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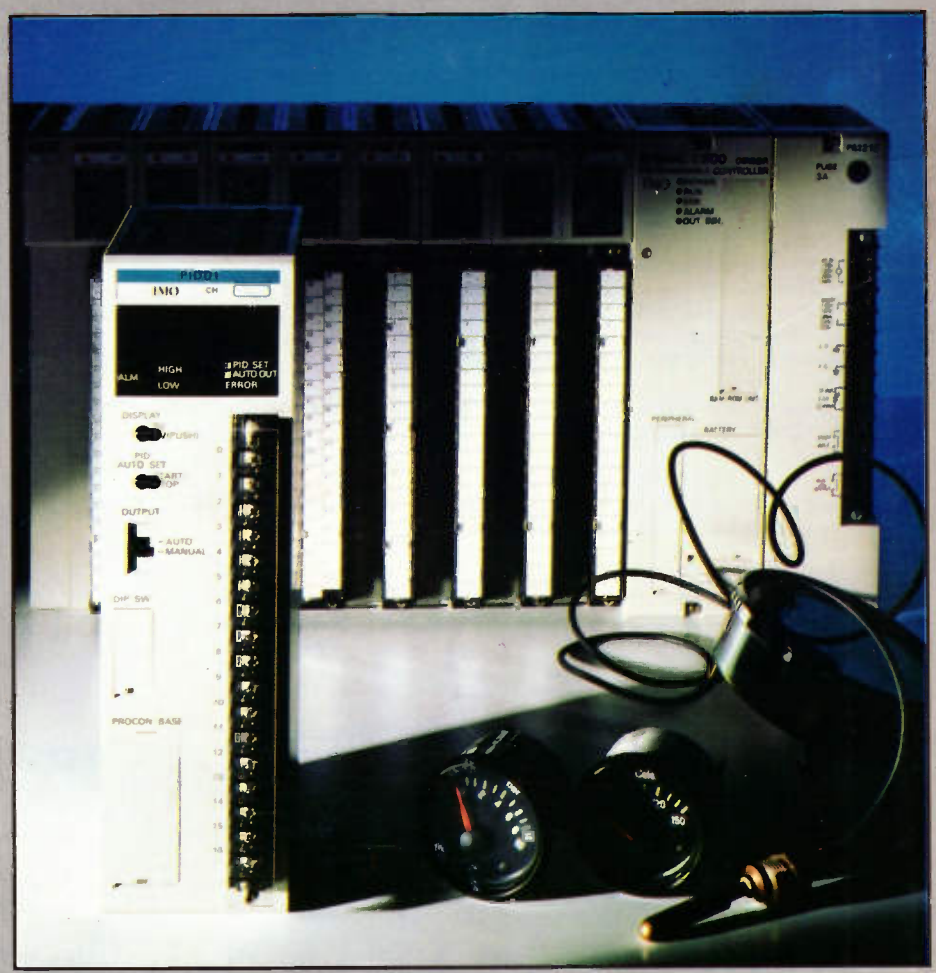
Radio & Electronics World

The communications and electronics magazine



QUIZ RESULTS: HOW DID YOU SCORE?

NICADS: CONSTRUCT A CHARGER

WSR524 REVIEW: WEATHER SATELLITE RECEIVER

SAT COMMS: EUROPE'S DATA RELAY SATELLITE

LOGIC CIRCUITS: FINAL INSTALMENT

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A WORLD FIRST FROM RWC LTD

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 >2μV pD HF, >1.5μV 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.

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

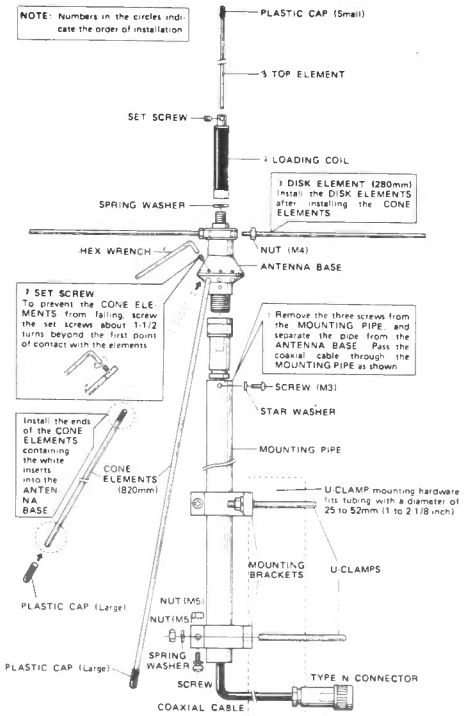
FRG9600/RWC MK3

AM-FM (WIDE & NARROW) LSB, USB. 100kHz-950MHz

Generous part exchange available on your existing receiver *(call for details)*
FRG9600 MK2 Model 60-950MHz 'N' connector @ £519.00 + £5.00 carriage. (Modified unit only).
FRG9600 MK3 Model 100kHz-950MHz 'N' connector and SO239 for HF @ £625.00 + £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 £725.00.

