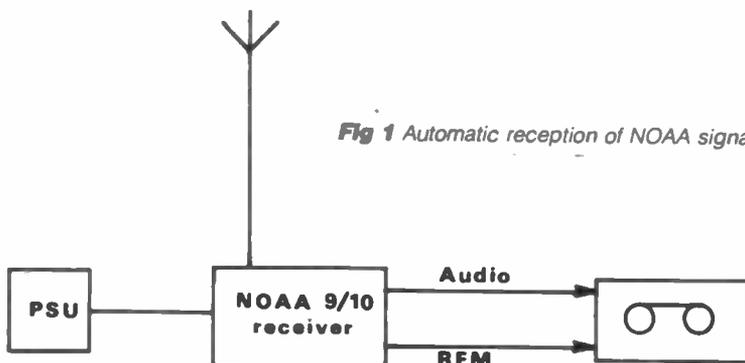
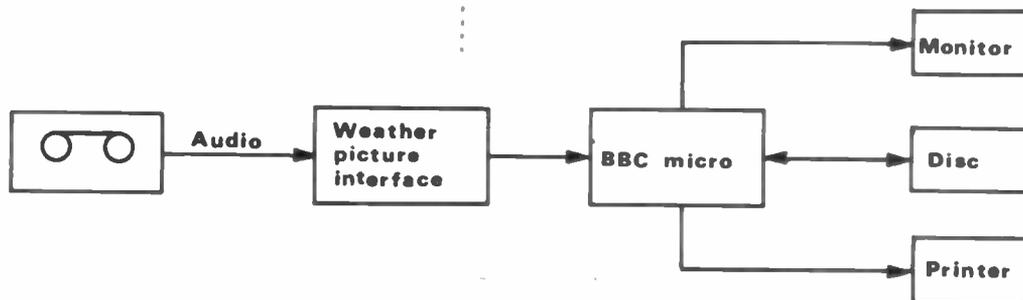


Fig 2 Loading recorded picture signals into BBC micro system via the weather interface



used. All parts were carefully and thoroughly packed and I had no difficulty in assembling the aerial or in getting the various items to function correctly. The documentation (mainly from three sources: the master manual and two separate software manuals) was also more than adequate to get things working and tried out.

HARDWARE

Aerial

The aerial is described as a right-hand circularly polarised 'turnstile' antenna, which consists of a pair of crossed loop dipoles and a pair of crossed reflectors. This aerial is omnidirectional and therefore does not need to be aimed at the satellite or to track it during its pass. Although optimum positioning may be achieved from a permanent siting of the aerial, it is one less variable to worry about and also makes it convenient for recording passes automatically (ie unattended). I obtained satisfactory results with the aerial positioned vertically.

Full instructions on assembling the aerial onto its boom and correct (phased) connection details are given, plus useful diagrams. All that is required is a small screwdriver, plus an adjustable spanner if mounting the aerial onto a mast.

My 'installation' consisted of the aerial clamped to a broom handle, which was then gripped in a Black & Decker Workmate in the centre of the lawn! Despite its weird appearance, this arrangement worked very well at an altitude of only 5-6 feet, but well clear of house and trees. Ten metres of co-ax cable terminated by a BNC plug at the receiver end and an N-type plug at the aerial end are provided, which is very useful for temporary trials of the equipment.

Receiver

The receiver, with provision for selecting up to six frequencies (two equipped, NOAA-9 and 10), is in the form of a flat, orange topped steel case measuring

about 24cm x 13cm x 4cm. It is clearly labelled for connection of the aerial (BNC socket), power supply (banana sockets) and a 75 ohm type TV aerial socket for connection to a tape recorder (MIC) input. A 4mm jack socket enables connection to the REMote socket of a portable cassette recorder. Aerial and cassette leads are included. As the unit is intended for school lab use, a bench power supply is assumed to be easily available. Another reason for this is that the 16-18V ac or dc supply input could be achieved using lamp batteries, enabling the receiver to be operated outside without the constraints of mains supplies. Presumably, an optional mains unit would increase the cost of the unit and also make it slightly heavier. Current requirements are typically 150mA.

The receiver unit includes an audio amplifier and speaker, which enables monitoring of the satellite signal during (attended) recordings or when just listening to a pass. This audio output is also 'tapped off' and outputted to the tape recorder.

In addition to the volume control, a squelch control can be used to adjust the signal level, which will activate the receiver and also turn on the recorder. A Doppler monitor output is provided for those interested in observing carrier frequency changes as the satellite progresses towards and past the ground station.

After connecting up the receiver to the aerial and tape recorder, the squelch is set so that it just turns off the recorder remotely. The unit is then left to record the next pass or passes. Remember to depress the record keys and also to switch on the external power supply!

Unless you are in attendance or have information about pass times (more on this later), the unit can be left on overnight or during the day. Also, unless you are experienced in interpreting infra-red pictures, it is more useful to record signals during the daytime, as pictures taken at night will probably not be very useful!

Before embarking on the recording and then processing of received signals, it is a good strategy to familiarise yourself with the system using the program disc (Weather-Pack-1) and sample tape. This is clearly explained in the Master Manual and also the booklet accompanying the disc.

Note: Receiving satellite signals does not require the operation of the computer system, unless you want to receive and monitor live pictures. However, this is not very practical due to RF interference generated by the computer itself. I will return to the use of software and the processing of received data after looking at the next part of the hardware, namely the interface unit.

Weather picture interface

The interface unit is another flat box which matches the receiver in size and appearance. It has a mains PSU, co-ax input from cassette (EAR) output and a switch to select SYNC A (infra-red picture) or SYNC B (visible picture).

Adjustable controls are provided for offset and amplifier gain which enable the unit to be adjusted to suit the level originating from the cassette tape. Instructions and diagrams are provided in the software manual and also on screen. The Weather-Pack software, which is menu-driven, allows adjustment to be made via visual graphical information on screen. Once set, this should need no further adjustment. In my case, the offset control was set to about 12 o'clock and the gain at about 9 o'clock. Output from the interface is via ribbon cable to the BBC user port.

The audio input to the interface unit is in analogue form. This can be listened to and produces a tick-tock sound, with tones between each tick and tock. The ticks and tocks are actually the sync pulses for each picture line, ie tick is sync pulse A (for infra-red) and tock is sync pulse B (for visible). The tone signals in between are the picture line signals. Figure 3 is a sync pulse and line waveform diagram.

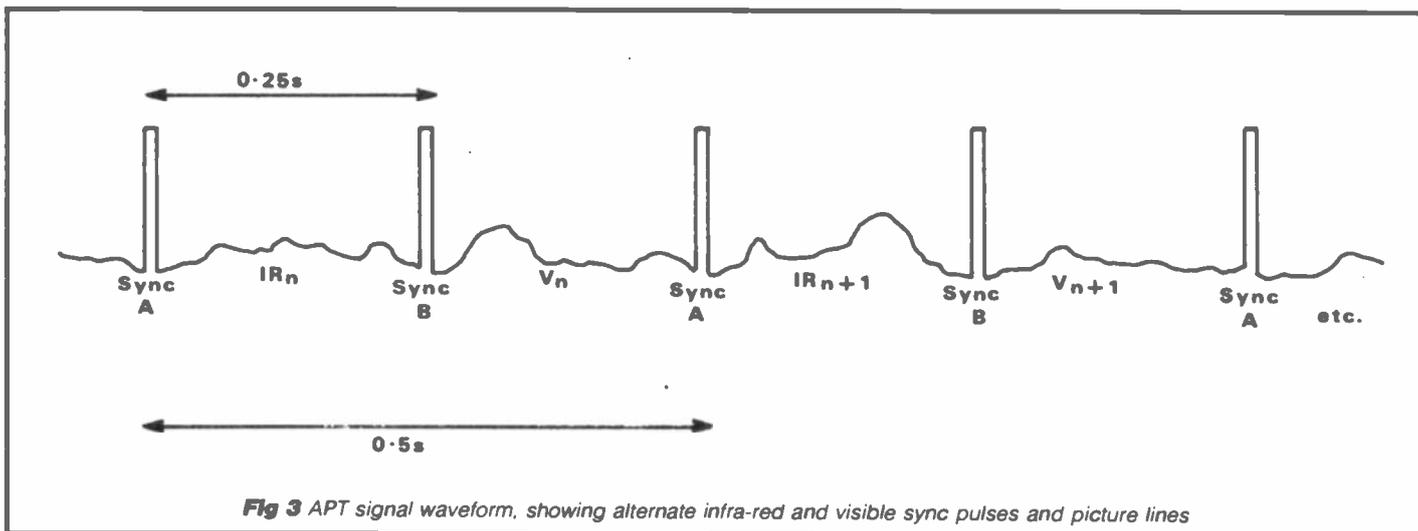


Fig 3 APT signal waveform, showing alternate infra-red and visible sync pulses and picture lines

Satellite	GMT	L EQX	Actual time	Pass no	Screen no	Cassette counter
NOAA-10	9.42am	212°W (148°E)	9.30am	1	1	000
					2	093
					3	172
NOAA-9	12.29pm	319°W (41°E)	12.05pm	2	1	272
NOAA-9	2.11pm	345°W (15°E)	2.00pm	3	1	304
					2	425
NOAA-9	3.53pm	010°W	3.15pm	4	1	459
					2	513
NOAA-10	6.09pm	339°W (21°E)	6.00pm	5	1	000
					2	100
NOAA-10	7.50pm	004°W	7.15pm	6	1	216
					2	284
					3	347
					4	403

Table 1 Received signals relating to NOAA-9/10 predictions for 30th May

The purpose of the interface is to convert this analogue information into digital form which the micro can then display on screen by writing the appropriate grey scale values as individual pixels on the screen. Thus, the interface is basically an A/D converter. Weather-Pack software then produces a digital picture representation on the screen as it is read from cassette, via the A/D unit.

The picture is produced from the bottom of the screen one line at a time, and takes about five minutes to complete. Completed pictures can be transferred to disc and afterwards rewritten to the screen, but this time much more quickly.

As before, no problems were encountered when using the interface unit. Connection is straightforward, all leads are supplied and the manuals give full instructions.

I would recommend trying out the interface unit and familiarising yourself with its operation using the sample tape to display a picture on screen and also to copy a picture from screen to disc. This makes it easier to deal with your own recorded pictures.

The Unilab system is very easy to use, being well organised and documented. It represents quite a sophisticated system in terms of hardware and software and provides a great deal of scope for a relatively small outlay.

I found that the equipment/system worked first time, with no problems, apart from a need for familiarisation with the different aspects of receiving, decoding and displaying.

The most difficult part of operating the system is understanding what is happening in terms of satellite position, interpretation of received pictures and knowing when to expect a useful pass. Although some information is given in the documentation, it must be realised that the Unilab system is a tool and the user must expect to learn and find out about the NOAA satellites from other sources.

Software

As the Unilab system is computer based, software is essential for the decoding of received picture signals. Weather-Pack-1 provides a suite of programs on one disc with the facilities outlined below.

Sat-Pack-1, the orbital prediction program, is very useful but not as essential as the Weather-Pack-1 disc.

Weather-Pack-1 comprises the 5¼in 40T single-sided disc with these facilities: set resolution - 8 shades, high resolution, 8 minutes of pass, with a half screen width (BBC mode 1), or 8 shades, medium resolution, 4 minutes of pass, and full screen width (BBC mode 2).

The change default drive enables the single drive system to be used as a program and data disc.

A set sync trigger allows the sync level to be set for best results from a tape output.

A sample cassette tape with a received picture signal can be loaded into the BBC micro via the interface unit and then displayed on the screen. The manual provides full instructions on how to operate the menu-driven software, and a keystrip is also provided.

The adjust interface produces graphs of amplitude variations. Prompts show how to adjust 'offset' and 'gain' controls for best results.

A new picture facility enables picture signals stored on cassette to be loaded to screen.

'Load picture' enables pictures stored on disc to be loaded to screen.

Two half-width pictures can be placed side by side on the screen for comparison. In addition, different sets of 4 colours can be toggled for colour or monochrome VDUs.

Other facilities include screen to printer dump (a printer screen dump program is required). Also inversion of picture (ie N>S to S>N) is possible. Display modes are: mode 1 (BBC 320×256) in 4 colours, or mode 2 (BBC 160×256), in 16 colours (8 are actually used). The printer dump routine is

provided as WXDUMP on the disc, if you are using an Epson compatible printer of the FX-80 type.

Some sample results

The table lists some typical results, achieved on 30th May 1987. These results are based on a table which conveniently appeared in *Oscar News*, produced by AMSAT-UK.

Although this publication deals mainly with UoSAT satellites, GM3CEA from Stranraer had produced these prediction figures. Discrepancies in the times are presumed to be due to the south-north travelling satellite passing over the vicinity of Hinckley in Leicestershire before reaching Stranraer!

L EQX is the latitude position at which the NOAA satellite crosses the 0° longitude equator in an approximately S>N direction. Satellite crossings are usually stated as being between 0-360°W although maps use 0-180°W (clockwise) and 0-180°E (anti-clockwise). I have included both forms.

The table shows a total of six satellite passes, but most passes last for 10 minutes or more and, as it takes about five minutes to fill a screen, up to three 'screenfuls' may be achieved. It is even possible to dump these successively to a printer and then join them up. Recording cassette counter numbers is useful for backtracking and tying in results with predictions.

These results may require time and effort in interpretation, as you need to know the actual orbital path (not actually due north from its equator passing point), whether it is in good radio range and, depending on its elevation, how long the pass is. It also helps to know in which direction it is travelling (it is possible to receive picture signals when it is heading over the North Pole in a southerly direction!)

This is when the picture inversion facility is useful. Thus, in theory you might get pictures from as far away as Japan, Turkey, etc. Poor visibility can also be a problem, and pictures over the Atlantic may not be easy to interpret!

Technical details

NOAA altitude: 800km

NOAA orbit time: 101 mins

RF carrier frequency: NOAA-9 137.62MHz; NOAA-10 137.5MHz

Tone is a sub-carrier signal of frequency 2400Hz. The amplitude represents the bright and dark areas. After sync pulse, a picture line is transmitted as a one quarter second burst of modulated sub-carrier (tone). Each line is 600 cycles of sub-carrier.

The A/D converter is an 8-bit device, which provides for 256 different shades. The BBC micro modes provide only four ranges (mode 1) or 8 (mode 2).

Minute markers are displayed on screen which not only relate to the pass time and therefore the displayed picture, but are useful when comparing (or

'synchronising') visible and infra-red screen or printer pictures.

Software provision is made for labelling picture files before saving to disc, eg latitude, satellite type, etc. IR black indicates a warm area, white indicates a cold area.

Channel 1 (visible) has 7 sync pulses at 1040 pulses per sec. Channel 2 (infra-red) has 7 sync pulses at 832 pulses per sec. Modulation is 5% black and 80% white, resolution in mode 1 is 320 x 256, that is 81,920 pixels. In mode 2 it is 160 x 256, or 40,960 pixels.

These figures compare favourably with more costly systems having typical resolutions of 256 x 256 x 16 = 10,485,76 pixels. Obviously, the more pixels (picture elements), the more detail there is in the picture.

Conclusions

Most people find the idea of receiving satellite weather pictures quite interesting, as they can relate it to something which affects them (the weather) and are also familiar with weather forecasting by this means on national television. Schools and hobbyists tend to find the subject fascinating and are keen to find out more once they have witnessed a demonstration. The Unilab NOAA receiver

system provides a sound basis in terms of hardware and software for investigating this area in some considerable detail.

My initial reaction to this system was very favourable, and having spent about three weeks using it for this review I am still impressed by its facilities and ease of use. At £210 for a complete system (aerial, receiver, interface, software and documentation), it provides a fairly sophisticated system which is relatively easy to install and commission. Although the system represents a great deal of time and effort and the utilisation of experience from many sources, it still provides an incentive to learn more about the subject and is also a source of continued stimulation and intellectual challenge.

Good value

In a nutshell, the Unilab system represents good value for money and is a good starting point for school or college project work. The equipment is reliable and produces good results. It also compares favourably with more expensive systems, including Meteosat.

In Part 2, I will review the Unilab UoSAT system. This will appear in the December issue.

Acknowledgements

My thanks go to Unilab Ltd for the loan of this system for review, in particular to Mr David Duff and Mr Alan Hammond. I would also like to acknowledge GM3CEA (Stranraer) in *Oscar News* (AMSAT-UK).

References

Unilab Ltd,
Clarendon Road,
Blackburn,
Lancs BB1 9TA.
Tel: (0254) 57643.

AMSAT-UK,
94 Herongate Road,
Wanstead Park,
London E12 5EQ.

Prices

Combined NOAA and UoSAT systems: £423.
NOAA system: £210.
NOAA-9/10 receiver: £77.67.
NOAA-9/10 interface: £62.73.

Further details can be obtained from Unilab.

Don't miss the December issue, when Alan Pickard presents a review of the Unilab UoSAT satellite receiving system

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4001B 0.30	74LS20 0.20	Z80A-PIO 1.68	VOLTAGE REGULATORS 1A	BZY88C9V1 0.08	2N2464 0.55	4700pF83V 0.04	POLARISED 0.26
4001B 0.26	74LS32 0.20	Z80A-SIO/0 4.96	FIXED VOLTAGE	BZY88C10 0.08	2N3055 0.50	0.47uF50V 0.04	5 WAY
4001B 0.50	74LS37 0.20	UPD41256-15 2.65	PLASTIC TO220 PACK	BZY88C11 0.08	2N3704 0.20	0.1uF25V 0.05	0.186" PITCH
4002B 0.86	74LS42 0.42	TC5516APL-2 3.00	7800/7900 SERIES	BZY88C15 0.08	2N3819 0.40	0.1uF50V 0.14	HOUSINGS 3 WAY
4002B 0.25	74LS85 0.82	ICM7217PI 4.21	-24V to -24V 0.45	BRIDGE REC'S	2N5307 0.20	TANTALUM	POLARISED 0.37
4024B 0.40	74LS123 0.67	AD & DA CONVERTERS	0.1A FIXED VOLTAGE	KBP008 1.42	2N5308 0.20	1.0uF16V 0.09	0.1" PITCH
4025B 0.20	74LS132 0.54	AD7525LN 19.25	7800/7900 SERIES	SKB202.5A 0.43	100pF10V 0.10	6.8uF10V 0.12	HOUSINGS 3 WAY
4025B 0.28	74LS139 0.46	DAC08N-CBI-V 19.50	PLASTIC TO92 PACK	KBU4D 0.95	100pF10V 0.10	100pF10V 0.13	POLARISED 0.12
4030B 0.28	74LS193 0.98	ADC1210HCD 45.55	-15V to +15V 0.27	W005 0.26	100pF10V 0.13	22pF16V 0.21	17 WAY
4040B 0.50	74LS240 0.67	ADC1211HCD 39.98	DIODES	TRANSISTORS	100pF10V 0.13	33pF16V 0.32	POLARISED 0.20
4042B 0.41	74LS244 0.58	DAC0800LCN 2.45	1N4001-7 0.05	BC107 0.12	16 way 0.32	100uF6.3V 0.57	CRIMPS 0.30
4050B 0.29	74LS245 0.75	DAC1200HCD 18.84	1N4148 0.02	BC108 0.12	18 way 0.36	150uF8.3V 0.94	0.186" PITCH
4053B 0.50	74LS365 0.52	DAC1201HCD 15.15	1N4833 0.25	BC182 0.12	20 way 0.44	1R-10M 0.02	HOUSINGS
4063B 0.70	74LS373 0.58	ICL7108CPL 8.40	1N3881 1.89	BC327B 0.12	24 way 0.48	0.5W 8% 5 WAY NON	LOCKING 0.33
4068B 0.20	74MC SERIES	AD7542KN 18.94	1N5339B 0.38	BC546B 0.12	28 way 0.56	10R-10M 0.03	8 WAY LOCKING
4068B 0.21	74HC00 0.33	LSI/AR	1N5401-6 0.12	BC546B 0.12	40 way 0.80	METAL FILM	0.186" PITCH
4068B 0.20	74HC02 0.33	TD A 3810 sound circuit 3.97	31DQ03 0.64	BC546B 0.12	PLAIN LOW COST	10R-1M 0.04	HOUSINGS
4070B 0.20	74HC04 0.33	UGN3020 Hall Effect IC 2.58	BAT85 0.10	BC556A 0.12	BUS48P 2.85	47K GM472W 1.95	POTENTIOMETERS
4071B 0.20	74HC11 0.33	074 Quad Op/Amp 0.88	BVY22-100 3.70	BD131 0.40	BUS98 5.70	18 way 0.11	CERMET 1/2" SQ
4078B 0.21	74HC25 0.83	1438 High Volt Op/Amp 3.70	BVY95B 0.18	BD233 0.33	18 way 0.10	18 way 0.13	PCB TOP ADJUST
4081B 0.16	74HC139 0.58	1458 Dual Op/Amp 0.41	BVY95C 0.20	BF250 0.28	J112 0.30	20 way 0.14	PCB SIDE ADJUST
4610B 0.46	74HC193 1.01	311 Comparator 0.44	BYX71-800 1.10	BFR50 0.44	IRF840 7.50	22 way 0.16	PCB SIDE ADJUST
4614B 0.46	74HC240 0.58	324 Quad Op/Amp 0.41	BY206 0.20	BRSR5 0.44	MJ2501 1.46	24 way 0.17	500R-200K 0.50
4614B 0.91	74HC244 0.95	3340 Elec Attenuator 1.30	40HF20 1.16	BUS48P 2.85	MJ2501 1.52	28 way 0.20	500R-200K 0.50
4618B 0.40	74HC245 0.95	398 Sample & Hold 3.95	40HFR20 1.16	IRF520 1.75	MTPN810 1.85	22 way 0.16	
4643B 0.50	74HC251 0.43	714 Precision Op/Amp 4.48	M16-100 0.93	J112 0.30	MJ2501 1.46	24 way 0.17	
4647B 1.23	74HC273 0.83	741 Op/Amp 0.18	M16-100R 0.93	IRF840 7.50	MJ2501 1.52	28 way 0.20	
40174B 0.48	74HC354 0.51	555 Q timer 0.46	M25-100R 1.27	IRF840 7.50	TLN105A 0.44	40 way 0.28	
40192B 0.58	74HC373 0.79	759 Power Op/Amp 2.72	M25-100R 1.27	IRF840 7.50	TLN105 0.40		
40193B 0.58	74HC374 0.79	SWITCHED REGULATORS	MTPN810 1.85	MJ2501 1.46			
40194B 0.56	74HC4002 0.71	3524 PSU Controller 2.85	MTPN810 1.85	MJ2501 1.46			
40195B 0.83	74HC4024 0.54	3528 PSU Controller 3.89	TPS703A 1.25	MJ2501 1.46			
40373B 1.10	74HC4040 0.54	3528J Ceramic Package 4.92	TLN105A 0.44	MJ2501 1.46			
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31

Ray Marston presents a concise survey of popular 'sensor' type devices.

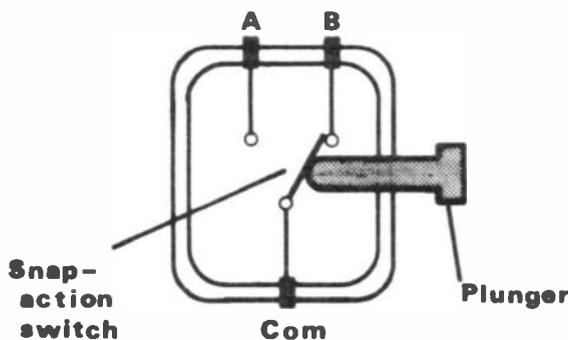


Fig 1 Basic structure of a microswitch

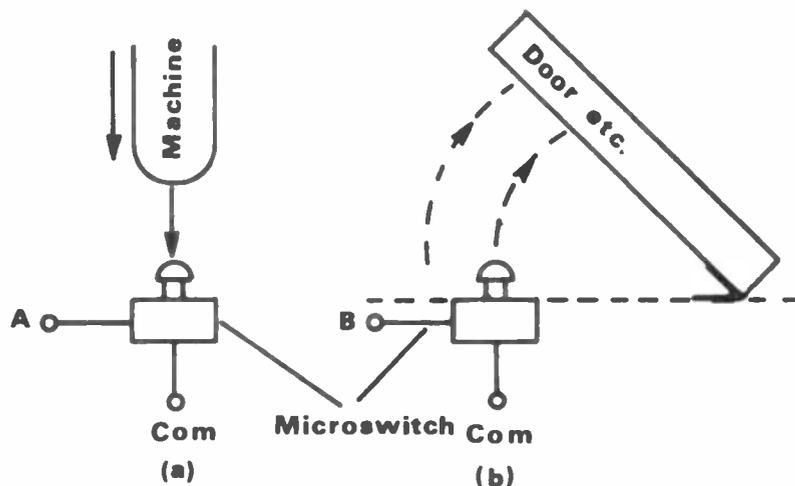


Fig 2 The microswitch can be 'closed' by either (a) pressing or (b) releasing the plunger

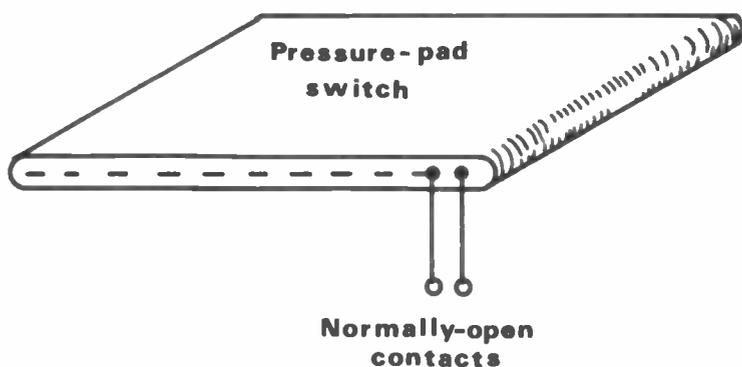


Fig 3 Typical form of a pressure pad switch

A wide range of 'sensor' devices are available to detect or respond to phenomena such as physical contact, light or heat levels, or mechanical movement, etc. Often, these sensors are used in 'security' applications in the home or factory. In the present edition of 'The File' we present a brief survey of the

best known and most readily available of these sensors.

'Contact' sensors

Microswitches: The microswitch is a very simple type of contact sensor. Figure 1 shows its basic structure. It comprises a snap action, single pole

changeover switch that can be changed from one state to the other via the mechanical movement of a plunger.

Note that the device's changeover action enables it to be used in such a way that it acts as a switch that closes when the plunger is either pressed or released, as shown in Figure 2. Thus, in Figure 2a the switch outputs are taken from contacts COM and A, which close when the 'machine' pushes the plunger down, as in 'end of movement' detection applications.

In Figure 2b, on the other hand, the switch outputs are taken from contacts COM and B, which close when the door (or window, etc) opens and releases the normally compressed plunger, as in intrusion alarm applications.

Pressure-pad switches: These are flat pad-like switches that can easily be hidden under a mat or carpet. The switches are normally open, but close under the weight of an intruder and can thence be used to activate an alarm, etc. The switches are normally hidden below a carpet in places where they are likely to be trodden on, such as under windows or at the bottom of stairs, etc.

Window foil: This is fragile self-adhesive aluminium tape that is meant to be stuck to the surface of a glass window, etc, to form a closed circuit. The tape fractures readily when the glass is broken and can thence be used to activate an alarm, etc.

Reed relays: These devices typically comprise a pair of magnetic tongues or reeds that normally repel each other and are housed in a gas-filled glass envelope. The two reeds can be forced into mutual contact by placing the device within a suitable external magnetic field, which can be generated via either a solenoid or a permanent magnet, as shown in Figure 4. Special reed-operating magnets are readily available, and give effective operating ranges of several millimetres.

The reed relay/magnet combination is probably the most popular of all door/window intrusion detecting units in home security installations. In use, the magnet is simply installed in the edge of the door or opening window, opposite the reed relay that is installed in the frame, as shown in Figure 5. When the door/window is closed, the adjacent magnet holds the reed relay closed; when the door/window is opened the magnet moves away from the reed relay, causing its contacts to open.

In practice, most commercial units of this type have two sets of output wires from the reed relay unit, one set giving normally open operation and the other giving normally closed operation, for maximum versatility.

Tilt switch: This device comprises a pair of wetted metal contacts and a globule of mercury, sealed within a suitable housing, as shown in Figure 6.

When the switch is held level the mercury rests on both contacts, which are thus shorted together. If the switch is tilted a significant amount the mercury globule will roll to one side and free itself from one of the contacts, thus forming an open switch.

Light sensitive devices

Light dependent resistors (LDRs): Each of these devices consists of a pair of metal film contacts separated by a snake-like track of cadmium sulphide (CdS) film, designed to provide the maximum possible contact area with the two metal films. The structure is housed in a clear plastic or resin case to provide free access to external light, and device operation relies on the fact that the conductive resistance of the cadmium sulphide film varies with the intensity of light falling on its face. This resistance is high (perhaps as high as a megohm) under dark conditions and is low (perhaps only a few tens of ohms) under bright conditions. Figure 7 shows the basic construction of the LDR, and Figure 8 shows the LDR symbol.

Practical LDRs come in a variety of sizes. They are fairly slow acting devices and are best used in applications where a response to ambient light level is needed. Figures 9 and 10 show how they can be used in conjunction with an op amp and a relay to make precision light or dark operated switches that activate the relay when the light level goes above (Figure 9) or below (Figure 10) a level preset via RV1. Note in each case that RV1 should have a mid value that roughly equals the LDR resistance value at the required triggering level.

Phototransistors: All semiconductor junctions are sensitive to the presence of light; when they are reverse biased their leakage currents are proportional to the light intensity on the junction. Normal diodes and transistors are specially protected from light with an opaque covering. Photodiodes and phototransistors, on the other hand, have no such protective covering and are used to exploit this light-sensitive characteristic. They are represented by the symbols of Figures 11 and 12.

Normally, these devices are less photo-sensitive than the LDR, but have far quicker response time. They are thus particularly well suited to use in fast acting opto-communication systems, etc. Some photodiodes and phototransistors are specifically designed to respond to the infra-red (IR) spectral response range.

Solar cells: So-called 'solar' cells are actually photo-voltaic units that convert light directly into electrical energy. Figure 13 shows the symbol used to represent a single solar cell, which generates a typical open circuit voltage of about 500mV (depending on light intensity) when active. Individual cells

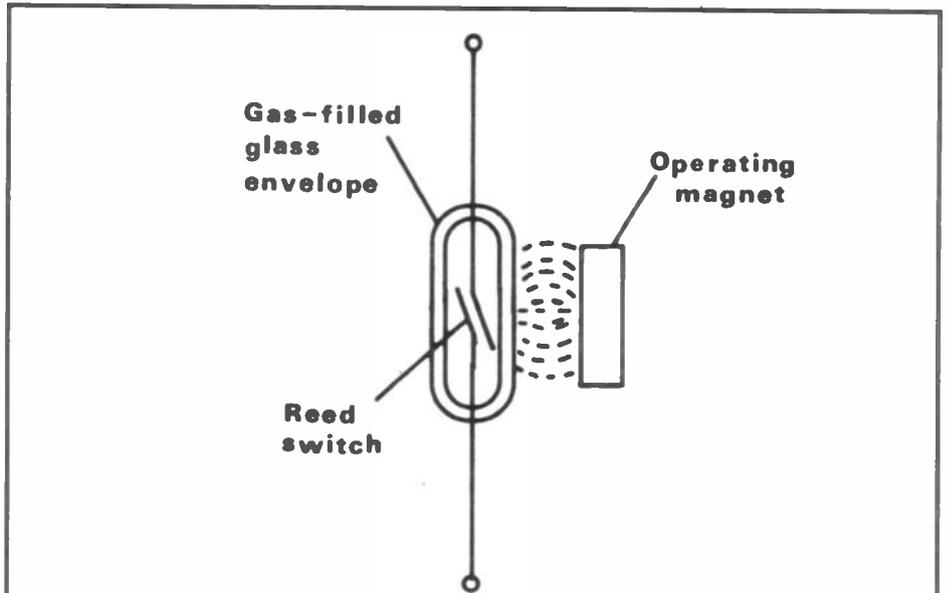


Fig 4 Reed relay and operating magnet

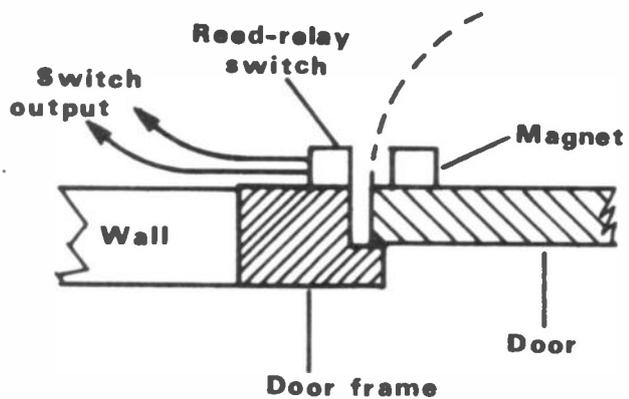


Fig 5 Method of fixing a reed relay/magnet combination to a door

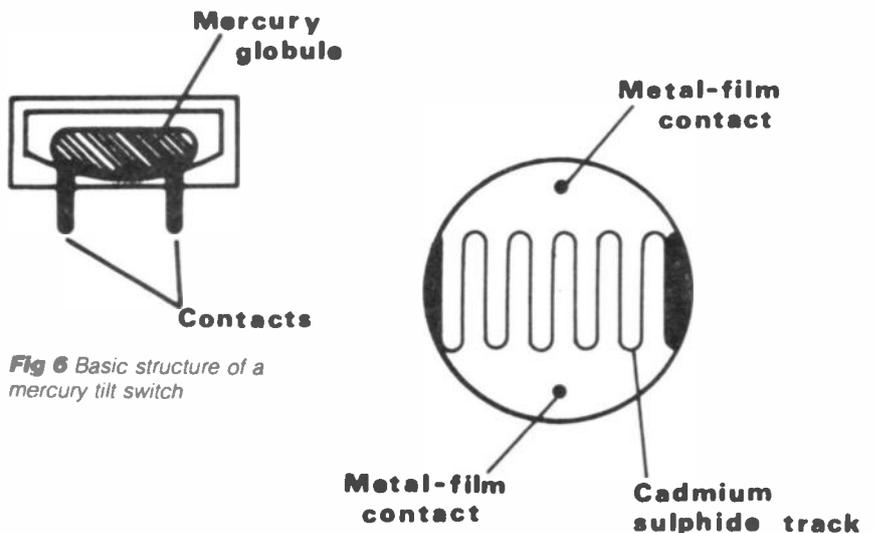


Fig 6 Basic structure of a mercury tilt switch

Fig 7 Basic structure of the LDR



Fig 8 LDR symbol

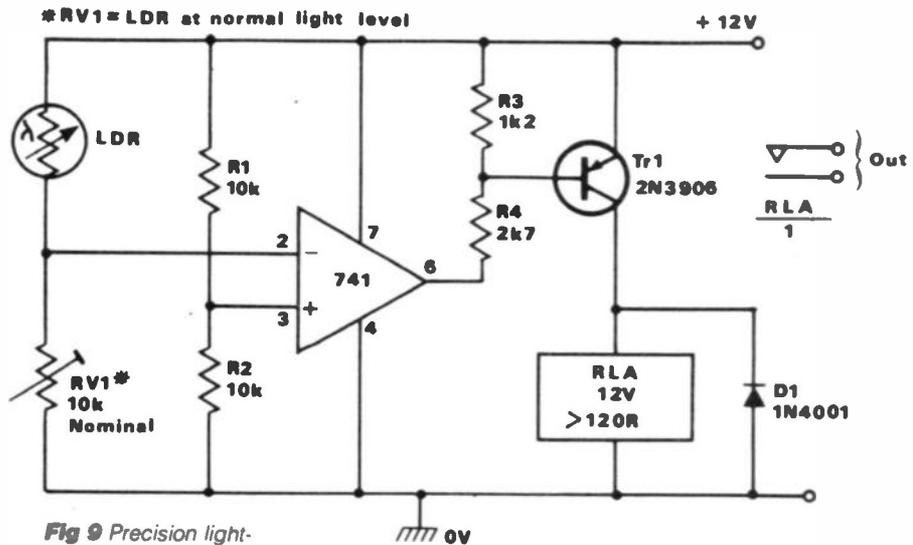


Fig 9 Precision light-activated relay switch

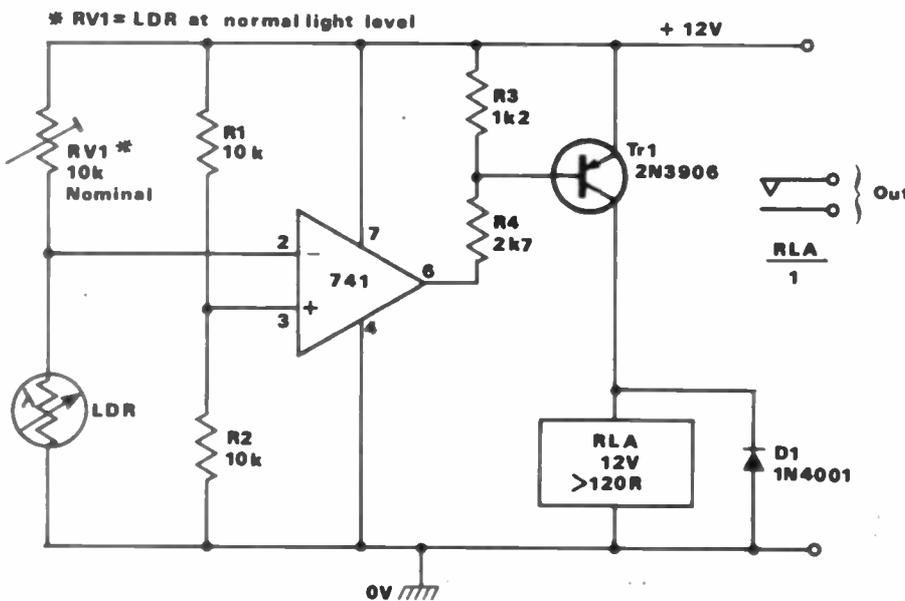


Fig 10 Precision dark-activated relay switch



Fig 11 Photo-diode symbol



Fig 12 Photo-transistor symbol

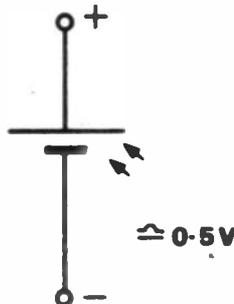


Fig 13 Symbol of a single solar cell

can be connected in series to increase the available terminal voltage.

The available output current of a solar cell depends on the light intensity, on cell efficiency (typically only a few per cent), and on the size of the active area of the cell face. Note that available sea level light energy is typically in the range 0.5kW to 2kW per square metre on a bright sunny day, so there is plenty of 'free' energy waiting to be converted!

Heat sensitive devices

Thermostats: The thermostat is a simple heat sensitive mechanical device that is represented by the symbol of Figure 14. Its heart is a conductive bimetal strip, made of two different metals that are bonded together along their length. When the strip is heated, its metals expand at different rates, thus causing the strip to bend. At a certain temperature the bent strip comes into contact with a fixed terminal, thus completing a conductive path and making the device act like a closed switch. At lower temperatures the device acts like an open switch.

Thermostats are slow-acting devices with relatively poor thermal sensitivity. Usually, their trip temperatures are adjustable over a limited range.

Thermistors: These devices (Figure 15) produce a resistance that is very sensitive to temperature. Some thermistors are designed to give a positive temperature coefficient (ptc), in which the resistance increases with rising temperatures, and others are designed to give a negative temperature coefficient (ntc), in which the resistance falls with rising temperature.

A wide selection of thermistor types are available, covering the temperature span -55 to +240 degrees centigrade, over a very wide span of resistance values. The two best known types of

thermistor construction are the 'rod' types and the 'bead' types. Rod types are fairly inexpensive but offer poor selection tolerance between different devices of the same type; bead types are more expensive but offer good selection tolerance.

Thermistors can be used (in conjunction with suitable electronic circuitry) in all applications where precision temperature control or measurement is required.

Silicon sensors: All silicon junctions, including those built into ordinary silicon diodes and transistors, have an inherent temperature coefficient of about -2mV per degree centigrade. Thus, if a silicon diode is forward biased with a fixed current and generates a forward voltage of 600mV at 20°C , its forward voltage will drop by 20mV (to 580mV) if the temperature is raised to 30°C . Any silicon diode or transistor can thus be used as a temperature sensor. A number of dedicated ICs are available that exploit this principle, and act as precision temperature to voltage converters.

Movement detectors

Infra-red beams: One of the most effective ways of detecting unauthorised movement within a protected area is to project an infra-red light beam across the protected area and on to the face of a matching infra-red detector, so that any intruder will inevitably have to break (pass through) the beam and thence activate a suitable alarm action. *Figure 16* illustrates the basic principle.

Note from *Figure 16* that, for the system to be effective, the infra-red transmitter and receiver units do not need to be precisely aimed at each other, but merely have to form a line-of-sight contact.

Ultrasonic systems: Another way of detecting movement within a protected area is to place an ultrasonic transmitter and receiver (typically operating at about 40kHz) side by side as shown in *Figure 17*, so that the transmitter floods the room with ultrasound and the receiver checks the received frequency. If there is no movement within the room, the transmitted and received frequencies will be the same and no alarm action will be called for, but if there is movement within the room it will inevitably cause a doppler shift on the received signal, thus causing a difference between the transmitted and received frequencies; under this condition a suitable alarm action can be initiated.

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Fig 14 Thermostat symbol



Fig 15 Thermistor symbol

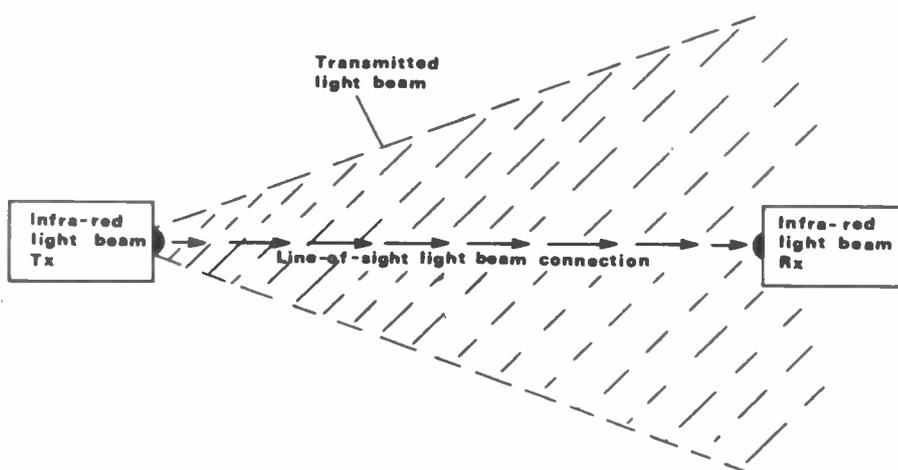


Fig 16 Infra-red light beam alarm system

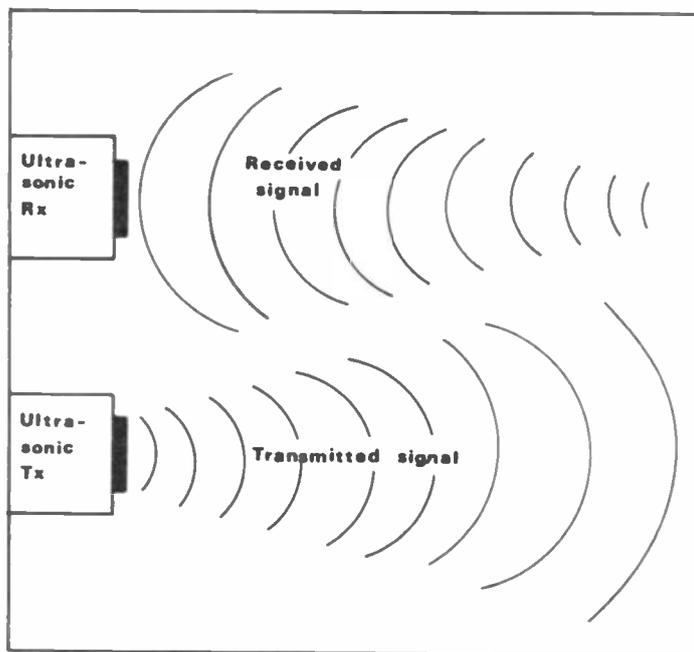


Fig 17 Basic ultrasonic alarm system

Ken Williams Remembers:

STRAIGHT RECEIVERS

It is over eighty years since the first radio signals transmitted by amateurs were heard on the air in this country.

Of course, the technology of that time using spark transmitters, coherers and crystal receivers would be totally unacceptable today; in fact, for many years the former have been specifically banned by international law. This technology, although it proved the viability of wireless communication, did not last for very long and by the early 1920s was replaced by thermionic techniques.

Even so, crystal detectors were still used well into the 1920s and the Author remembers being shown an article by an amateur in a tattered magazine of that period, in which the writer claimed that by adding an additional 'cats whisker' to a crystal and applying suitable low voltages he could obtain amplification.

A footnote by the learned Editor stated that such a claim was, of course, impossible, but it was included as it was an interesting circuit! Right or wrong, the circuit given looked very like that of a transistor amplifier.

The work of Fleming and De Forest had brought first the diode and then the

triode valve and, by the beginning of the First World War, the basic theory of thermionic valve technology was well known.

When peace returned, as happened again some twenty-five years later, quantities of government surplus equipment were available for experimenters. In the succeeding decade, the manufacturers were vying to develop ever more complex and efficient valves, and every bookstall carried magazines giving full constructional details of new circuit designs and techniques by such giants as Scott Taggart in England, and Armstrong (who developed both FM and the superhet receiver) in the United States. Furthermore, the commercial manufacture of radio receivers was only in its infancy so, in general, if you wanted to listen to the radio, you had to build your own equipment. It was the golden age of the home constructor.

By the late 1920s, amateur radio signals from the United Kingdom had been heard almost all over the world and Gerry Marcuse, G2NM, had even received permission to radiate broadcast programmes. These were radiated to the Empire from his home, Coombe Dingle, near Caterham in Surrey, and although only operational for a few months, their success was directly responsible for the

inauguration of the BBC's Empire Broadcasting and later the Overseas Service on the short wave bands.

By the 1930s, DX was commonplace with leading operators using multivalve transmitters and receivers.

Surprisingly, in the United Kingdom, the majority of leading operators preferred simple straight two and three valve receivers and the superhet, although it had been invented as early as 1920 and had been successfully used in the 1923 transatlantic tests, never found favour among British amateur operators until the first commercial receivers, such as the RME69 and the HRO, found their way into the country immediately prior to the war.

Even immediately after the war, many short wave listeners used straight (ie not superhet) receivers and such designs for both amateur and broadcast equipment were appearing in some magazines well into the 1950s.

Surprisingly, many of the early post-war television receivers also employed a straight receiver circuit for both sound and vision, and it was not until the introduction of a second TV channel in the early 1950s that the superhet TV receiver became universal.

I think that it would be true to say that all of our remaining two letter call stations and many of our longer serving G3 plus threes cut their radio constructional teeth on straight one, two or three valve receivers.

In this modern age of transistors and microchips, it may be thought that there is no place for such circuits, but modern solid-state equipment can prove expen-

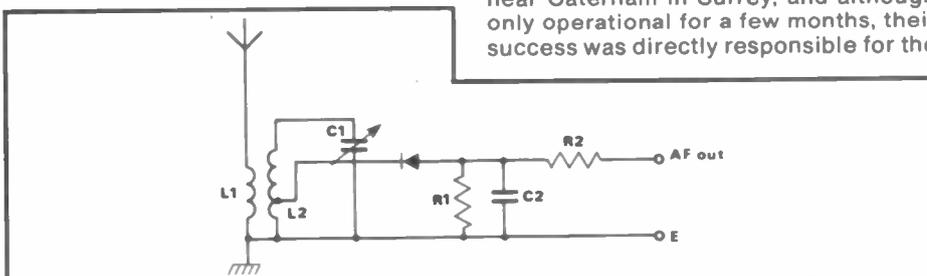


Fig 1 Basic diode detector. R_1 , R_2 would be in the order of 5-20k Ω , C_2 about 100pF and the tap about $\frac{1}{2}$ up from earth end of L_2

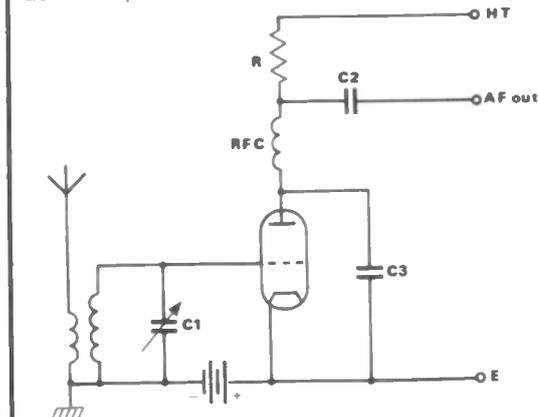


Fig 2 Basic anode-bend detector. The AF output is developed across R . C_3 is an RF bypass capacitor of low (47-100pF) value

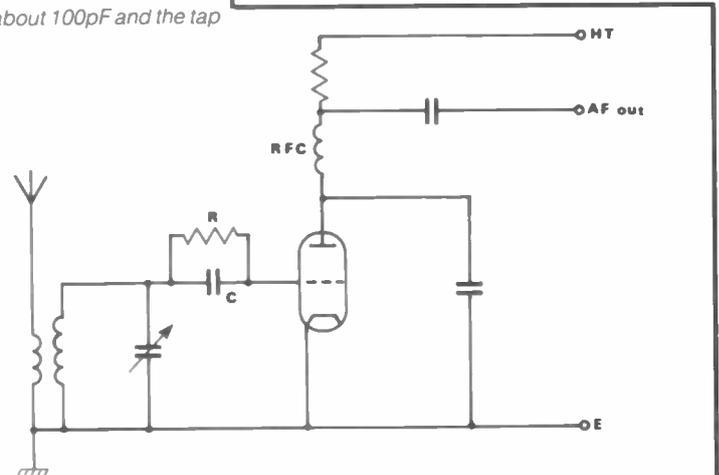


Fig 3 The basic leaky-grid detector. In this R and C provide self biasing

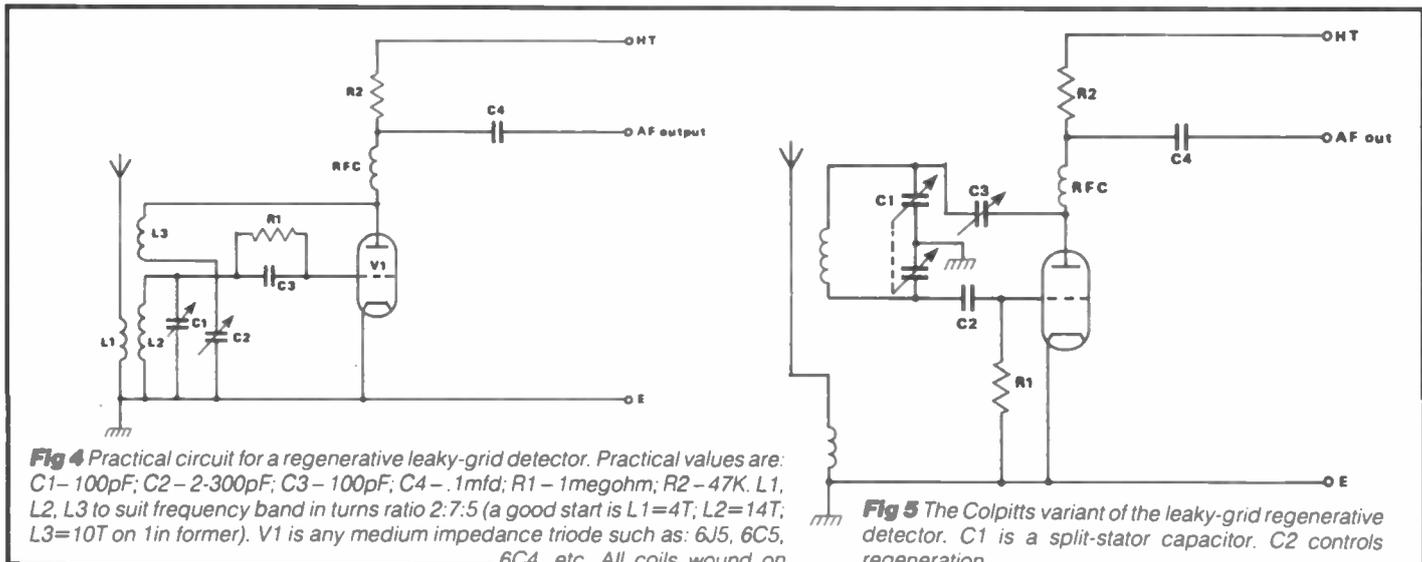


Fig 4 Practical circuit for a regenerative leaky-grid detector. Practical values are: C1-100pF; C2-2-300pF; C3-100pF; C4-.1mfd; R1-1megohm; R2-47K. L1, L2, L3 to suit frequency band in turns ratio 2:7:5 (a good start is L1=4T; L2=14T; L3=10T on 1in former). V1 is any medium impedance triode such as: 6J5, 6C5, 6C4, etc. All coils wound on the same former in the same direction

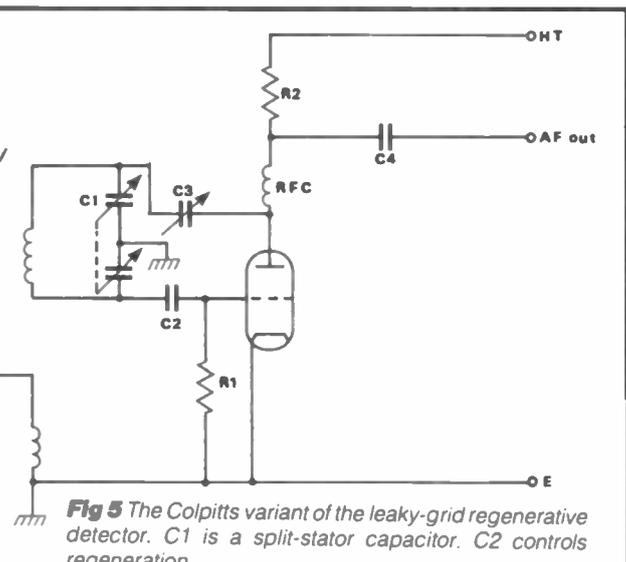


Fig 5 The Colpitts variant of the leaky-grid regenerative detector. C1 is a split-stator capacitor. C2 controls regeneration

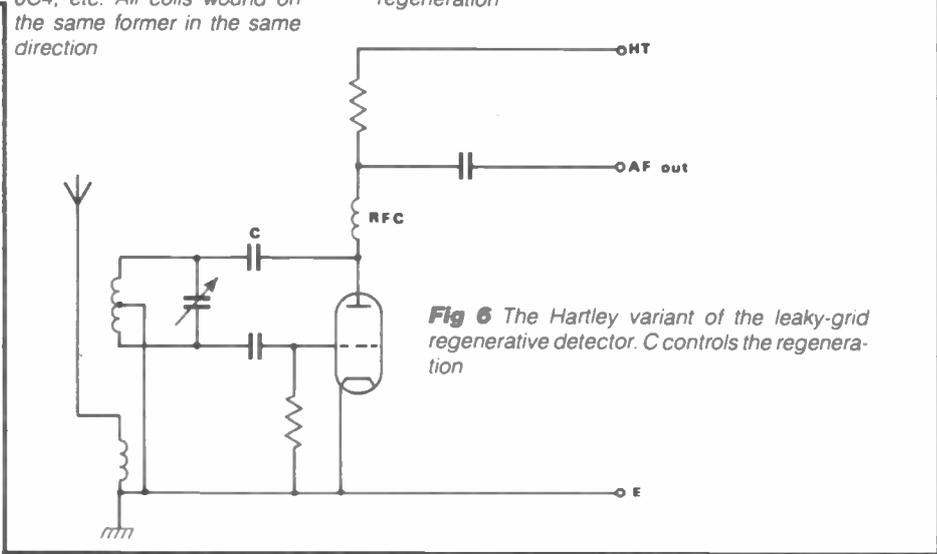


Fig 6 The Hartley variant of the leaky-grid regenerative detector. C controls the regeneration

sive. Even with the cheapest components, the modern technique is to construct on printed circuit boards which must be purchased or, if made at home, be accurate in design and manufacture. If a circuit modification is desired, a new board must be made and construction started afresh.

Perhaps this is one reason for an increasing interest in the older technologies for, by using hardwiring techniques, it is possible to vary the design almost infinitely, provided that the number of large holes required in the chassis remains constant. Furthermore, valves are very forgiving of misuse and rarely fail due to circuit errors. Despite the belief that valves deteriorate from the moment that they are first switched on, I would nevertheless estimate that over 90% of those which I have either purchased or received as 'free gifts' in club junk sales in recent years have been perfectly serviceable.

The simplest receiver circuits are capable of quite remarkable sensitivity, even when the valves are half a century old.

The first receiver which I constructed in 1944 used two valves provided by my grandfather which he had purchased in 1928. The other components were of similar antiquity. In 1946/7, this receiver logged over two hundred countries. How, then, were these receivers constructed?

THE TRF RECEIVER

The detector

One of the earliest valve circuits used was the simple diode detector which, when coupled to a good aerial and earth was (and still is) quite capable of receiving strong broadcast signals. However, for the purpose of receiving amateur signals, which are normally much weaker, it left much to be desired. When the triode valve was introduced, gain was at last possible in the detector stage.

One of the first circuits used was called

the anode bend detector which operated by externally biasing the valve almost to the point where the anode current ceased. The grid/cathode circuit then acted as a diode detector, the output of which was amplified by the grid/anode circuit. Also used was the leaky grid detector, which operated in a very similar fashion except that self biasing was provided by a capacitor in series with the grid, which therefore built up a charge which was then allowed to leak away to earth (hence leaky grid) by a high value resistor.

These circuits were a big improvement on the diode, but really were still inadequate for weak signal detection. The great breakthrough came with the addition of regeneration to the detector. This could most easily be applied to the leaky grid detector by arranging that a little output from the anode was fed back in the correct phase to the grid circuit. Provided that the feedback was insufficient to cause violent oscillation, the sensitivity of the circuit was improved beyond belief and weak signal reception was a reality.

Many different means were devised to

provide this feedback, with every experimenter extolling the virtues of his own design. In almost every case, the level of regeneration was controlled by a variable capacitor which was known in the United Kingdom as the 'reaction control'.

The object of all these circuits was to provide controllable positive feedback and so be able to hold the detector stage on the verge of oscillation, at which point it was at its most sensitive.

When the RF pentode was introduced, smoother control became possible by variation of the screen potential. This method of control also made it possible to use a development from the electron coupled oscillator circuit, which became very popular in the United States and with which the Author had considerable success in the mid-1940s.

It is interesting to note that regeneration has also been applied to other stages of the receiver. In the late 1920s, the famous designer Scott Taggart published a circuit in which an additional valve was placed across the grid circuit of the RF stage in order to provide regeneration without the associated

STRAIGHT RECEIVERS

noise. The same circuit appeared in the massive DST100 wartime communications receiver, which the Author can vouch was extremely effective.

More recently, regeneration was applied to the IF stages of some superhets to improve selectivity – only here it was called a Q-multiplier. Today this principle is termed 'positive feedback'!

Sensitive though the regenerative detector may be, the output from the

weaker signals was still not sufficient to be audible in the headphones. It was therefore desirable to amplify the output to a more realistic level by the addition of an audio amplifier stage. This could take the form of a simple triode stage or, in later years, one of the newly introduced power output valves, such as the 6V6 or 6F6, which could even drive a loudspeaker on the stronger signals.

This circuit line-up was also used in the late 1920s by some commercial receiver

manufacturers. The Author well remembers his amazement when, in 1954, he was faced with repairing a 1929 HMV Super Lowboy-2. This was a radiogram which used a two-valve receiver. The customer's complaint was that 'it didn't pick up the foreign programmes very well'. The workshop manager just produced a very dusty service sheet and told me to get on with it!

Flushed with the success of adding one audio frequency amplifier, many experimenters sought further improvement by adding yet another. This certainly made the output much louder and made reception of almost all signals possible on a loudspeaker.

For headphone reception, however, many considered that the extra stage provided too much audio gain and arranged the circuit so that the headphone jack took its output from the first amplifier stage, simultaneously disconnecting the output stage.

When listening to the loudspeaker, all stages were used.

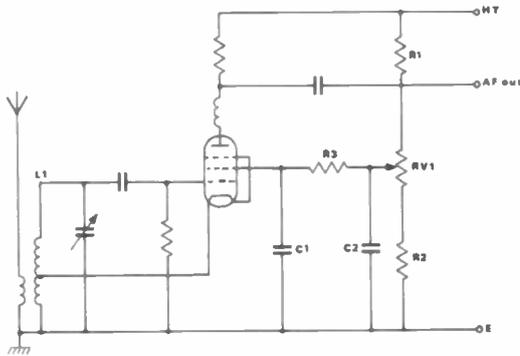


Fig 7 Another Hartley variant of the regenerative leaky grid generator. The regeneration is obtained by the cathode tap on L1 and controlled via R1, R2, R3, VR1. This circuit was popular in the USA. Potentiometers are, of course, cheaper than the variable capacitors used in the other circuits

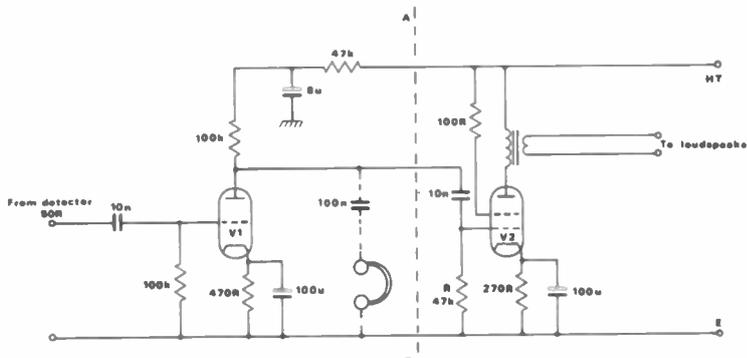


Fig 8 Practical circuit of an audio and output stage, which may be used individually or together. If only headphone output required, everything to the right of AB may be omitted with headphones connected as shown by dotted connections. For volume control, R may be replaced by a 4K or 100K log potentiometer, with grid of V2 connected to moving arm. Values shown will prove suitable for almost all types of low power valves

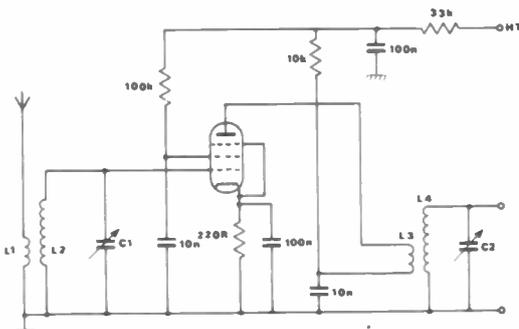


Fig 9 Practical circuit diagram for an HF RF amp. Values shown will be suitable for many different types of valves, eg 6K7, EF92, but if a high gain valve, like EF91, is used the output will have to be well screened from the input circuit. C2 L4 is the input circuit for the following stage. C1 and C2 may be ganged for ease of operation

Radio frequency stages

When listening to weak signals on a simple receiver such as we have been discussing, the noise level of the detector circuit could easily be heard to be masking the weakest signals. The next task was therefore to add an amplifier before the detector stage. This was not, in the beginning, as easy as it may seem, for until the late 1920s only triode valves were available and their performance was so poor it made the advantage of RF amplifiers questionable.

With the introduction of RF tetrodes and pentodes, this situation changed. Unfortunately, the pre-war valves had very little gain and, although one stage would give some advantage, two stages were needed for optimum performance.

For many years, two RF stages were felt to be necessary. Most of the classic receivers up to, during, and immediately after the war, such as the HRO, the AR88, the CR100 and even some post-war Eddystone receivers, used this number. Since that time, however, the gain of RF valves has increased to such a degree that one stage can provide all the gain which can possibly be used.

Low noise

More recently, the development of low noise mixer stages has entirely eliminated RF amplification from most modern HF communications receivers.

With the addition of RF stages, other advantages were evident – with the aerial feeding directly to the detector, the loading of the aerial upon the grid circuit could seriously affect its operation, even to the point where it was impossible to bring the stage to the point of oscillation. Furthermore, on a windy day, the variation of aerial characteristics due to movement could make it almost impossible to control the reaction

for optimum performance. The RF stages provided sufficient isolation to eliminate these problems. They also prevented the radiation of a signal if the detector burst into oscillation!

Terminology

Nowadays, when describing our equipment over the air, we just say that we have an FT225 or an IC271 and these are sufficiently well-known to require no further comment. When most equipment was home built, a full description could be quite long-winded, so a shorthand form became common.

In this, the letter V was used to represent the detector stage and a prefix and a suffix represented the number of stages prior to, or succeeding, the detector. Thus, a receiver with one RF stage, a detector and two audio stages would be described as a 1-V-2 whilst a detector/LF arrangement would be an 0-V-1.

You'll be surprised!

It is a long time since I heard of anyone building a simple straight one, two or three valve receiver, but I am sure that if anyone did they would be pleasantly surprised with the results which they could obtain.

Two pages from 'Radio for the Million', September 1927. This receiver cost about £10:16/6d (we don't understand old money!) to build. A good wage at the time was £2



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100/16, 100/25 7p, 100/50 12p, 100/100.....	14p
220/16 8p, 220/25, 220/50 10p, 470/16, 470/25.....	11p
1000/25 25p, 1000/35, 2200/25 35p, 4700/25.....	70p
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MULTI ARRAY AERIALS

This article describes the design of compact, high gain, multi-array aerials for UHF television and VHF/FM radio, and was originally prompted by the need to adapt and improve an existing home-built indoor television aerial. This was being used to receive the four local television transmissions within channels 22 and 33.

Having already found that reasonable quality TVS (Television South) signals were receivable in the Southgate area of North London on channel 42 using a separate indoor aerial, it was decided to find a way to convert the folded dipole 'local' aerial to receive all five channels. Physically and electronically this was no easy task, because although the five channels are all horizontally polarised, the fifth channel requires an aerial beamed in a different direction to the one for the four local channels. Also, resonant element lengths and spacings are different for channel 42.

Figure 1 shows the construction and dimensions of the folded dipole aerial that was already used for reception of the local television channels (11 in is half-wave for 533.65MHz, approximately channel 28). It was made of heavy-gauge wire and connected to the coaxial feeder cable by a plastic terminal block, which also secured the dipole in a convenient indoor position at the top of a window frame.

It is assumed that readers will not already have an aerial of this type in position, so it is, in effect, the first part of the project to construct and, with the tapping points shown in Figure 1 well defined and tinned in advance for subsequent connection of further elements, this sub-assembly forms the heart of the multi-array aerial. The tapping points were found by experiment and are quite precisely defined nodes at a distance of $\frac{3}{4}$ in from each end of the folded dipole; the distant signal being sought was found to peak strongly when the first two of three

Ivor Nathan presents some compact, high-gain aerials for UHF television and VHF/FM radio

subsequent Yagi arrays (to be described) were connected while the signal was being observed. The effect was similar to the fine tuning that can be obtained by adjusting Lecher lines and resonant cavities, especially as used in radar applications.

The given dimensions of the dipole are for optimum reception of the four London channels but, when augmented by the extra sections to be described later, the finalised multi-array aerial forms a wide bandwidth, high-gain device that gives an outstanding performance over the entire UHF television band.

Figure 2 shows how 15 directors were added to the dipole as three separate Yagi arrays of five elements each; the

eccentric layout was unavoidable because the indoor aerial was fitted into the curved bay of a set of window frames, where space was restricted, and because received signals were from two different directions at this location. Figure 3 shows an improved, but unidirectional, symmetrical layout for the finished aerial, but it is dependent on the individual constructor's receivable channels and on the space available.

If preferred, a rugged version of the aerial could be built using the symmetrical layout, and it could be installed in the loft space, where it would occupy an area $1\frac{1}{2}$ ft long and $2\frac{1}{2}$ ft wide; considerably less than a conventional 3-bay Yagi aerial. All diagrams in this article show configurations for horizontally-polarised signals, except Figure 6.

Figure 4 shows the dimensions and spacing of the five director elements which are required for each of the three arrays; for a light, neat, indoor version of the aerial, $\frac{1}{8}$ in aluminium rod or tube can be used for the elements, and each one can be forced through holes drilled in a light, plastic support boom (a suitable length of plastic, as used for report binding, can be very effective; no adhesive is required if the aluminium elements are forced into slightly undersized holes drilled in the plastic).

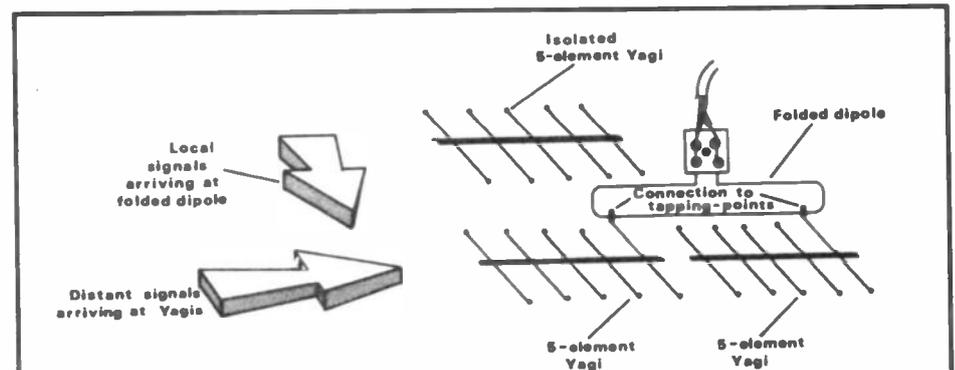


Fig 2 Addition of three Yagi arrays, arranged eccentrically

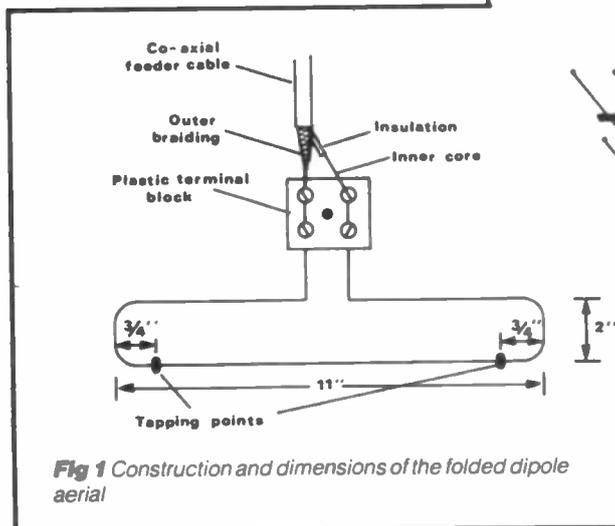


Fig 1 Construction and dimensions of the folded dipole aerial

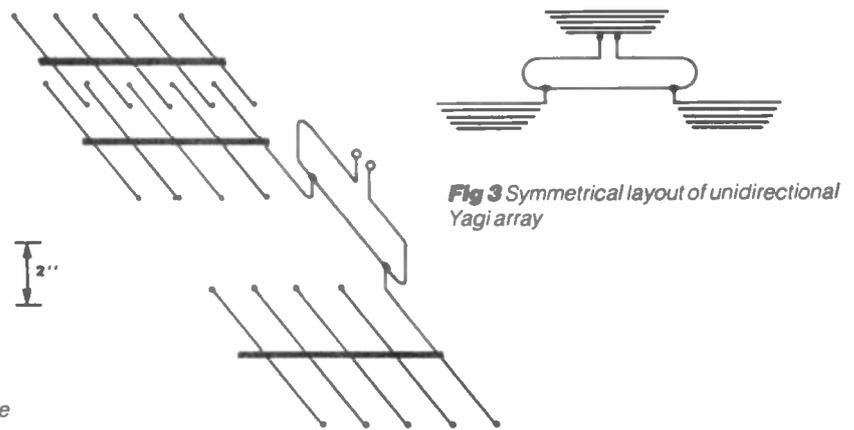


Fig 3 Symmetrical layout of unidirectional Yagi array

For channel 42 (vision signal on 639.25MHz) each half-wave element should be 9in long, and the spacing between successive elements is 3in. For optimum results, elements should be cut to half a wavelength long at the frequency of the channel to be received. In practice, the first element in each of two arrays must be cut about 1/2in oversize to allow one end of each to be attached (using a tightly coiled wrap of heavy gauge wire) to each end of the folded dipole, at the tapping points shown in *Figure 1*.

It is essential to ensure efficient electrical contact at these two points, and it is advisable that these connections be soldered to avoid any doubt. Note that only two of the three Yagi arrays are electrically connected to the folded dipole; the third Yagi should be placed centrally to, and slightly above, the other two, but care should be taken to ensure that there is no electrical contact between any of the individual elements nor between the three separate Yagi arrays.

If the aerial is to be installed in a loft space, it can be made more durable and given greater bandwidth and capture effect by increasing the aluminium rod diameter from 1/8in to 3/16in. Any convenient method of attaching each element to its supporting, insulated boom may be used. If the folded dipole is also to be strengthened, it could be constructed from 3/16in diameter aluminium as well, but tube is preferable, for easier folding.

A modified method of connecting it to a plastic terminal block and the coaxial feeder cable must then be employed, if the tube will not fit into the terminal block connection holes. The simplest way to do this is to first terminate each end of the folded dipole with a tightly coiled wrap of heavy gauge wire and then feed each wire into the terminal connections before securing the four terminal screws which join the dipole to its coaxial feeder cable. When installed in a loft space, it is a simple matter to add a thirty-inch reflector, made of 3/16in diameter aluminium rod or tube and spaced six inches behind the folded dipole, to provide even greater gain and directivity (*Figure 5*). The reflector was dispensed with for the room aerial version due to lack of space.

Constructors who have access to metal workshop facilities may wish to construct an even more ambitious version of this television aerial array, using a metallic ball-and-socket connection at each tapping point for the two Yagis, so that these may both be orientated to receive signals whose polarities are different to those of the signals arriving at the reflector and folded dipole (*Figure 6*). This would also allow optimum adjustments to be made so that 'twisting effects' experienced by long distance signals arriving at the aerial could be accommodated - an added bonus for DX enthusiasts! The folded dipole would, in this case, need to

be made of tubing other than aluminium so that the ball-and-socket ends could be soldered to it; tinned copper would be ideal.

The basic room aerial, as shown in *Figure 2*, is being used with a mains-powered aerial amplifier and, in North London, near the Hertfordshire border, gives good reception of the four London channels, entertainment quality signals from the distant TVS station at Hannington, and several other weaker signals between channels 21 and 68.

The same concept can be adapted for use as a high gain, directional aerial array for VHF/FM stereo radio reception, providing distortion-free reception of local stereo transmissions and good,

interference-free mono reception of distant transmissions. For these Band II frequencies (as opposed to Bands IV and V already discussed), dimensions and spacings must be multiplied approximately by a factor of six for resonance at VHF instead of at UHF. This results in a necessarily large aerial system, which can be accommodated in a roof loft space rather than outdoors, where high winds could cause problems.

Nevertheless, because of the compact arrangement of the three Yagi arrays, it only occupies an area approximately 9ft long and 16 1/2ft wide, which is considerably less than a conventional, equivalent, VHF array. Thus, it is easily fitted within an average loft and there

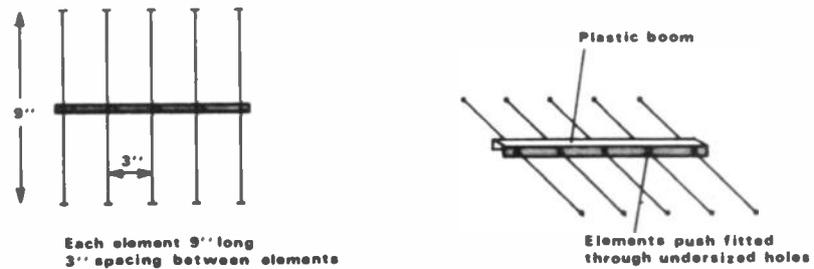


Fig 4 Dimensions and spacing of one set of five director elements

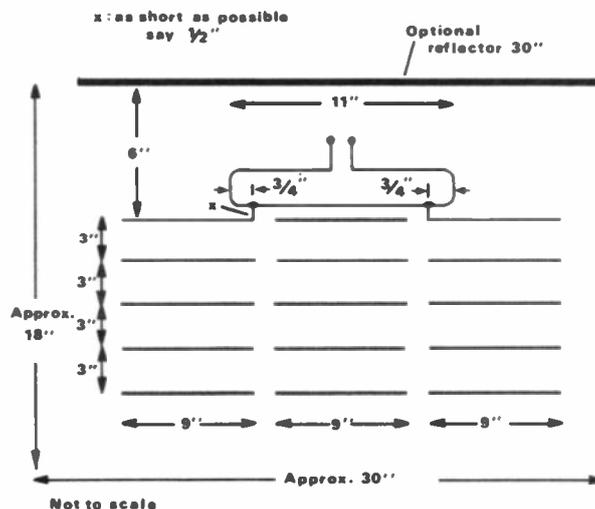


Fig 5 Complete 17 element array, including reflector: UHF television

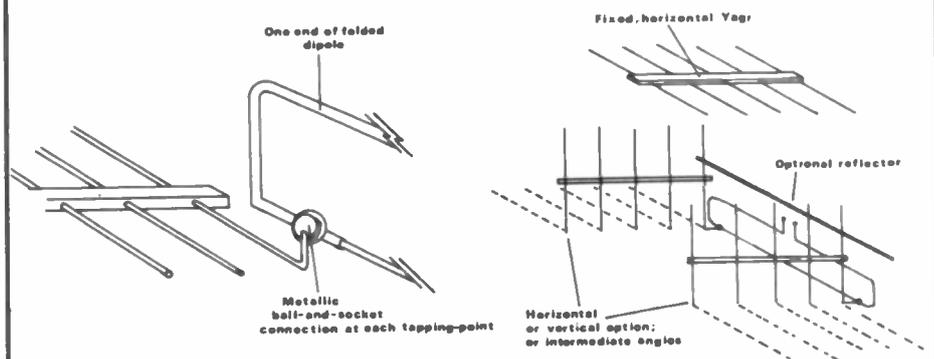


Fig 6 Ball and socket version, variable polarity

MULTI-ARRAY AERIALS

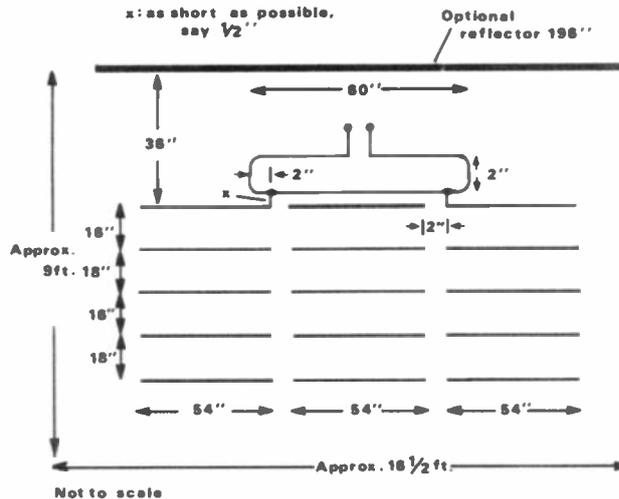


Fig 7 Complete 17 element array, including reflector: VHF/FM radio

should be sufficient room to include a reflector made of $\frac{3}{8}$ in aluminium tubing, cut to a length of 198in and mounted 36in behind the folded dipole.

Because of the need for rigidity in this instance, the folded dipole must be made of $\frac{3}{8}$ in aluminium tubing and folded, as shown in *Figure 7*, to measure 60in from end to end after folding. This requires approximately 124in of tubing, to allow

for folding and terminating via a plastic terminal block, leaving a distance of approximately 2in between the back and front of the folded dipole. The tapping points for connection of the two Yagi arrays are at a distance of 2in from each end of the folded dipole, which is cut to resonate at 97.50MHz, approximately at the centre of the 88 to 108MHz VHF radio band.

Again, 15 directors are used as three separate Yagi arrays of five elements each. Each half-wave element should be 54in long, and spacing between successive elements is 18in. As before, the first element in each of the two arrays should be about $\frac{1}{2}$ in oversize to allow one end of each to be attached (using a tightly coiled wrap of heavy gauge wire) to each end of the folded dipole, at the 2in tapping points shown in *Figure 7*. As with the UHF television version of the array, the third Yagi is placed centrally to, and slightly above, the other two; again, ensure that there is no electrical contact between any of the individual elements nor between the three separate Yagis.

The aerial should be built upon strong, insulating booms, preferably made of plastic. However, in the accompanying diagrams details of this structure are not given because they are completely standard. Similarly, although not shown, it may prove helpful to support the ends of the Yagi booms with polypropylene cords attached to timbering in the loft space.

All aerials described in this article have a nominal impedance of 75 ohms; the safety precaution of fitting isolated coaxial plugs to feeder cables must be observed when connecting these aerials to live chassis receivers.

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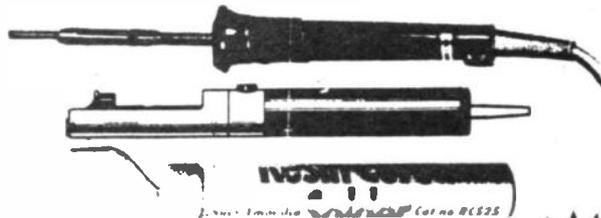
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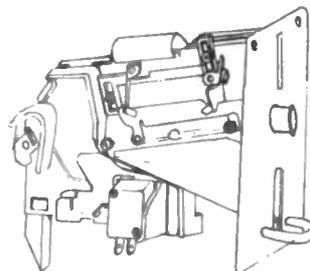
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AUTOMATIC SEND/RECEIVE FOR RTTY

A project from W G Borland G3NXM

On the HF bands, I use a Spectrum Plus computer and a TS130S transceiver for RTTY. This transceiver has a VOX facility which can be actuated by the tone from the computer, and therefore one can have automatic send/receive. There is some local RTTY activity on 2 metres and, while the FT290R has PTT, it does not have VOX. Some circuit was required that would operate the PTT line from the output tone of the computer.

A good circuit

There are some units available which incorporate a small relay, the contacts of which are connected to the PTT line and so operate the relay in the transceiver. However, the operation of two relays takes a certain amount of time and if the 'type ahead' of the computer program is used, this slight delay before both relays 'make' means that the first few letters are not transmitted. If the circuit was in the form of an electronic switch, the changeover to transmit would be faster as there would only be the relay in the transceiver to operate.

The problem was to find such a circuit. Fortunately, G8UIX came to the rescue and designed the circuit shown in Figure 1. The 741 operational amplifier is biased to 5.1 volts by means of the Zener diode ZD1. Therefore, without an incoming

signal, the output from the op amp will be 5.1 volts. This output will be blocked off from the transistors by another Zener diode, ZD2, which is also rated at 5.1 volts.

The tone from the computer is about 1.3 volts and when applied to the input of the circuit results in the output of the op amp being raised to 6.4 volts, a mixture of dc and audio. This is then rectified by D2. The Zener diode ZD2 only passes the voltage in excess of 5.1, in this case 1.3 volts. This is applied to the base of the transistor T1, turning on transistor T2, allowing it to conduct and opening the path between the PTT line and earth. This, in turn, activates the relay in the transceiver, switching it on to transmit.

VR1 adjusts the sensitivity. In the prototype it was set to half value and did not require further adjustment. D1 prevents any back EMF from the transceiver relay from affecting the circuit.

A difficulty may arise with the Zener diodes. Their tolerance is often only 10%, which means that one rated at a nominal 5.1 volts could be anything between 4.5 and 5.5. If ZD1 was 4.5 and ZD2 5.5 volts, the output from D2 with the computer tone applied would be only 5.8 volts (bias 4.5 plus audio 1.3 volts) and the output from ZD2 to the transistor base only 0.3 volts. It is doubtful if this would be

sufficient to turn on the transistors. If these Zener diodes were changed over, then the output from ZD2 would be 1 volt, even without an input from the computer, and the transistors would be turned on permanently. If either of these conditions occur, try different Zener diodes until you get a reasonably matched pair. Their actual value is not critical as long as they are about 5 volts.

Figure 2 shows the etched side of the printed circuit board. All holes are 1mm except the three marked 'x', which are for VR1 and are 1.5mm or 1/16in. Figure 3 shows the component layout.

This unit, together with the RTTY filter, was built into a control box which had a three-position switch allowing the choice of (a) a microphone using either its own PTT switch or a send/receive switch on the control box, (b) RTTY using the control box send/receive switch, or (c) RTTY with automatic send/receive. In position (b) voltage is applied to the filter only, and in position (c) to both the filter and the PCB, no voltage being applied when in position (a). Unfortunately, the operation of this switch sometimes caused the computer to 'crash' even though the voltage was obtained from a separate supply.

Obtaining the voltage

However, it is quite practicable to obtain the necessary voltage from the Spectrum power unit. This is rated at a nominal 9 volts but actually measured 10.2. The control box was connected to

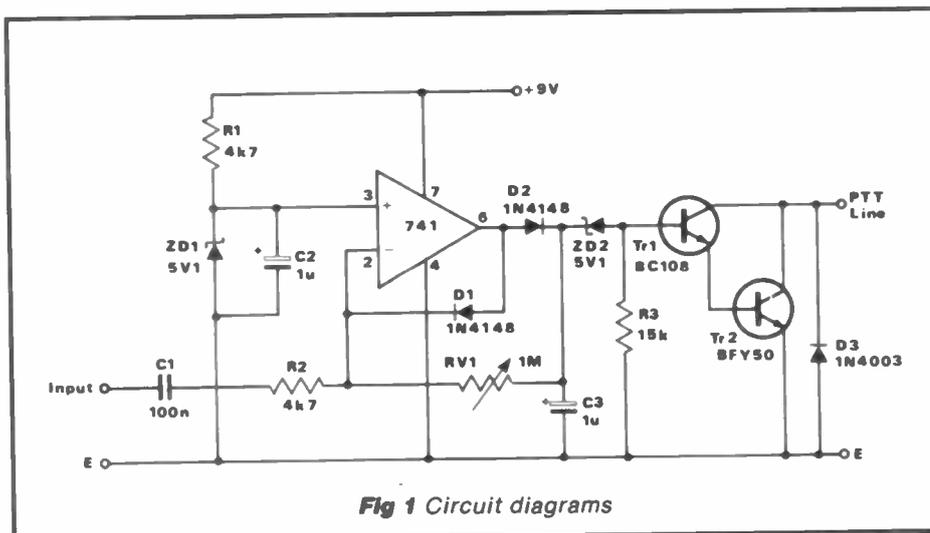


Fig 1 Circuit diagrams

Parts List

R1,2	4.7 kilohms
R3	15 kilohms
R4	39 ohms
VR1	1 megohm
C1	0.1μF
C2,3	1μF electrolytic 25V wkg
D1,2	1N4148
D3	1N4003
ZD1,2	5.1 volt Zener diode
ZD3	9.1 volt Zener diode
IC	LM741
T1	BC108 or similar
T2	BFY50, 51 or smaller

Single-sided copper clad board, metal box, wire, connectors, etc

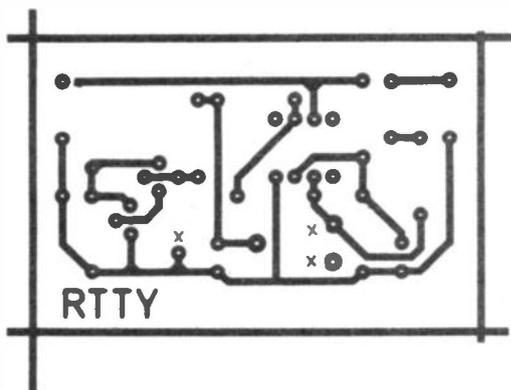


Fig 2 Printed circuit board, foil side. Holes marked 'X' are 1.5mm (1/16in). Remainder are 1mm

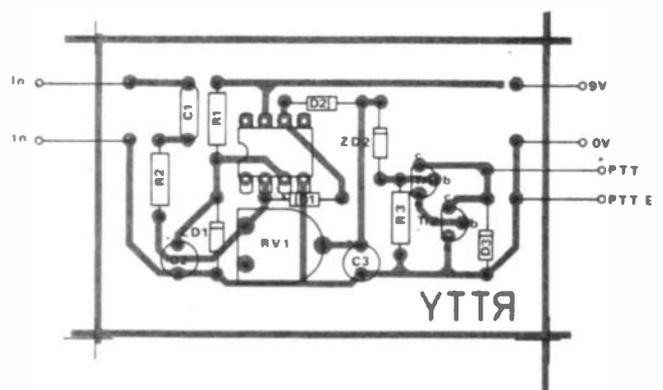


Fig 3 Printed circuit board, component side

this power unit via the stabilising circuit shown in *Figure 4*. The Zener diode prevents any surges or spikes caused by the switching from affecting the computer and causing it to crash. As a bonus, when the supply to the computer is switched off, so is the supply to the control box.

Of course, there is no reason why a separate power supply should not be used, as long as the output is stabilised using a Zener diode with, of course,

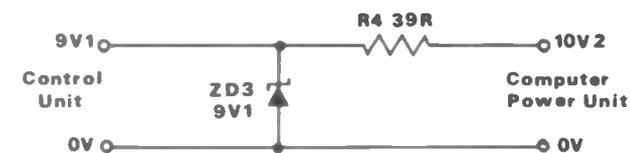


Fig 4 Stabilising diagram for connection to computer power supply

any necessary change to R4 in *Figure 4*. Although built primarily for the FT290R, this circuit has been used with the

TS130S and should work with any transceiver which earths the PTT line to transmit.

NEXT ISSUE

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examination of the circuit will show its simple operation. To prevent the input floating high and switching, it is tied low through the 10K resistor.

By taking pin 1 low on the 4515, it is possible to freeze the setting at the last point selected. However, this would have complicated the stepping action via the reset pulse, so the inputs were tied low to prevent them floating high and switching, which this IC is prone to do. Operation is again quite simple, but you cannot go outside the band with the electronic selector.

You will no doubt see that you have a 256-way rotary switch here, should you need one, and if you cascade them where would you end up? A further improvement would be to change the 4518 for an up-down counter, but the complication was not considered worthwhile; you can slip round the channels quite quickly enough.

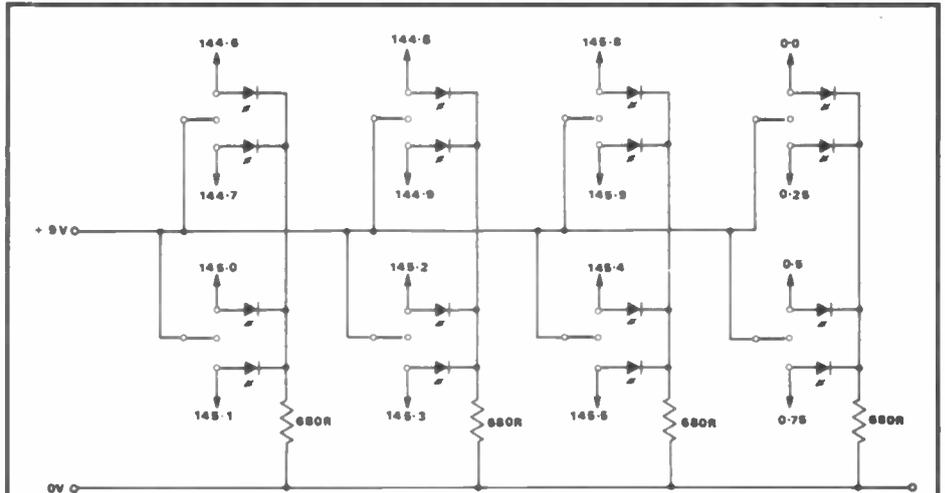
The circuit which drives the IC240 is similar to a previous design, but does not include auto-repeater shift - this is not necessary when the IC240 is in the shack. If you mix the LED readout colours you will know when you are on repeater channels, then you can put the appropriate shift in to the main unit.

Construction is on Veroboard and providing the layout takes into account tidy wiring - as short as possible - there should be no problems. We are, after all, only switching dc circuits. The unit plugs into the IC240 at the rear where a 25-way connector has been fitted, the matrix wires connect to the appropriate points on the 'spare' row on the matrix board, and the rotary switch is placed out of circuit, ie to a start position on the main dial.

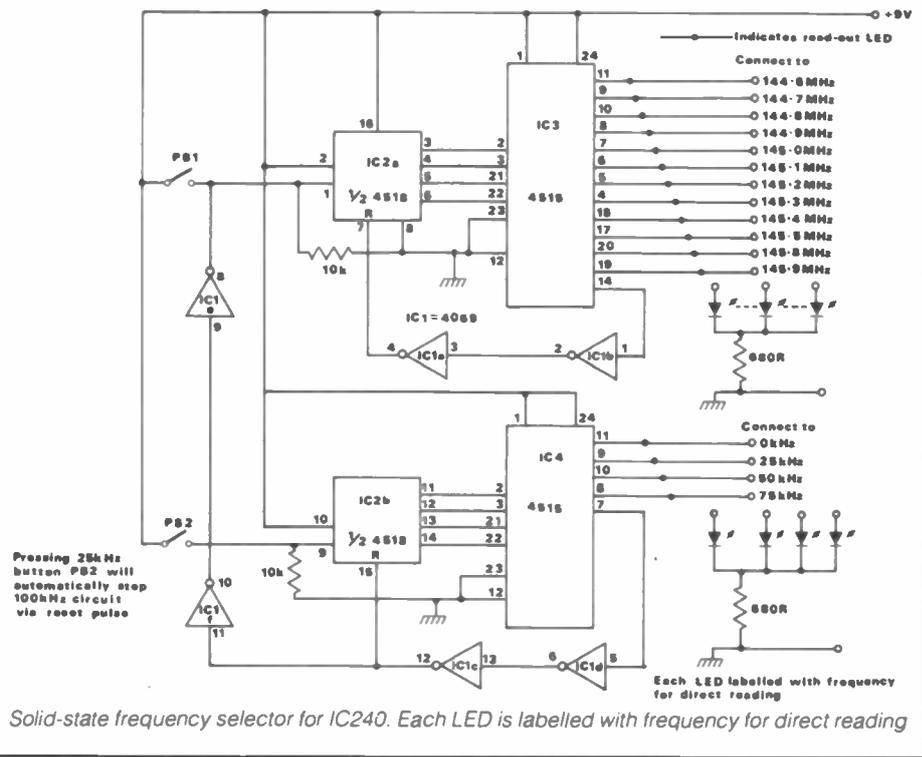
Radiation therapy

The frequency range covered by this modification is 144.6MHz to 145.575MHz and 145.8MHz to 145.975MHz. This jumps the repeater outputs which can't be used anyway, so I have not included them.

Have fun with the system, and long may your IC240 radiate.



Direct frequency readout switching IC240 transceiver: mechanical frequency switching



Solid-state frequency selector for IC240. Each LED is labelled with frequency for direct reading

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418/440V to 240V		30V 15V C P&P		12V 24V C P&P		For step-up or down			
(80-1000VA Tap Secs)		05 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24		03 A 015 2.92 110 500 2.22 1000 1.60 1500 1.70 2000 1.90 3000 2.05 4000 2.10 5000 2.25 7500 2.60 10KVA±230.98 OA		80 VA £5.88 1.70 150 8.69 1.85 250 10.34 1.98 500 18.12 2.68 1000 28.79 3.25 1500 34.17 3.66 2000 41.62 4.62 3000 57.72 5.72 4000 71.78 OA 5000 131.33 OA 7500 202.71 OA 10KVA±230.98 OA			
20	7.08	2 18	3.08	1 41	0.5	3.70	2 22 1000	28.79	3.25
50	11.81	2 31	6.47	1 192	1	5.18	1 70 2000	81.09	4.62
100	19.43	2 59	11.72	2 220	4	8.94	1 90 3000	94.98	5.72
200	33.01	3 10	14.49	2 31	6 A 3	9.31	2 05 4000	112.78	OA
250	23.01	3 24	16.40	2 255	8 M 4	10.89	2 10 5000	131.33	OA
350	28.46	3 40	21.95	2 260	12 P 6	13.20	2 25 7500	202.71	OA
500	35.45	3 66	25.32	2 284	16 S 8	15.73	2 60 10KVA±230.98 OA		
1000	64.28	4 52	28.07	2 295	20 10	21.17	3 04		
1500	82.92	5 85	31.68	3 51	30 15	25.31	3 10		
2000	99.76	6 36	43.22	5 95	40 20	37.56	2 22	240V Cable Input	
3000	139.89	OA			60 30	53.92	4 90	115V USA socket	
6000	288.89	OA			83 41	82.08	5 65	outlet	
05 25V	8.01	1 75	2	4	11.18	2.20			
1 2	8.09	1 90	3 A 6	16.12	2.34				
2 A 4	10.84	2 20	4 M 8	18.38	2.55				
3 M 6	12.84	2 25	5 P 10	23.23	2.78				
4 P 8	17.16	2 58	6 S 12	26.80	3.02				
6 S 12	21.84	2 79	8 16	37.25	3.65				
8 16	30.89	3 15	10 20	43.37	3.99				
10 20	38.06	3 60	12 24	48.98	4.65				
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DX-TV RECEPTION REPORTS

Compiled by Keith Hamer and Garry Smith

On reflection, June 1987 must rate as one of the better months for sporadic-E reception for many seasons. The many hectic openings experienced during the month soon brought in virtually every European country. Signals also arrived from two other continents. In general, exotics were plentiful in Band I; a few mystery signals remain unidentified. On the other hand, tropospheric DX at Band III and UHF seemed insignificant with only a few French Band III transmitters showing at times.

Exotic events

Arabic DX-TV signals from the Middle East and North Africa were commonplace throughout June. Andy Webster of Billinge, near Wigan, telephoned to say he'd seen a PM5534 test pattern on channel E4 shortly after 1100 on the 5th. The identification read 'ORTAS DAMAS', confirming that reception originated from Syria.

Meanwhile, at Chris Howles's home in Lichfield, Staffordshire, an Arabic programme was noted on channel E2. The

Tunisian FuBK test pattern was logged by many enthusiasts on the 11th from the Remada transmitter on channel E4. The signal made a brief appearance in colour (SECAM) here at Derby, although for most of the time the transmission was obscured by heavy co-channelling from TVE-1 in Spain, which was most unfortunate.

Jordan was identified by Leeds duo Kevin Jackson and Mark Dent on the 12th and 23rd when the 'JTV SUWEILIH' PM5534 appeared. On the 12th Ray Davies went one better. The Iranian FuBK test pattern featuring a large digital clock was monitored for a while on channel E2. The 'EPT' PM5534 from Greece on channel E3 was seen during the same opening.

On the 14th, Chris Howles and Mike Wilkinson in Workington (Cumbria) noticed a film with Arabic subtitles on channel E4 between 1330 and 1340. The following evening, Kevin Jackson saw a programme on channel E2 with two lines of Arabic subtitling during an opening from the south-east.

Canadian DX

Perhaps the most important and exciting event took place between 2000 and 2200 BST on June 19th, when signals arrived from across the Atlantic. Reception was monitored by Paul Davies of Leeds. Using a scanner, Paul noticed a build-up of Canadian and American radio hams at 50MHz, with VE1YX Nova Scotia present at considerable strength. This was also heard by Mike Allmark G1EZF of Leeds. The vision buzz and sound carrier from four TV services was audible on channel A2, while on channel A3 one station was present. Using a television receiver, one of the A2 stations, from Canada, was resolved for approximately one minute before being lost under Spanish transmissions on the same frequency (55.25MHz). The vision buzz was monitored via the scanner for two hours. The most likely origin of the Canadian transmission on channel A2 is CKCW-TV located at Moncton, New Brunswick.

Several enthusiasts have commented on the reception of unusual test patterns

PHOTO FILE ● PHOTO FILE ● PHOTO



Fig 1 PM5534 test card used by the private TV3 network in Spain



Fig 2 TV3 identification caption from the Catalunya region



Fig 3 Announcer following the TV3 opening sequence



Fig 4 'Telediario' news programme from the state-owned TVE in Spain



Fig 5 Clock caption from Radio Televizija Beograd, Yugoslavia

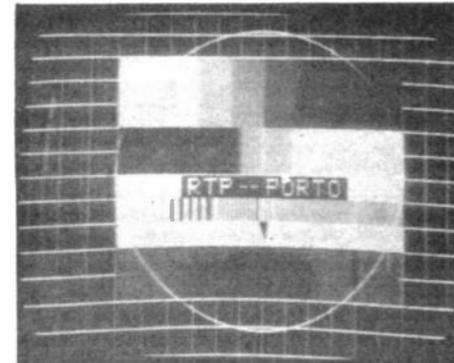


Fig 6 FuBK test card radiated by RTP in Portugal

and identifications this month.

Ray Davies of Happisburgh, Norfolk, reports the sighting of a new Polish test card resembling the IBA's Channel 4 ETP-1 pattern. The identification 'TVP' was clearly visible.

John Bray, of St Neots, spotted an FuBK one morning towards the end of June at 1130 carrying a line of Arabic writing across its centre black bar. The aerials were pointing south at the time, but the short duration of the signal didn't allow for re-positioning. It is interesting to note that Simon Hamer of New Radnor in Powys saw a similar pattern during the 1986 season which was never identified.

As far as we know, only three countries use the FuBK bearing some form of Arabic identification. These are Iran, Tunisia and Libya. The first two services also include identification in the Roman alphabet on the left-hand side of the black bar, whereas Libya carries Arabic script at each end. Although there are no Libyan Band I transmitters listed, there is a possibility that an E3 outlet is now in existence. Only recently, Morocco and Tunisia have started using this band for TV purposes.

The Swiss '+PTT SRG 1' FuBK test card has recently carried a moving line of text at the bottom of the pattern advising viewers that a teletext service has now commenced. We shudder to think what garbled messages will appear on screens due to poor reception, especially in the mountainous regions!

The Italian PM5544 looked a little unusual on June 7th during an early morning opening at around 0730. An identification was shown at the bottom of the test card which read 'RAI-ROMA'. A Sunday morning check while on holiday a fortnight later revealed only the usual 'RAI 1' at the top.

DX-TV log for June

This month we are featuring a mammoth log report sent in by Chris Howles of Lichfield. Chris uses various fixed-position Band I aerials mounted in the attic.

4/6/87: JRT (Yugoslavia) on channel E3 with Beograd programmes from 1630 onwards.

6/6/87: The following were noted on programmes after 1820: RAI IA and IB; JRT E3 and E4; TELE-MARKET (Italy) E2; MTV-1 R1 and R2 with clock; RTS (Albania) IC; ORF E2a.

7/6/87: 0725-0930: RAI IA blank raster switching to the PM5544 test pattern with 'RAI-ROMA' identification in the bottom block; TVA (Italy) IA with cartoons and pop music programme; TSS R1 and R2 on programmes. 1800-2000: JRT E3 and E4; TVE-1 E3; RTU (Radio-Tele-Uno, Italy) IA; TSS R1 with 'HOBOTN' news; MTV-1 R2; TVR (Romania) R3; Italian and Yugoslavian FM signals present between 87-90MHz.

8/6/87: An all-day opening with the

following stations: TVE-1 E2, E3 and E4; RTP (Portugal) E2 and E3 on FuBK test pattern; YLE (Finland) E4 at 1100 on 'YLE TV1' FuBK; unidentified FuBK from the south at 1347 on E4; TVP R1 and R2 on PM5544; RAI IA programmes at 1615; TSS R1 'BPEMR' at 1810.

11/6/87: RTP E2, E3 and E4 (35W relay at Valenca do Duro); SVT (Sweden) E2 and E3 on 'TV1 SVERIGE' PM5534 at 1215; NRK (Norway) E2 showing the 'NORGE MELHUS' PM5534; RAI IA; Canal Plus L3; RTT (Tunisia) E4 with FuBK test pattern between 1615 and 1655.

On the 12th, 13th and 14th Chris visited the home of Mike Wilkinson and his wife in Workington, Cumbria, and noted the following DX:

12/6/87: TSS R2 in sound and SECAM colour at 1500; TVE-1 E2 and E4 during the early evening.

13/6/87: 1600-2140: DFF-1 (East Germany) E4; ARD-1 (West Germany) E2, E3 and E4; RAI IA and IB; TSS R1 and R2; TVP R1, R2 and R3 with sound and colour on all channels; TDF Canal Plus L4; MTV-1 R1 clock; RTS (Albania) IC; ORF E2a athletics; FM radio band active at 1720.

14/6/87: 0830-1100: ARD-1 E2, E3 and E4 programme schedules; DFF-1 E4; DR (Denmark) E3 with 'DR DANMARK' PM5534; RAI IA; TDF Canal Plus L3 with encoded vision; TSS R2 Intervention caption in SECAM colour with sound; TVP R1, R2 and R3 with the Pope's visit in SECAM colour with sound; ORF E2a; SVT-1 E4. 1100-1235: RAI IA and IB; NRK E2 'NORGE STEIGEN' PM5534; NRK E4 'NORGE HADSEL' PM5534; CST R1 'Zpravy TV' caption; unidentified film with Arabic subtitles between 1330 and 1340.

On returning to Lichfield, Chris continued his activities and received the following:

15/6/87: 1050 until 1400: RTP E3; RAI IA; CST (Czechoslovakia) R1 on 'RS-KH' EZO test card; TVP R1 and R2 with PM5544 - good sound and colour; ORF E2a 'ORF FS1' PM5544; TSS R1 UEIT test card. 1800-2000: RAI IA; TSS R1 and R2; Unid R3; TVE-1 E2, E3 and E4; SVT E2. 2310-2350: TVE-1 E2, E3 and E4 (channel E2 noise-free); TVE-2 E2 close down followed by unmarked colour bars; RTP E3 very strong with colour and sound.

18/6/87: 0745-0900: TVE-1 E2, E3 and E4 showing the GTE colour test card prior to the opening sequence preceding 'Por la Mañana'. 1730-2000: TSS R1, R2, R3 and R4; NRK E2, E3 and E4; SVT-1 E2; RUV (Iceland) E3 and E4 (on PM5544 test pattern); lots of unidentified signals; 2230 onwards: RTP E2 and E3.

19/6/87: 1030-1330: TSS R1 and R2 on UEIT test card; TVP R1 and R2 on PM5544; NRK E2 'NORGE MELHUS' PM5534; NRK E3 'NORGE BAGN', 'NORGE HEMNES' and 'NORGE GAMLEM' PM5534 test cards; NRK E4 'NORGE HADSEL' PM5534; RUV E4 'RUV ISLAND' PM5544; TSS R1 'letterbox' test pattern at 1407.

1830-1900: RUV E4 with conference about RUV; JRT E3; ARD-1 (West Germany) E2; TVE-1 E2; RAI IA; CST R1; ORF E2a.

20/6/87: RAI IA and IB on 'RAI-1' PM5544 at 0740; CST R1 children's programme; ORF E2a English language programme at 0830. 1730-2000: TDF Canal Plus L3 and L4.

24/6/87: RAI IA noted several times between 0740 and 1430. 1815-1900: TVR (Romania) R2 news with sound and PAL colour; RAI IA; RTS IC documentary. 1900-2100: TVE-1 E2, E3 and E4; RTP E2, E3 and E4; TDF Canal Plus L4.

28/6/87: 0930-1430: ORF E2a; JRT E3 and E4 with the 'RTV LJNA' PM5544 at 1330; MTV-1 (Hungary) R1 multiburst test pattern; DFF-1 E4 with children's programmes; TVR R2; RAI IA and IB; SRG-1 (Switzerland) E2 and E3; TDF Canal Plus L4.

Reception reports

With the help of a D-100 DX converter this summer, Ari Inkinen of Virmutjoki in Finland has successfully identified several stations operating in the Middle East. These include Dubai E2, Jordan E3, Saudi Arabia E3 (ARAMCO CHANNEL 3 TV) and Syria E3. Middle East FM radio signals have been present, too. The ones positively identified include Iraq, Israel, Turkey and Cyprus (CBC, Bayrak and BFBS). There were many more which will remain unidentified.

Channel IA is providing a source of interest this season with several Italian private stations coming in. Chris Howles (Lichfield) queries one station with anti-pirate identification in the bottom left-hand corner of the picture. It was seen at 1730 on the 30th and it resembled a letter 'A' within a box. While on the subject of on-screen identifications, East German TV was noted displaying the letters 'DDR' during programmes on June 28th.

Simon Hamer of New Radnor (Powys) has done it again! TSS was seen on channels R1, R2, R3, R4 and R5 on the 15th when the muf approached 100MHz. A new country for Simon was Tunisia, which unveiled itself with the FuBK test card on the 16th.

A couple of the older Italian private stations were resolved by Simon, thus confirming that they still exist! Radio-Tele-Uno swamped RAI transmissions with its distinctive test pattern on the 12th, while NCT (Nord Centre Television) was logged showing a film with the letters 'NCT' in the corner on the 20th.

Bob Brooks of South Wirral also saw Tunisia on the 11th, but unfortunately he couldn't make a video recording of it. It's usually the case with exotics! Other interesting signals were Radio-Tele-Uno on caption at 1903 on the same day and the Eesti TV 'AK' news on channel R2 on the 15th.

Bob often listens on the ATV sound channel and apparently there is quite a lot of interest shown in DX-TV. Perhaps any ATVer or amateur radio enthusiast

MEDIUM WAVE



by Steve Whitt

Last month I took an introductory look at the reception of North American Medium Wave radio stations on this side of the Atlantic, so this time I have included a couple of more detailed feature items describing the sort of stations you could hear. But first this month, I'd like to take a closer look at aerials.

Is bigger better?

It is often said that the larger your aerial the better the DX you will hear, but this rather sweeping statement needs to be examined a bit more closely in the context of medium wave listening.

One of the basic laws of physics says that all electrical components will generate a small (usually unwanted) noise signal due to the flow of electrons. Your receiver is no exception in this matter and it is possible to detect this noise since it usually becomes audible as the hiss in the headphones when the aerial is disconnected.

For you to be able to hear a station on your radio, the received signal has to be substantially stronger than the receiver's internally generated noise, otherwise all that is heard is the background 'hiss'.

When you put up an aerial it doesn't only pick up the signal you want to listen to, since numerous unwanted signals, as well as unwelcome electrical interference and noise, are also fed to the aerial socket on the back of your receiver. On medium wave (and indeed for most short wave frequencies up to 20MHz or so) the limiting factor to reception is not the noise generated inside the radio but that generated outside, ie man-made electrical noise and thunderstorm static. Even with a small aerial, the received level of external noise far exceeds and dominates any other internal noise sources.

It therefore follows that if you double the size of your aerial, not only will you increase the strength of the desired signal, but simultaneously the level of the naturally occurring atmospheric noise will also rise by the same factor (as indeed will the strength of any interfering stations). The overall result is no change in the ratio of the received signal strength to the received noise and interference level.

Taking the hiss

Since improved reception is only possible by improving the received signal-to-noise or signal-to-interference ratios, simply making your medium wave aerial bigger is unlikely to yield better DX.

Thus, if you are keen to DX the medium waves and thought that you didn't have enough space for a sophisticated aerial, worry no more. A small 'active aerial', of which several examples are commercially available, will prove to be just as good as a random length of wire strung

along the garden - and it is far less likely to irritate the neighbours!

If a bigger aerial won't give us any better DX, what can we do to improve the received signal? The only practical option is to reduce the level of received noise and interference without disturbing the desired signal - hence the directional aerial is born! More about this topic next month.

KDKA: memory corner

The callsign KDKA will be familiar to many readers, since this station in Pittsburgh, Pennsylvania can be heard fairly often by the MW-DXer on this side of the Atlantic Ocean. However, these four letters are bound to stir some memories in the minds of our older readers, since KDKA goes right back to the earliest days of radio broadcasting.

Broadcasting at KDKA began on 2nd November 1920 with a report on the Harding Cox election returns, and thus was born the world's very first commercial radio station. This was just five years after spoken messages had been transmitted across the Atlantic for the first time. The novelty of radio soon turned into a huge public success, leading to

over 500 stations being established in the USA by 1922.

One Harold Arland is credited as being the world's first full time radio announcer, since he started the first programme from KDKA using for a studio a tiny shack on top of an East Pittsburgh building. However, a station decision to broadcast live music forced a move from this hut to a larger tent, also on the roof top! Harold Arland, who died last year, was also the first broadcaster to present sports commentary live from a stadium. Radio had turned into a popular international medium and KDKA had become so successful that by 1924 Arland was voted the world's most popular broadcaster by several radio magazines.

At this time, uncluttered radio bands meant that KDKA was regularly listened to throughout the world, and in 1925, when Arland finally quit broadcasting, it was noted in an English paper that he was 'the best known voice in Europe'. It's not that surprising therefore to note that, according to the station, their signal has been heard in every US state and in every country in the world at some time or another.

In contrast with the early days, recep-

KDKA-FM 67.9 ft. antennas located atop KDKA-TV 679 ft. tower, Pittsburgh, Pa.

KDKA-AM 718 ft. tower located at Allison Park, Pa.

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The most famous radio station in the country! Broadcasting began at KDKA with the broadcast of the returns of the Harding-Cox election, November 2, 1920. Operating at 1020 on the dial, 24 hours daily, KDKA's 50,000 Watts-Clear Channel provides a rounded and balanced program fare for five and a half million people within its primary coverage area, but its powerful signal has also been picked up in every state in this country and in every country in the world at some time or other.

MEDIUM WAVE DXING

tion of KDKA today is hardly an everyday affair, but the DXer interested in logging this historic station should look to 1020kHz, where a 50000W signal is radiated 24 hours a day.

Sport for all

These days MW radio in the USA has become predominantly a medium for the spoken voice, since the majority of music stations have shifted to FM in the search for hi-fi and more listeners. Thus, the MW-DXer is likely to find heavy emphasis on phone-in shows, news and information and, of course, play-by-play sports commentary.

Within the States many radio listeners (not DXers!) tune into distant stations specifically to hear live match reports of major non-local games. This is made possible because a number of stations throughout the States operate on what used to be known as Class 1 clear channels, providing interference-free reception over a dozen or more states. Thus, the keen baseball fan is indeed in the fortunate position that 18 of the 26 major league teams have their games regularly carried by Class 1 50000W AM stations.

The chances are that the keen DXer will also find many of these stations

among his list of those most often heard. Try looking for the stations in the table.

Newsdesk

United Kingdom: The latest plans for BBC Radio reveal the following tentative on-air dates for a new phase of BBC local radio stations:

Gloucestershire – mid 1988;
Hereford and Worcester – mid 1988;
Swindon – mid 1988;
Suffolk – end of 1988;
Warwickshire – end of 1988;
Berkshire – late 1989;
Surrey – at the end of 1989.

Despite being such a long way into the future, some transmitter and studio sites have already been chosen. BBC Suffolk, for example, will have VHF transmitters co-sited with BBC Essex facilities at Manningtree and with Saxon Radio at Great Barton whilst the MW transmitter will be sited with that of Radio Orwell at Foxhall Heath, just east of Ipswich. BBC Surrey, meanwhile, has chosen studios within the campus of the University of Surrey at Guildford and will be sharing transmitter sites with ILR County Sound. Apparently, as yet, no firm choices of frequencies have been made.

DX file

Unfortunately there is only room for one quick item this month, which comes from Mark Hattam. In the past, I have mentioned that station WHN in New York was a regular signal with UK-based DXers, but the station changed to become WFAN in July this year. Mark heard the new-look station within days of the change and wrote to them with a reception report. Just a fortnight later he was rewarded with one of the first QSLs from this station. Why not have a go yourself? Look for WFAN on 1050kHz after midnight, with regular identifying slogans such as: 'Sports Radio 10-50 WFAN', 'The world's first 24-hour all sports radio station' or 'WFAN New York City – all sports, all the time'. Reception is best after BBC Radio 1 leaves 1053kHz for the night.

That wraps it up for another month, but in the mean time your listening tips, queries or ideas will be most welcome if you care to drop me a line c/o the *Radio and Electronics World* offices. **REW**

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Latest Literature

ANTENNAS VOLUME 1

by E Roubine and JC Bolomey

The first part of a complementary two-volume treatise on antennas, this book was inspired by a series of lectures given at the École Supérieure d'Électricité.

The task the authors faced was to pare down the enormous body of work on this subject and yet present a comprehensive overview of modern technical knowledge in the field.

Volume 1 deals with the general principles which underly the physical bases of antenna function. Although this is a classic subject, it is dealt with in a strikingly innovative and economical manner.

This volume itself divides into two parts, a theoretical introduction and an explanation of the general properties of antennas.

The various subjects involved include the basic elements of optics. Each is examined in conjunction with the complex mathematical formulae involved, which suggests that this is a book for serious students of electronic engineering or practising engineers.

Kogan Page Ltd, £27.50. ISBN 0-946536-22-8

AN INTRODUCTION TO DISTRIBUTED AND PARALLEL PROCESSING

by JA Sharp

This book is based on notes prepared for a final year undergraduate course in computer programming.

The concept of parallelism is introduced, and the ways in which computers have developed to exploit parallel processing are discussed.

In the second part, distributed processing is examined, and part three examines the programming of such systems. The final part looks at possible architectures for the next generation of computers.

This book will be of interest not only to undergraduates, but also to students of electrical engineering and

electronics, and those working in related areas.

Blackwell Scientific Publications Ltd, £14.95. ISBN 0-632-01462-8

AN INTRODUCTION TO ANTENNA THEORY

by HC Wright

This inexpensive book starts with first principles, explaining the mathematics involved in this subject in a straightforward manner, illustrating each topic with clear diagrams.

The basic concepts of receiving and transmitting antennas are dealt with in a way which emphasises the mechanisms and minimises the complicated, technical aspects involved.

This is a handy guide for the radio enthusiast, at a very affordable price.

Bernard Babani (publishing) Ltd, £2.95. ISBN 0-85934-173-9

POWER SELECTOR GUIDE

by JCJ Van de Ven

This guide is the second of a new generation of pocket guides, specially compiled for the electronics designer, engineer or hobbyist.

The specifications of many thousands of electronic devices are presented in tabular form with the aid of a new computer system.

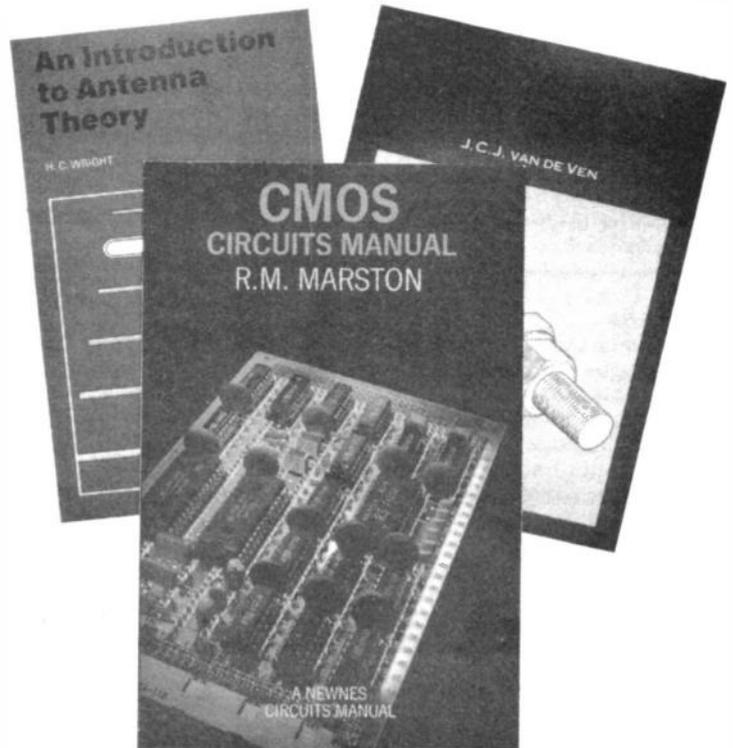
Devices can be selected by reference to their electrical properties, thus enabling the reader to choose equivalent devices to replace unavailable items, without being tied to a particular manufacturer's products.

Bernard Babani (publishing) Ltd, £4.95. ISBN 0-85934-180-1

AMATEUR RADIO SATELLITES - THE FIRST TWENTY-FIVE YEARS

by Arthur C Gee

Twenty-five years have passed since amateur radio satellites first appeared on the radio amateur scene. The last few months have seen numerous tributes to the



passing of this memorable quarter-century.

In response to the interest shown, Arthur C Gee G2UK, the chairman of AMSAT-UK, has assembled some of the records of these years, to provide a fascinating glimpse of AMSAT's own view of its initiation and growth.

The 34-page brochure contains many black and white photographs of history - making moments in the past, from the early days of Project Oscar to AMSAT as it is today.

A very interesting read.

AMSAT-UK HQ, 94 Herongate Road, Wanstead Park, London E12 5EQ, £2.75 inc P & P and VAT.

CMOS CIRCUITS MANUAL

by RM Marston

CMOS digital ICs are currently the most popular of the digital IC types, and this book is intended to introduce the reader to progressively more complex types of CMOS ICs.

Consequently, the book can be used equally by the complete beginner or electronics expert. The author has designed, built and evaluated all of the included circuits, and

ensured that all use inexpensive and internationally available devices.

Unfortunately, the book itself could not be described as inexpensive, as the 190-page paperback costs £9.95. If this is a book you need, you'll have to grit your teeth and think of the quality rather than the quantity.

Heinemann Newnes, £9.95. ISBN 0-434-91212-3

PRACTICAL MICROPROCESSOR INTERFACING

by SA Money

This comprehensive guide to microprocessor interfacing examines in detail the various techniques used to transfer data to and from the central processing unit.

Invaluable to anyone well-grounded in electronics wishing to connect a microprocessor based system to an external device, the author includes plentiful explanations of the machine-level control functions necessary.

Interface software is also examined, and in addition test routines and start/initialisation

Latest Literature

procedures are approached in this thoughtfully presented book, along with appropriate diagrammatic explanation.

This book is certain to become a much referred to guide for those involved in this field.

Blackwell Scientific publications Ltd, £20.00. ISBN 0-00-383329-1

HUGHES ELECTRICAL TECHNOLOGY

revised by I McKenzie Smith

The first revision for ten years of this standard reference text includes a great deal of new material, reflecting the tremendous changes that have taken place in electronics fundamentals within the last decade.

The current emphasis on semiconductor technology has been acknowledged, with the inclusion of FETs and op amps as well as the junction transistors included in the fifth edition. Digital systems are covered, and an introduction to microprocessors and programming has been added.

Intended for student use, this text uses worked examples throughout, with examination standard questions concluding each chapter, to test the reader's grasp of the subject. This is a welcome revision of a most useful book.

Longmans Group UK Ltd, £12.95. ISBN 0-582-41372-9

Siemens

Siemens Ltd have produced a catalogue containing various articles which describe applications of various Siemens components. Each is examined in detail, and diagrams illustrating the circuits and their characteristics are included.

A components service lists new publications of data books, short form catalogues and other technical components literature that may be of interest.

*Siemens Ltd,
Siemens House,
Windmill Rd,
Sunbury-on-Thames
Middlesex TW16 7HS.
Tel: (09327) 85691.*

Feedback Instruments

Feedback Instruments Ltd has produced a new 12-page colour catalogue highlighting the products supplied by the company's recently formed Test and Measurement Division.

Instruments covered in the catalogue include oscilloscopes, logic analysers, analogue and digital multimeters, counters and timers, signal sources, phase meters, component analysers, recorders, power supplies, fibre-optic testers, temperature monitors, impedance testers and static meters.

Manufacturers represented in the catalogue cover many leading names in electronic test and measurement, including ITT Metrix, Thorn-EMI, Thandar, Hameg, Lloyd Instruments and Technotrend, as well as Feedback Instruments' own manufactured products.

In addition, a special 'stop press' supplement covers the

company's two latest product lines: counter/timers and communication test equipment from Racal Instruments and LCR meters from Wayne Kerr.

*Feedback Instruments,
Park Road,
Crowborough,
East Sussex TN6 2QR.
Tel: (08926) 3322.*

RR Electronics

RR Electronics have produced a quick reference selector guide for PMI brand op amps, based on an exclusive joint RR/PMI design.

Printed on both sides of a heavy-duty A4 plastic sheet, the guide is easy to use: it takes less than a minute to pick out the right model for an application. You just decide the key parameter for your application: slew rate, supply current, etc, plus the value you need.

On the chart, the part numbers are listed next to the value you decided on. You then check that the other parameters for your selected op amp are acceptable.

RR Electronics is a subsidiary of Electrocomponents Group plc.

*RR Electronics Ltd,
St Martins Way,
Cambridge Road,
Bedford MK42 0LF.
Tel: (0234) 47211.*

Solartron

A new booklet has been released outlining in detail how engineers may use an IBM PC via the RS232 interface to communicate

with and control Solartron Instruments' 3530 Series Orion data logging system.

The 11-page booklet highlights a software program that enables an Orion data logger to be controlled when connected to an IBM PC via the RS232 interface.

The program features the automatic transmission of a standard channel and task set-up to the Orion and its immediate execution. The data received from the logger is displayed on the PC's VDU screen. The method by which user commands may be sent at any time to the Orion is also described.

The example program described in the booklet is written using IBM PC Basic.

The booklet is available on request from Solartron with a copy of the demonstration program from the company's local data acquisition sales engineer.

*Solartron Instruments,
Victoria Road,
Farnborough,
Hants
GU14 7PW.
Tel: (0252) 544433.*

Argo

Argo Electronic Components Ltd have published their latest catalogue covering their extended range of aluminium instrument control knobs, dials and shaft locking devices.

Included in the catalogue for the first time are several slow motion and dual speed dials, some of which have setting accuracies of 0.1° (ie 6 minutes of arc).

Argo's Designers' Guide

also includes the range of wire wound general purpose and precision rotary potentiometers, previously manufactured by May Precision Components Ltd.

Other interesting items in the guide include a solution to disintegrate epoxy and polyester resin; a shaft shear to cut (without shock) 7 different diameters of component shafts and a range of instrument trolleys.

The guide concludes with details of custom made aluminium control knobs, manufactured without any tooling charges.

*Argo Electronic Components,
Stiron House,
Electric Avenue,
Westcliff on Sea,
Essex
SS0 9NW.*

ITT Instruments

New from ITT Instruments is a 6-page, 4-colour guide to the company's diverse range of multimeters.

ITT multimeters are offered in a wide variety of types; with a choice of taut band or pivoted analogue movement, digital display, or a combination of both.

There are clamp on types, ones designed for panel mounting, plus a large number of hand-held models. Over two dozen instruments are listed, as well as many optional accessories.

This guide should be indispensable to anyone using multimeters, and is available from ITT Instruments free on request.

*ITT Instruments,
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On these pages we present details of interesting contacts from clubs and individuals. We would be happy to receive any similar items from readers

Errata

In the article 'A Combined Morse and RTTY Decoder for the ZX Spectrum', in our June '87 issue, *Figure 1* is incorrect. Pin 8, not Pin 9 should be connected to V+. This error also occurs in the original article of June '86. The IC operates satisfactorily when attached to certain boards, which suggests that the internal architecture of the XR2211 is not the same for all manufacturers. Consequently, depending on the source of supply, the decoder as drawn may or may not work.

BARTG discussions

The annual general meeting of the British Amateur Radio Teleprinter Group (BARTG) is to be held on Saturday, November 7th at

2pm in the Churchill Room, London House, Mecklenburgh Square, London WC1. All members are invited.

One issue to be discussed is an increase in membership fees for next year; 1987 subs remain at £7 for UK members, £10 for Europe and £16 for overseas airmail until the end of the year, and BARTG say that it's still not too late to join! For further details, contact Mrs Pat Beedie GW6MOJ, 'Ffynnonlas', Salem, Llandeilo, Dyfed SA19 7NP.

DX techniques

Wimbledon and District Amateur Radio Society is holding a talk on DX techniques, given by Nigel Cawthorne G3TXF, to take place on October 30th. All W&DARS

Dun Laoire Festival

A special event station was set up during the recent Dun Laoire Summer Festival by members of Wicklow Amateur Radio Club and South Dublin Radio Club. The station was located at Leopardstown Racecourse for the festival opening ceremonies by EEC commissioner Mr Peter Sutherland.

A link was set up with Holyhead Festival Station, from which the Lord Mayor sent best wishes to his counterparts at Dun Laoire on the twinning of the two festivals.

The Dun Laoire station used the callsign EI2HAD, while the Holyhead and District Amateur Radio Society operated GB2HAD.

meetings are held on the second and last Fridays of each month at 7.30pm in St Andrew's Church Hall, Herbert Road, Wimbledon, London SW19.

The Sheffield Award

The Sheffield Amateur Radio Club is reinstating the Sheffield Award, piloted in the mid '70s. The award is available to both licensed transmitting amateurs and SW listeners.

The award is given for one of the following:

In the UK, establishing two-way contact with thirty Sheffield stations. SWLs should log the same number, but must include in their log extract the calls of the stations being worked by the Sheffield operator.

Stations in Europe but outside the UK must make two-way contact with ten Sheffield stations. SWLs should follow the above procedure.

Stations outside Europe should establish two-way contact with ten Sheffield stations. SWLs should follow the rules outlined in the UK section. A Sheffield station is defined as being one within the Metropolitan District boundary.

Bonus points are given for working club members – they count as two contacts – and a contact with an SARC organised special event station scores as five contacts.

A microwave section is also included, and an award given for any station who has worked five Sheffield stations on the bands from 1.3GHz up.

A copy of the relevant log entries, examined and certified accurate by a local amateur, and dated and signed by both operator and the witnessing amateur, should be sent to SARC Awards, c/o G3PHO, 146 Springvale Road, Sheffield S6 3NU, enclosing £1 or the equivalent of £1.50 in IRCs if overseas.

Club meetings are held every Monday at 8pm in the Firth Park Pavilion, Sheffield. Tuition for Morse and the RAE takes place between 7pm and 8pm.

Details can be obtained from Alan G8ZHG on (0742) 395287. The club AGM is on October 12th.

70cm contest

A 70cm contest is being held by the Dunstable Downs Radio Club on October 3rd and 4th. Later in the month, the meeting on October 16th will be concerned with satellite TV equipment, and at the end of the month, on October 30th, a junk sale is being held. Perhaps the ideal place to find the spare parts for your satellite TV equipment?

Meetings are held every Friday at 8pm, at Chews House, 77 High Street South, Dunstable, Beds. For more information, contact Tony G0COQ on (0582) 508259.

Worthing workshops

The Worthing and District Amateur Radio Club holds its AGM on October 7th. The club's recently introduced workshop evenings have proved to be a great success, covering subjects such as capacitors, resistors, inductors and even valves.

All details of forthcoming events can be obtained from G4GPX QTHR, on Lancing 753893.

Chelmsford nets

The Chelmsford Amateur Radio Society is also holding its AGM in October – it must be a good month for such meetings. It will take place on October 6th, and the club members will presumably have recovered by then from their DF hunt, which was held in July, for two ingeniously hidden stations (one of which was only found with help after dark).

The club holds a 2 metre FM net beginning at 7.45pm on Tuesdays, on 145.255MHz, and a 10 metre SSB net on 28.325MHz, starting at 8.30pm. Meetings are held at the Marconi College in Arbour Lane.

For more information about club events please contact Roy G3PMX or Ela G6HKM on (0245) 360545.

Wartime radio

Fareham and District ARC is going back in time for its meeting on October 21st. G3AUV is giving a talk on his wartime experiences in the Radio Security Service, for those with a touch of nostalgia for the past.

G4JEV will be talking about

Special event station at Leopardstown



the TM1000 ATU on October 7th. Both of these talks will be given at the club's regular meeting place, Portchester Community Centre, Westlands Grove, Portchester, Hants at 7.30pm. A Morse class is also held from 6.30pm.

For details contact the club secretary, G3CCB, on Fareham 288139.

Surplus sale

For those in search of a bargain, the Farnborough and District Radio Society is holding a surplus equipment sale on October 28th. Club meetings are at 7.30pm for 8pm at the Railway Enthusiast Club, Howley Lane, Farnborough. To find out more contact the club secretary, Tim, on Camberley 29231.

Eisteddfod events

Instead of bursting into song, Newport Amateur Radio Society is preparing for the Royal Welsh National Eisteddfod by giving awards for contacting the club call-sign, GB2EC.

Club members will hold GB2EC on a monthly rota from October until the Eisteddfod begins in July '88, a total of ten stations. GB2EC will be active on HF and VHF. All contacts will receive a QSL card. The GW4EZW club call-sign will qualify for one contact only.

For further information contact NARS via Box 33, Newport.

Construction competition

Bury Radio Society is holding a construction competition on October 13th, judged by George Dobbs G3RJV. Those who would like to enter should contact M Jamil G1VQE, the club publicity officer.

The club meets every Tuesday at the Mosses Youth and Community Centre, Cecil Street, Bury.

PASCAL at Burnham

Burnham Beeches Radio Club has two main events this month: a surplus equipment sale on October 5th and a talk on PASCAL by Tony Watson on October 19th.

The BBRC meets at the Haymill Youth and Community Centre, Burnham Lane, Slough at 8pm on the first and third Mondays of the month.

Club contact is Eileen Chislett G6EIL, on Maidenhead 25720.

Video night

Bath and District ARC is holding a video night on October 14th and a constructor's competition on October 28th.

Club meetings are held at the Englishcombe Inn, Englishcombe Lane, Bath on Wednesdays at 8pm. Club contact is H Welchman G6E1Y, on Bath 28010 day-times and Bath 318128 evenings.

Knotty, knotty. . .

Felixstowe and District ARC is a bit tied up on October 5th, with a lecture on knot tying for the radio amateur. If you are at a loose end, this could be just the thing for you. . .

Later in the month, on the 19th, the club is holding a social.

All club meetings take place at 8pm in the Scout Hut, Bath Road, Felixstowe, unless otherwise specified. Further details are available from Paul Whiting G4YQC on (0473) 642595, daytime only.

No ASTRID at AMSAT

In Alan Pickard's article in the August issue, *An Introduction to Communications Satellites*, AMSAT-UK was listed as a supplier of the ASTRID system. This information is incorrect, however, and we apologise to AMSAT-UK for any inconvenience caused by this error.

Further information on the ASTRID system can, in fact, be obtained from Steve Webb of SRW Communications, on (0653) 697513.

CW CARS

The Coventry Amateur Radio Society is holding two Morse tuition evenings, including time on the air, on October 9th and 23rd. The 16th is a quiz night, so now is the time to start polishing up your radio knowledge.

On the 30th the club is planning a direction finding game indoors, presumably with the unreliable British climate in mind.

The club usually meets every Friday at 8pm, the venue being Baden Powell

Notes from the Past

Comments made in 1953 on the future of transistors

When that mighty midget, the transistor, was first announced in 1948, many constructors began to look forward to a real breakaway in contemporary radio design. With the big American corporations eagerly competing to put it into harness few guessed that today, five years later, transistors would still be beyond our practical experience. For us they are 'just around the corner' and it seems it will be a year or two yet before we can use them in our circuitry.

It is doubtful that, even in its perfected form, the transistor will supersede the thermionic valve. There are a lot of jobs the germanium wonder cannot do, for the uses of the valve have now become legion. Even in its present state of development there are many production snags to be ironed out before the manufacture of transistors on a large scale can be achieved, and defence and national services rightly have priority. Germanium itself is plentiful enough but its refinement to a meticulous degree of purity has to be made before it is fit for use. Then impurities have to be introduced, with equally meticulous care!

Possibilities

The lack of access by British constructors has given rise to some doubt whether the transistor is all that it is cracked up to be. Early reports are invariably over-enthusiastic. Most of the apparatus described which incorporates them has come from American sources, and over there they are still in short supply and very expensive. The general impression in Europe is that, as a substitute for the valve, they are not yet the valve's equal, and this seems (at present) to fairly summarise the position. Thus interest in them is not so great as it might be if the transistor was as revolutionary as the early enthusiasts claimed. It is natural that constructors should ask themselves: 'Why pay a high price for a substitute of doubtful efficiency?'

House, 121 St Nicholas Street, Radford, Coventry. The club secretary is Bill Hahn G3UOL, who can be contacted on (0203) 414684.

Irish races

The fund raising committee of the Irish Radio Transmitters Society is looking for members to get sponsorship for the society's Race Night, in the form of advertisements

in the book which will form the race card.

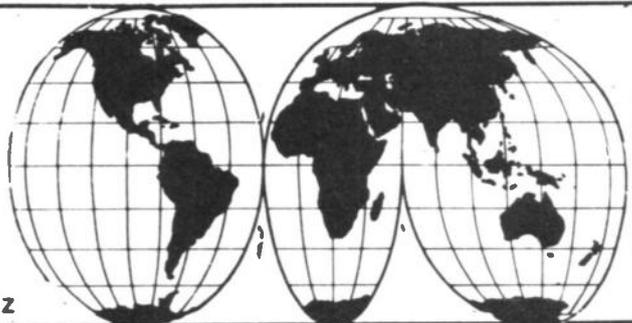
Admission to the evening is £1.00, which includes the race card and light refreshments. Bar facilities will also be available.

Subscriptions and details of advertisements should be sent to Tony EI6EW, PO Box 462, Dublin 9. All cheques should be made payable to the IRTS.

SHORT WAVE NEWS FOR DX LISTENERS

By Frank A Baldwin

All times in UTC, **bold** figures indicate the frequency in kHz



Continuing our update of some of the Bolivian transmitters now currently in operation on the low frequency bands, begin the search by tuning to **4875.8** where, should the propagation conditions be favourable, the signals from Radio La Cruz del Sur located in the capital city of La Paz may be heard. It programmes in Spanish and Quechua from 2200 to 0200 with a power of 1kW.

Quecha is one of a linguistic family of West South America whose member languages are spoken in Bolivia, Ecuador, Peru and North West Argentina. The official language of the Inca empire was one of this family.

Listen for these

Radio Monteagudo, Sucre, on **4935**, is scheduled from 1400 to 0200 with a power of 1kW. Coping with the Brazilian signals on this channel will effectively prevent any chance of hearing this one.

On **4945** Radio Illimani, La Paz, is in operation only on Sundays from 0900 to 0400 but sometimes signing off at 0500 with a power of 10kW in Spanish and local Quechua. However, the co-channel 20kW Caracol in Neiva, Colombia with its 24-hour schedule unfortunately dominates the channel.

Radio Juan XXIII, located in San Ignacio de Velasco, is scheduled on **4965** from 2000 to 0025 (Sunday from 1100 to 2300) in Spanish with a power of 3kW.

Radio Maria Auxiliadora, Santa Cruz, is on the air from 1000 to 0100 (Sunday from 1200 to 0400) at 1kW with programmes in Spanish. The frequency is **4975**.

Radio Animas, Chocaya, on **4991** presents Spanish programmes on weekdays from 2100 to 0300 and has a power of 1kW. It is only rarely heard far from Bolivia.

The 1kW Radiodifusora Cristal, La Paz, on **5005** in

Spanish, opens at 2200 and closes at 0300 (0100 on Sunday). Seldom heard worldwide, it is more often reported by USA DXers.

On **5030** is Radio Cuarto Centenario in Tupiza, operating in Spanish from 2200 to 0200 at 0.3kW. It has also been reported closing at 0100.

AROUND THE DIAL

Look out for these loggings made in East Anglia recently.

AFRICA

Lesotho

Maseru on **4800** at 2147, an interview with religious recordings during a requests programme in English, OM with an announcement in Sesotho at 2155 then a choral rendition of the National Anthem and sign-off at 2200. Maseru is on the air from 0300 to 2200 in vernaculars and English, the power being 100kW.

Liberia

ELWA Monrovia on **3230** at 2135, OM with a talk in vernacular. The Home Service schedule is from 1810 to 2200 (Sunday also from 0615 to 0800), all in vernaculars. The power is 10kW.

Mozambique

Radio Mozambique, Maputo on **3348** at 0315, OM and YL interview in Portuguese. At 10kW, this one is on the air in Portuguese and vernaculars from 0300 to 0545 and from 1630 to 2215. Owing to utility interference it is rarely heard here in the UK, the best chance of reception being around the time quoted.

Djibouti Republic

Djibouti on **4780** at 2105, OM with announcements in Somali then a chanting type of song complete with drum backing. The schedule is Friday from 0500 to 1300 in vernaculars and Somali, Saturday to Thursday inclusive from 0300 to 0800 in vernaculars, Somali and Ara-

bic, from 0900 to 1300 in vernaculars and Somali and from 1300 to 1900 in Arabic, vernaculars and Somali. The power is 20kW.

South Africa

Radio Oranje, Johannesburg on **3215** at 0320, a song in English with piano accompaniment. At 100kW, R Oranje transmits from 0300 to 0540 and from 1550 to 1930 in Afrikaans and English.

RSA Johannesburg on **3230** at 0324, OM and YL with a talk in English about astronomy. The schedule is from 0300 to 0426 in English and from 1900 to 1956 in Portuguese. The power is 250kW.

Togo

Radio Tome, Lome on **3222** at 0533, OM with a sermon in French followed by a choir with hymns. Radio Tome is on the air from 0528 to 0815 and from 1645 to 2305 in French and vernaculars. The power is 10kW.

CENTRAL AMERICA

Cuba

Radio Rebelde, Havana on **5025** at 0358, OM with a talk in Spanish about Brazilian affairs. Radio Rebelde (Rebel) operates in Spanish around the clock with a power of 50kW.

Honduras

Sani Radio, La Ceiba on **4755** at 0040, local pops with announcements in Spanish. The schedule in Spanish and local languages is from 1200 to 1600 and from 2200 to 0200 with a power of 10kW.

NORTH AMERICA

WCSN Boston, a Christian Science station, on **9465** at 0540, listeners' letters being answered in the English transmission to South Africa, scheduled from 0400 to 0600.

WHRI South Bend, Indiana on **9620** at 0710, YL and OM with a religious talk followed by the station identification in the English programme for

Canada and Europe, timed from 0600 to 0800.

WCSN Boston on **17640** at 1050, YL and OM with Bible readings in an English programme for South Africa, timed from 1000 to 1200.

SOUTH AMERICA

Bolivia

On a recent good night for Bolivian reception here in the UK, the following were logged:

Radio Reyes, Beni on **4421.6** at 0123, male broadcaster with a folk ballad in Spanish. The schedule is from 1500 to 1800 and from 2315 to 0335 in Spanish with a power of 0.4kW.

Radio Movima, Santa Ana on **4471.9** at 0147, OM with announcements in Spanish, YLs with a folk song complete with guitar backing. This 1kW transmitter operates in Spanish from 1055 to 2000 and from 2200 to 0300.

Radio Paititi, Guayamerin on **4682.2** at 0234, folkloric songs and music with announcements in Spanish. The schedule is from 1100 to 1800 and from 2100 to 0300 in Spanish, the power being 5kW.

Radio 2 de Febrero, Bamba-marca on **5505.2** at 0148, male broadcasters with a discussion, a short interlude of orchestral music then back into the talking. Broadcasting in Spanish, this one is on the air from 1100 to 1600 and from 2100 to 0245. The power is 0.5kW.

Peru

Radio Ancash, Hurez on **4990.6** at 0235, announcements, YL with a folk song then OM with the station identification. Radio Ancash is on the air in Spanish from 0830 to 0500 with a power of 10kW.

Radio Tacna, Tacna on **6571** at 0020, OM with a talk in Spanish. This one operates entirely in Spanish from 0900 to 0500 and from 2200 to 0500 at 0.2kW.

Venezuela

La Voz de Carabobo, Valencia on **4780** at 0454, promotions, an announcement and local pops on records. Programming in Spanish, this 1kW transmitter is operative from 0900 to 0400.

Radio Capital, Caracas on **4850** at 0050, local pops, music and promos (promotions). The schedule is from 1000 to 0500 (Sunday around the clock) with a power of 1kW.

ASIA

Bangladesh

Dhaka on **6240** at 1835, YL with a talk in English about foreign affairs. This English and Bengali transmission is intended for Europe, being timed from 1815 to 2000. Also heard when in parallel on **7505**.

China

Yunnan PBS Kunming on **2460** at 2137, OM with a talk in Chinese. This 15kW transmitter carries the Home Service 1 in Chinese from 2130 to 0100, from 0255 to 0600 and from 0855 to 1540. There are English language lessons from 2200 to 2230, from 0500 to 0530 and from 1400 to 1430. A parallel channel is **4760**.

Hubei PBS, Wuhan on **3940** at 2147, interview in Chinese. At 10/50kW, Hubei PBS is on the air with the Home Service 1 in Chinese from 2100 to 0610 and from 0850 to 1530.

Quinghai PBS, Xining on **3950** at 2233, OM with a talk in Chinese. Radiating the Home Service 1, the schedule is from 2155 to 0030, from 0340 to 0630 and from 0955 to 1530, an English language lesson being timed from 1400 to 1430. The power is 10kW, parallel channels being **4940** and **6260**.

Iran

Teheran on **9790** at 1657, YL with the station identification, announcements, chimes at 1700 then a newscast, all in Farsi.

Oman

Muscat on **9735** at 1905, OM with a talk about Medina during an Arabic transmission for the Middle East, scheduled from 0400 to 2130.

Iraq

Baghdad on **9555** at 1755,

music and songs then a pips timecheck, the station identification and a newscast in the Arabic programme for North Africa, scheduled from 1600 to 0000.

Pakistan

Azad (Free) Kashmir on **4790** at 1749, YL with a talk in Kashmiri. The Home Service in Urdu and Kashmiri is timed from 1200 to 1415 and from 1430 to around 1805, which includes a news bulletin in English relayed from Radio Pakistan scheduled from 1600 to 1610.

United Arab Emirates

Abu Dhabi on **9630** at 1825, OM with a talk followed by the station identification, all in the Arabic transmission to Europe, timed from 1600 to 2130.

SOUTH-EAST ASIA

Vietnam

Hanoi on **9840** at 1313, OM and YL with the news followed by the station identification during the French programme for East Asia, timed from 1300 to 1330.

EUROPE

Austria

Vienna on **9600** at 0637, OM and YL with the local and world news during the English programme for Europe, timed from 0630 to 0700.

Iceland

Reykjavik on **9985** at 1858, OM and YL with news items in the Icelandic transmission to Europe, timed from 1855 to 1940.

Finland

Helsinki on **9560** at 0629, interval signal, the station identification, schedules and then the news in the English programme for Europe, timed from 0630 to 0655.

Sweden

Stockholm on **9630** at 1104, OM with a news bulletin in the English programme for Europe, timed from 1100 to 1130.

Switzerland

Berne on **9565** at 0655, OM with a talk about African farming techniques and affairs in an English programme for Africa, scheduled

from 0600 to 0700.

Greece

ERT Thessalonika on **9935** at 1443, non-stop Greek music and songs in the Greek Home Service to the Middle East, timed from 0900 to 2115.

Poland

Warsaw on **9540** at 1732, YL with a news bulletin during an English programme for West Europe, scheduled from 1730 to 1800.

PACIFIC

Australia

Carnarvon on **7120** at 1524, OM with the station identification in English, 'Waltzing Matilda' and sign-off at the end of the Cantonese programme for Central Asia, scheduled from 1430 to 1530.

Carnarvon on **7205** at 1551, OMs with a discussion about the characteristics of Australians. This English transmission is directed to Europe from 1530 to 2040.

Shepparton on **9655** at 0654, interval sign ('Waltzing Matilda'), timecheck pips, OM with the station identification and news of both local and world events in the English programme for Europe, timed from 0700 to 1030.

Canada

Montreal on **9750** at 0515, schedule information, the station identification followed by the news in the English presentation to Europe, timed from 0515 to 0600.

CLANDESTINE

Radio Iran Toilers on **4775** at 1830, YL with the identification, music and songs in Farsi (Persian). This one backs the Iranian Tudeh (Communist) Party, radiating via the facili-

ties of Radio Afghanistan. It identifies as 'Radio-ye Zahmatkeshan-e Iran'. Significantly, Radio Afghanistan is on this channel with the Kabul City Service from 0130 to 0230.

NOW HEAR THESE

Radio Zimbabwe, Harare, on **3395.5** at 2105, YL with a pop song in English. This 100kW transmitter carries Radio 1 programmes in English from 0325 (Sunday from 0400) to 0530, and from 1530 to 2100 (Saturday until 2200) with newscasts at 0400, 0500, 1600, 1745 and at 2000. It relays Radio 3 programmes from 2100 to 2200 from Sunday to Thursday inclusive. The frequency can vary slightly.

ABC Brisbane, Australia on **4920** at 2022, OMs with an interview all about Australian sporting events and personalities. ABC Brisbane is on the air in English from 1900 (Sunday from 1930) to 1402 with a power of 10kW.

NOW LOG THESE

Radio Andina, Huanacayo, Peru on **4996** at 0452, OM with announcements, promotions, YL with a song in Spanish followed by the station identification.

Radio Andina has a power of 2kW and operates in the Emisoras Cruz del Peru network from 1000, closing any time between 0430 to 0530.

Radio Rio Amazonas, Macuma, Ecuador on **4870** at 0132, OM with a talk in Spanish. This one seems to excel in long and seemingly interminable talks, at least that is the impression after logging their transmissions many times. The power is 5kW and the schedule is from 1100 to 1600 and from 0000 to a variable sign-off between 0400 and 0500. 

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■ MET 50/3 antenna unused, £32. 2m Slim-Jim, unused £5. Buyers to collect. Tel: Leamington Spa (0926) 313669

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■ Trio R-600, boxed, as new condition, £250. Also Mizuho KX-3 ATV, £25. Together would make an ideal starter pack for a new SWL. Both units hardly used. Tel: Aberdeen (0224) 311597, after 8.30pm

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■ WKS1001 10m and 11m transceiver, good condition, £60. Mr Martin Fuller, 37 Green Field Close, Eccles, Nr Maidstone, Kent ME20 7HU

■ Microwave Modules linear amplifier for 2 metres, 10 watts in 100W out, perfect condition, with manual, £75. Mr Richard De Ste Croix, 46 Nelson House, Albert Street, Grimsby, Sth Humberside DN32 7HH

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■ Yaesu FT707 (100W) with mike, Morse key, £260. KR400RC rotator with controller, £50. Squeeze key MK705 (with keyer), £15. HF ATU Amtech 300, £20. HF SWR/power meter, Hansen SWR-3E, £10. Tel: Tisted 306, after 4pm, ask for Darren

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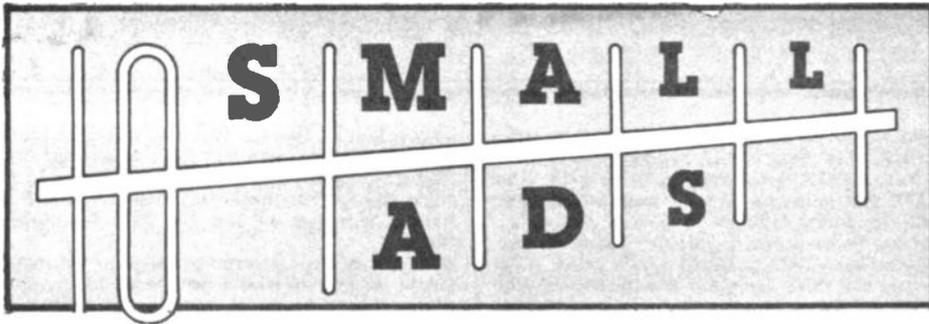
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formal qualifications, if for instance you are a radio amateur who can, with confidence, build and repair your own equipment, you
could be ideal!

A basic knowledge of radio is essential, and a practical test may be given. If you want to improve your career prospects, then
come and show us what you can do!

We are conveniently situated close to junction 3, M5. We use modern test equipment and work in a small friendly environment,
with a team of talented people

Please send a written application or call Ray Withers personally, on the above telephone number.

**WE OFFER YOU THE CHANCE TO GROW WITH AN EXPANDING COMPANY, PROVIDING BUSINESS
AND AMATEUR RADIO ENTHUSIASTS WITH TOMORROW'S RADIO TECHNOLOGY TODAY . .**

**EX R.A.F. VULCAN
SOLID STATE.**

Tail warning, Radar, Indicator unit (Part of Red
Steer) Last Chance to Obtain A Once
Operational Item. £49.50 + Securicor

BRENT ELECTRONICS
Tel: 0472 690383

D & D ELECTRONICS

(Kennington)

The sort of shop you used to see in
Lisle St. All sorts of surplus supplies, so come
along and browse or send
SAE for info. sheets.

3a Braganza Street, London SE17 3RD
Tel: 01-793 0054 (Open 6 days a week)

**COUNTY
GUIDE**

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

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

RADIO & ELECTRONICS WORLD COUNTY GUIDE ORDER FORM

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

print your copy here

NUMBER OF INSERTIONS REQUIRED

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

PAYMENT ENCLOSED

£

Cheques should be made payable to Radio and
Electronics World. Overseas payments by Internat-
ional Money Order

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

Registered No 2307667 (England)

C P I

DISPLAY AD RATES		series rates for consecutive insertions			
depth mm x width mm	ad space	1 issue	3 issues	6 issues	12 issues
61 x 90	1/8 page	£91.00	£86.00	£82.00	£73.00
128 x 90 or 61 x 186	1/4 page	£160.00	£150.00	£145.00	£125.00
128 x 186 or 263 x 90	1/2 page	£305.00	£290.00	£275.00	£245.00
263 x 186	1 page	£500.00	£560.00	£530.00	£475.00
263 x 394	double page	£1140.00	£1070.00	£1020.00	£910.00

COLOUR AD RATES		colour rates exclude cost of separations	series rates for consecutive insertions		
depth mm x width mm	ad space	1 issue	3 issues	6 issues	12 issues
128 x 186 or 263 x 90	1/2 page	£420.00	£395.00	£375.00	£335.00
297 x 210	1 page	£810.00	£760.00	£730.00	£650.00

SPECIAL POSITIONS	Covers: 20% extra, inside covers 10% extra	Outside back cover 20% extra, inside covers 10% extra
Bleed: 10% extra (Bleed area - 307 x 220)		
Facing Matter: 15% extra		

DEADLINES		*Dates affected by public holidays			
issue	colour & mono proof ad	mono no proof and small ad	mono artwork	on sale thurs	
Sep87	16 Jul 87	22 Jul 87	24 Jul 87	13 Aug 87	
Oct 87	13 Aug 87	19 Aug 87	21 Aug 87	10 Sept 87	
Nov 87	10 Sep 87	16 Sep 87	18 Sep 87	8 Oct 87	
Dec 87	15 Oct 87	21 Oct 87	23 Oct 87	12 Nov 87	

CONDITIONS & INFORMATION	
<p>SERIES RATES Series rates also apply when larger or additional space to that initially booked is taken. An ad of at least the minimum space must appear in consecutive issues to qualify for series rates. Previous copy will automatically be repeated if no further copy is received. A hold ad is acceptable for maintaining your series rate contract. This will automatically be inserted if no further copy is received. Display Ad and Small Ad series rate contracts are not interchangeable.</p>	<p>If series rate contract is cancelled, the advertiser will be liable to pay the unearned series discount already taken. COPY Except for County Guides copy may be changed monthly. No additional charges for typesetting or illustrations (except for colour separations). For illustrations just send photograph or artwork. Colour Ad rates do not include the cost of separations.</p>
<p>Printed - web-offset. PAYMENT Above rates exclude VAT. All single insertion ads are accepted on a pre-payment basis only, unless an account is held. Accounts will be opened for series rate advertisers subject to satisfactory credit references. Accounts are strictly net and must be settled by publication date.</p>	<p>Overseas payments by International Money Order Commission to approved advertising agencies is 10%. CONDITIONS 10% discount if advertising in both Radio & Electronics World and Amateur Radio. A voucher copy will be sent to Display and Colour advertisers only. Ads accepted subject to our standard conditions, available on request.</p>
<p>FOR FURTHER INFORMATION CONTACT Radio & Electronics World, Sovereign House, Brentwood, Essex CM14 4SE (0277) 219878</p>	

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£1 BAKERS DOZEN PARCELS

Price per parcel is £1.00, but if you order 12 you get one extra free. All the parcels listed below are brand new components. Unless marked s.h.

- 1 - 5 13 amp ring main junction boxes
- 2 - 5 13 amp ring main spur boxes
- 5 - 3 flush electrical switches
- 7 - 4 in flex line switches with neons
- 8 - 2 80 watt brass cased elements
- 9 - 2 mains transformers with 6V 1A secondaries
- 10 - 2 mains transformers with 12V 1A secondaries
- 11 - 1 extension speaker cabinet for 6 1/2" speaker
- 12 - 5 octal bases for relays or valves
- 13 - 2 glass reed switches
- 14 - 4 OCP 70 photo transistors
- 16 - 4 tape heads, 2 record, 2 erase
- 17 - 1 ultra sonic transmitters and 1 ditto receiver
- 18 - 2 15000 mfd computer grade electrolytics
- 19 - 2 light dependent resistors
- 20 - 5 different micro switches
- 21 - 2 mains interference suppressors
- 22 - 2 25 watt crossover units 2 way
- 23 - 1 40 watt 3 way crossover unit
- 28 - 1 6 digit counter mains voltage
- 30 - 2 Nicad battery chargers
- 31 - 1 key switch with key
- 32 - 2 humidity switches
- 33 - 2 aerosol cans of ICI Dry Lubricant
- 34 - 96 x 1 metre lengths colour-coded connecting wires
- 36 - 2 air spaced 2 gang tuning condensers
- 37 - 2 solid dielectric 2 gang tuning condensers
- 38 - 10 compression trimmers
- 41 - 6 Rocker Switches 10 amp mains SPST
- 43 - 5 Rocker Switches 10 amp SPDT Centre Off
- 44 - 4 Rocker Switches 10 amp DPDT
- 45 - 1 24 hour time switch mains operated (s.h.)
- 46 - 1 6 hour clock timeswitch
- 48 - 2 6V operated reed switch relays
- 49 - 10 neon valves - make good night lights
- 50 - 2 x 12V DC or 24V AC, 4 CO relays
- 51 - 1 x 12V 2C 0 very sensitive relay
- 52 - 1 12V 4C relay
- 53 - 2 mains operated relays 3 x 8 amp changeovers
- 55 - 1 locking mechanism with 2 keys
- 56 - Miniature Uniselector with circuit for electric jigsaws
- 57 - 5 Dolls' House switches
- 60 - 5 ferrite rods 4" x 5/16" diameter serials
- 61 - 4 ferrite slab serials with L & M wave coils
- 62 - 4 200 ohm earpieces
- 63 - 1 Mullard thyristor trigger module
- 64 - 10 assorted knobs 1" spindles
- 65 - 5 different thermostats, mainly bi metal
- 66 - Magnetic brake - stops rotation instantly
- 67 - Low pressure 3 level switch
- 69 - 2 25 watt pots 8 ohm
- 70 - 2 25 watt pots 1000 ohm
- 71 - 4 wire wound pots - 18, 33, 50 and 100 ohm
- 73 - 4 3 watt wire wound pots 50 ohm
- 77 - 1 time reminder adjustable 1-60 mins
- 78 - 5 5 amp stud rectifiers 400V
- 85 - 1 mains shaded pole motor 1/2" stack - 1 shaft
- 86 - 2 5" ali fan blades fit 1/2" shaft
- 87 - 2 3" plastic fan blades fit 1/2" shaft
- 88 - Mains motor suitable for above blades
- 89 - 1 mains motor with gear box 1 rev per 24 hours
- 91 - 2 mains motors with gear box 16 rpm
- 93 - 4 11 pin moulded bases for relays
- 94 - 5 87G valve bases
- 95 - 4 skitted 89A valve bases
- 96 - 1 thermostat for fridge
- 98 - 1 motorised stud switch (s.h.)
- 101 - 1 2 1/2 hours delay switch
- 103 - 1 6V mains power supply unit
- 104 - 1 4 1/2V mains power supply unit
- 105 - 1 5 pin flex plug and panel socket
- 107 - 1 5" speaker size radio cabinet with handle
- 109 - 10 1/2" spindle type volume controls
- 110 - 10 slider type volume controls
- 112 - 1 heating pad 200 watts mains
- 114 - 1 1W amplifier Mullard 1172
- 115 - Wall mounting thermostat 24V
- 118 - Teak effect extension 5" speaker cabinet
- 120 - p.c.b. with 2 amp full wave and 17 other recs
- 122 - 10 mtrs twin screened flex white p.v.c. outer
- 132 - 2 plastic boxes with windows, ideal for interrupted beam switch etc
- 155 - 3 varicap push button tuners with knobs
- 188 - 1 plastic box, slipping metal front, 16 x 95mm, average depth 45mm
- 241 - 1 car door speaker (very flat) 6 1/2" 15 ohm made for Radiomobile
- 245 - 2 speakers 6" x 4" 15 ohm 5 watt made for Radiomobile
- 266 - 2 mains transformer 9V 4A secondary split primary so OK also for 115V
- 267 - 1 mains transformers 15V 1A secondary p.c.b. mounting
- 330 - 2 6V 0.6V mains transformer .3A p.c.b. mounting
- 350 - 40 double pole leaf switches
- 365 - 1 7uf 660V 50hz metal cased condenser
- 453 - 2 2 1/2in. 80ohm loudspeakers
- 454 - 2 2 1/2in. Bohm loudspeakers
- 463 - 1 mains operated relay with 2 sets c/o contacts
- 464 - 2 packets resin filler/sealer with cures
- 465 - 3 5A round 3 pin plugs will fit item 193
- 466 - 4 7 segment i.e.d. displays
- 470 - 4 pc boards for stripping, lots of valuable parts
- 473 - 1 5" 4ohm speaker with built in tweeter Radiomobile
- 480 - 1 3A double pole magnetic trip, saves repairing fuses
- 498 - 4 1000uf 25V axial electrolytic capacitors

TELEPHONE BITS

- Master socket (has surge arrester - ringing condenser etc) and takes 8 T. plug £3.95
- Extension socket £2.95
- Dual adaptors (2 from one socket) £3.95
- Cord terminating with 8 T. plug 3 metres £1
- Kit for converting old entry terminal box to new 8 T. master socket, complete with 4 core cable, cable clips and 2 BT extension sockets £11.50
- 100 mtrs 4 core telephone cable £8.50

COMPACT FLOPPY DISC DRIVE EME-101

The EME-101 drives a 3" disc of the new standard which despite its small size provides a capacity of 500k per disc, which is equivalent to the 3 1/2" and 5 1/4" discs. We supply the Operators Manual and other information showing how to use this with popular computers: BBC, Spectrum, Amstrad etc. All at a special snip price of £27.50 including post and VAT. Data available separately £2, refundable if you purchase the drive.

EVERLASTING BATTERIES!

Well not quite, but if you don't switch it on, the lithium battery has an almost indefinite shelf life, which makes it suitable for emergency, standby & similar applications, also for quartz clocks and instruments that draw only microscopic currents. The lithium battery we have is 3V and about as big and thick as 2p coin. Price 2 for £1 ref B0558. Note these run on Dill socket our ref B0553.

3 POLE MODEL MOTOR

Will operate from as low as 1.5V and speed will increase steadily as the voltage is increased, at 9V however a governor takes over and the speed remains constant - and ideal motor for models. Size approx 28mm x 40mm easily reversible and with good length spindle 80p each our ref B0543.

CASSETTE STEREO TAPE HEADS

With mounting brackets and with tape guides pairs, one record/playback and the other erase £1 pair ref B0541.

OPTO INTERRUPTER

Consists of an IR emitter mounted close to light dependent resistor when light or IR is interrupted the change of resistance can be made to switch or operate a relay - useful for counting, motor stopping etc Price 2 for £1 ref B0545.

VENNER TIME SWITCH

Mains operated with 20 amp switch, one on and one off per 24 hrs, reports daily automatically correcting for the lengthening or shortening day. An expensive time switch but you can have it for only £2.95 without case, metal case - £2.95, adaptor kit to convert this into a normal 24hr. time switch but with the added advantage of up to 12 on/off's per 24hrs. This makes an ideal controller for the immersion heater. Price of adaptor kit is £2.30.

Ex-Electricity Board. Guaranteed 12 months.

12 volt MOTORS BY SMITHS

Made for use in cars, etc. these are very powerful and easily reversible. Size 3 1/2" long by 3" dia. They have a good length of 1/2" spindle - 1/10 hp £3.45. 1/8 hp £5.75. 1/6 hp £7.50.

SOUND TO LIGHT UNIT



Complete kit of parts for a three channel sound to light unit controlling over 2000 watts of lighting. Use this at home if you wish but it is plenty rugged enough for disco work. The unit is housed in an attractive two tone metal case and has controls for each channel, and a master on/off. The audio input and output are by 1/2" sockets and three panel mounting fuse holders provide thyristor protection. A four pin plug and socket facilitate ease of connecting lamps. Special price is £14.95 in kit form.

This Month's Snip

9" VDU OR MONITOR ideal to work with computer or video camera uses Philips black and white tube ref M24/300W. Which tube is explosion and X-Ray radiation protected. VDU is brand new and has a time base and EHT circuitry. Requires only a 16V dc supply to set going. It's made up in a lacquered metal framework but has open sides so should be cased (if you are handy with a drill and file you could make a case out of two of our 6 1/2" speaker cabinets). The VDU comes complete with circuit diagram and has been line tested and has our six months guarantee. Offered at a bit less than some firms are asking for the tube alone, only £18 plus £3 post. We also have some that failed the line test, again brand new but offered without guarantee at £8 plus £3 post. We do a kit for the 16V 2A psu to operate this monitor price is £3 our ref 3P26.

SLIDE SWITCHES

Sub miniature size only 10mm x 4mm single pole change over or on/off. Price 5 for £1 ref B0553.

LOW VOLTAGE RELAY

DMRON 3.5V coil, plug in dill sockets, 5a c/o contacts. Brand new offered at a silly price 2 for £1 ref B0548.

POLARISED RELAY

Depending upon its direction of current as low 14 Ma makes this open circuit, so it could be used to protect delicate instruments or as an earth leakage, or reverse voltage trip etc. 2 for £1 ref B0549.

SLOTTED OPTO SWITCH

Infra red emitter and sensor mounted in slotted moulding, so that the emitter beam when broken makes a contactless switch, can be used in electronic ignition, speed sensing etc. etc. Price 2 for £1 ref B0545.

24hr TIME SWITCH

Especially made with West German precision. Just under 4" square with 15amp c/o contacts can be set anywhere around 24hr dial to the nearest 15 mins also with a override switch. Ref B056 but hurry we have only 300. Price £8.

COMPUTERS

The Acorn 'Electron' as used in many schools for games and serious jobs. Works into colour or Black and White TV. Proper price was £198, our Price, tested and working £45 + £3 post, tested but slightly faulty £36 + £3 post and lastly tested but not working £20 + £3 post, all are new and complete with mains P.S.U., 300 page handbook, TV lead, and tested cassette. Full range of Software also in stock at very low prices.

TELEPHONE LEAD

3 mtrs long terminating one with new BT, flat plug and the other with 4 correctly coloured coded wires to fit to phone or appliance. Replaces the lead on old phone making it suitable for new BT socket. Price £1 ref B0552 or 3 for £2 ref 2P184.

POWERFUL IONISER

Generates approx. 10 times more IONS than the ETI and similar circuits. Will refresh your home, office, shop, work room etc. Makes you feel better and work harder - a complete mains operated kit, case included £9.50 + £2 P.&P.

J & N BULL ELECTRICAL

Dept. R.E., 250 PORTLAND ROAD, HOVE, BRIGHTON, SUSSEX BN3 5QT

MAIL ORDER TERMS: Cash, P.O. or cheque with order. Orders under £20 add £1 service charge. Monthly account orders accepted from schools and public companies. Access & B/card orders accepted. Brighton 0273 734648 or 023550.

NEW ITEMS

Some of the many described in our current list which you will receive with your parcel

£2 POUNDERS*

- 2P120 - 1 combined clockwork switch and thermostat for boiler control
- 2P122 - 1 30a rotary switch, surface mounting with pointer knob
- 2P123 - 1 25a rotary switch, surface mounting, cover engraved, high, medium low and off
- 2P124 - 1 28Vr .001mfd block condenser
- 2P127 - 1 30a bridge rectifier assembly on heat sinks
- 2P129 - 1 10rpm motor 115V so supplied with adaptor for 230V
- 2P131 - 1 Crozet motor 230V fits the Crozet gearbox
- 2P132 - 1 calling heart-stat for fire warning or protection
- 2P133 - 1 Circuit breaker 20a, Cartron ref C50
- 2P134 - 1 9V 500mA psu plugs in 13a socket
- 2P135 - 10m 10 conductor intercom cable
- 2P136 - 1 2-jaw element made for tangential blowers
- 2P137 - 1 Thermo couple stainless steel topped for measuring internal heat
- 2P138 - 1 Mains transformer 20V-0-20V 1a upright mounting
- 2P141 - 1 rechargeable battery D size (14 AA) solder tag ended
- 2P142 - 10m 4 pair intercom cable White PVC outer
- 2P144 - 1 mains operated relay with 4 x 8a c/o contacts
- 2P145 - 1 10,000 of 10V d.e. smoothing capacitor
- 2P146 - 1 7,800 of 150C d.e. smoothing capacitor
- 2P147 - 1 10w 100ohm line matching transformer
- 2P148 - 1 Technical information on 3" FDD refundable if you buy fdd
- 2P149 - 5 diff battery operated model motors
- 2P150 - 1 PSU chassis with all components for 24V 2A d.c. unregulated
- 2P151 - 1 Metal box 14 1/2 x 14 x 4 with lid add £2.00 post
- 2P152 - 1 Motor start capacitor 80uf 250V
- 2P153 - 1 Two station intercom unregulated, line reject
- 2P154a - 1 Nicad charger - plug into 13a socket 5.2V, 700mA output
- 2P154b - 1 Nicad charger - plug into 13a socket 6V, 900mA output
- 2P155 - 1 Mains transformer giving 16, 17, 18 & 20V 80W
- 2P158 - 1 Oven thermostat with temp calibrated knob
- 2P159 - 1 9V 500ma cased with mains lead and output lead
- 2P160 - 1 13a plug adaptor fused takes 3 x 13a plugs
- 2P181 - 1 6" diagonal slide cutters
- 2P182 - 1 Stereo Matrix PCB mounting deemphasis K35
- 2P183 - 1 AC Working capacitor 12uf 500V AC or 1500V dc
- 2P183a - 1 AC Working capacitor 14uf 350V AC or 800V dc
- 2P184 - 3 Phone leads 3 mtrs long taps one and B.T. plug other and

£3 POUNDERS*

- 3P7 - 1 DC voltage, doubler or halver for 12V to 24V 12 to 6V 24 to 12V
- 3P8 - 1 24hr time switch Sangamo, new construction Guaranteed 1 year
- 3P9 - 1 12V 500mA psu plugs in 13a socket
- 3P10 - 1 Mains transformer 50V 2VA with 6.3 pilot light winding, upright mounting, fully shielded
- 3P13 - 1 Morse filter to fit in mains lead of appliance up to 25a
- 3P15 - 1 waterproof case will take 200 watt transformer
- 3P16 - 1 signal box, 3 lamps on face plate of metal box size 5 1/2 x 3 1/2
- 3P17 - 1 choke and starter to work 8" fluorescent tube at 125W
- 3P18 - 1 22V 3a mains transformer with bridge rect fitted on top panel
- 3P20 - 1 0-5a ammeter 3/4 ac/dc ac equipment
- 3P21 - 1 power factor correction condenser 35uf 350ac
- 3P22 - 1 200va - auto transformer 230 to 115V toroidal encapsulated £1.50 post
- 3P23 - 1 36V-0-36V tapped 20V-0-20V 100va
- 3P24 - 1 3" Hopydy disc for Amstrad etc
- 3P25 - 1 7" Electrician's pliers

£4 POUNDERS*

- 4P11 - 1 Car Radio aerial
- 4P12 - 1 50m low loss co-ax 75ohm + £1 post
- 4P13 - 3 Hertzian time and set switcher 15amp
- 4P14 - 1 150va mains transformer "c" core 43V 3.5A secondary
- 4P15 - 1 powerful motor 2" stack fitted with gearbox final speed 60rpm mains operated, could operate door opener etc
- 4P17 - 1 Uniselector 3 pole 25V, 50V coil standard size
- 4P18 - 1 Volt meter with digital display (DIGIVISOR)
- 4P19 - 1 12V dc motor will fit to gearbox 4P20
- 4P20 - 1 Gear train giving speed reduction

£5 POUNDERS*

- 5P86 - 1 Transformer upright mounting 230/240V primary 2 x 100 1b secondary
- 5P88 - 1 Transformer in waterproof metal box 24V 5A add £2 post
- 5P89 - 1 4 bank heating element each 2kw add connector heater
- 5P90 - 1 18" long tangential blower with motor at one end
- 5P91 - 1 14" blower, motor in middle
- 5P92 - 10m Audio co-ax double screened 75ohm super low loss for TV
- 5P93 - 1 8" Alarm bell 24V dc or ac
- 5P94 - 1 Current transformer 14V out with 1a dc input
- 5P95 - 1 Vintage phone call
- 5P97 - 1 impedance matching transformer D-4-5-8-160 ohm 100 add £150 post
- 5P98a - 1 0-90a ammeter for mounting outside control panel
- 5P98b - 1 0-180a ammeter for mounting outside control panel
- 5P99 - 1 Mains operated blower centrifugal output size app 5" x 1 1/2"
- 5P100 - 1 Mains splitter 45a switch 3 x 15a fused circuits
- 5P101 - 1 Model motor 1 rpm from 6V reversible

£7 POUNDERS*

- 7P1 - 1 instant heat solder gun - mains with renewable tip and job light

£8 POUNDERS*

- 8P1 - 1 Charger transformer 10a upright mounting 230/240 primary 16v 10a secondary
- 8P2 - 1 8" underdome alarmbell suitable for a fire alarm or burglar alarm mains operated
- 8P3 - 1 heat sink big powerful so ideal for power transistor
- 8P5 - 1 1 1/2 hp motor 300 rpm capacitor run
- 8P6 - 1 24hr time switch - 2 on off 10a c/o contacts 3" x 3" x 1 1/2"
- 8P7 - 1 Silent sentinel invisible ray kit
- 8P8 - 1 14pin fan 3 1/2 x 3 1/2 x 1 1/2 230V metal bodied

£10 POUNDERS*

- 10P13 - 1 reversible motor with gearbox 104rpm Parvalux
- 10P14 - 1 100a time switch 1 on/off per 24hr extra triggers £1 pair
- 10P15 - 1 Max demand meter 230 ac mains
- 10P16 - 1 powerful air mover 2 small type blowers with motor in middle
- 10P18 - 1 mains operated klaxon
- 10P19 - 1 12V alarm bell really loud, mains operated, in iron case + £5 post
- 10P21 - 1 super metal box size 19" x 20" x 7" deep lockable + £3 post
- 10P22 - 1 sensitive volt meter relay
- 10P23 - 1 fruit machine heart, 3 fruit wheels each stepper motor operated
- 10P24 - 1 big panel meter face size 4 1/2 x 2 1/2 200uA movement scaled 1-10
- 10P25 - 1 1000W audio transformer 50-0-50W primary 8 ohm secondary
- 10P26 - 1 Secretary phone auto-dialer complete untested sold as such
- 10P29 - 1 12V engine cooling fan
- 10P30 - 1 instrument psu on pcb has 4 outputs .12V/.5V BA/12V SA/5V SA
- 10P31 - 1 7 day time switch 16a c/o contacts sap switches for each day
- 10P32 - 1 68 rpm 1/8th hp motor reversible

£15 POUNDERS*

- 15P1 - 1 kit for 115V hi fi amp
- 15P2 - 1 kit for psu to supply one or two 15P1 amps
- 15P3 - 1 time switch battery or mains operated - 16a c/o contacts, 7 day programmable has 30hr reserve

£25 POUNDERS*

- 25P1 - 1 1500 PSI hydraulic pump 24V dc motor, made for operating aircraft under-carriage etc.

LIGHT CHASER KIT motor driven switch bank with connection diagram, used in connection with 4 sets of xmas lights makes a very eye catching display for home, shop or disco, only £5 ref 5P56.