ICOM AH-7000

SUPER WIDEBAND OMNIDIRECTIONAL ANTENNA



SPECIFICATIONS

Frequency coverage	Receive: 25 to 1300MHz Transmit: 50, 144, 430, 900, 1200MHz bands
Input power rating	200 watts
Input impedance	50 ohms
Supplied connectors	Type N
Supplied coaxial cable	50-2V (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.
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.

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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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Bottom – High Technology Electronics Ltd's advanced video switching system -p10

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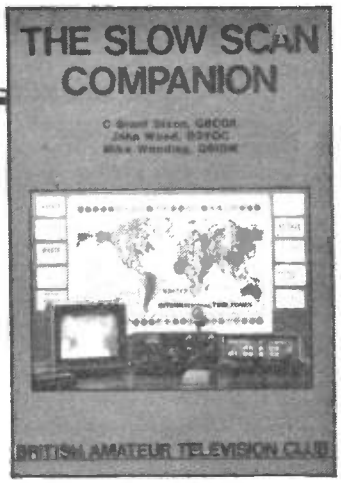
REGULARS

READER SERVICES

NEXT MONTH

☐ **Next Issue**
Cover date May 1987 on sale Thursday, 9 April

☐ **Publication Date**
Second Thursday of the month preceding cover date



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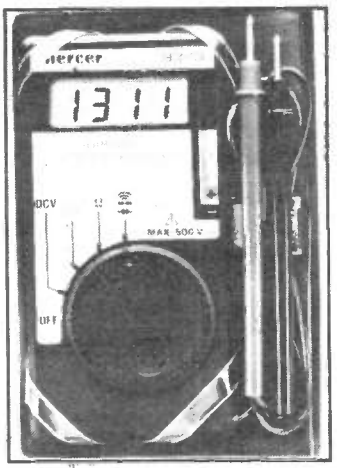


Greater accuracy – page 4

MW Success – page 28

Quiz winner – page 55

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

RF MILLIVOLTMETER

The 3440A is a reliable programmable RF millivoltmeter, manufactured by Ballantine and available from UK distributors PPM.

Advanced circuitry and stability make the unit well suited to system measurement, field and laboratory use. The true RMS instrument features high resistance to hostile RF environment, shock and vibration. Reliability is further enhanced using a solid-state monolithic chopper stabilised amplifier, and audible noise is reduced to zero. Inside the probe a self-regulating heater keeps the detector diodes at a constant temperature, eliminating calibration errors caused by temperature variation.

Signals over the frequency range 10kHz to 1.2GHz are measured in eight ranges from 1mV to 3V (FSD). Up to 30mV response is true RMS permitting highly accurate non-sinusoidal waveform calibration. From 30mV to 3V response changes from true RMS to peak to peak linear. An analogue 'curve matching' circuit computes the changing characteristic and corrects it, providing a high-linearity meter response over the higher ranges. Ranges are programmable with TTL logic or optional IEEE488 bus coupler.

Probe design is enhanced utilising a spring tip, and a 50 ohm terminated adaptor mates with BNC or N-type connectors. Also available are a 50 ohm tee adaptor, an unterminated (BNC/N) adaptor, and a 100:1 capacitative divider.

PPM Instrumentation Ltd,
Hermitage Road,
St Johns,
Woking,
Surrey GU21 1TZ.
Tel: (04867) 80111.

MINIATURE THERMOMETER

ETI have introduced a new miniature thermometer, measuring 103mm × 62mm × 26mm and weighing only 100 grams.

Housed in a tough, easy to handle case, the thermometer has been specifically manufactured to withstand the harsh conditions of industrial environment and features a high degree of protection against dust and liquids.

The 12.5mm bright liquid crystal display gives a read-out of 1°C with an accuracy of 1% over the range −50°C to 750°C, together with low battery indication. The thermometer is designed to be used in conjunction with type K thermocouple probes for which ETI offer over 40 different standard probes. The instrument is suitable for a wide variety of applications including servicing, testing and quality control.

The price of each unit is £39.50 plus VAT and carriage at cost.

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

SIGNAL GENERATOR

An AF signal generator, type 2016, producing sine, square and sine-burst waveforms which are suitable for effective audio test applications, has been announced by Electronic and Computer Workshop Ltd (ECW).

Sine wave distortion is just 0.05% from 500Hz to 20kHz into 600 ohms, and 0.5% from 50Hz to 500kHz, rising to a very reasonable 1.0% at 1MHz. Square wave overshoot is 2% at maximum output (3V peak to peak).

The sine wave burst facility is particularly useful for testing the dynamic performance of audio equipment, such as amplifiers, filters, loudspeakers, etc, and burst options include 4 cycles on/4 cycles off, 4 cycles on/12 cycles off and 8 cycles on/8 cycles off.

Leakage during the off period is within 2%. Frequency response is substantially flat (±0.3dB) into 600 ohms, up to 100kHz. Output control range is from −70 to 0dBm with a step attenuator and variable level control.

The type 2016 signal generator is part of an audio test system including an AF output power meter and distortion analyser, which assembles into a complete AF test bench.

ECW offers the type 2016 low distortion signal generator at a price of £212.75, including VAT and post/packaging.

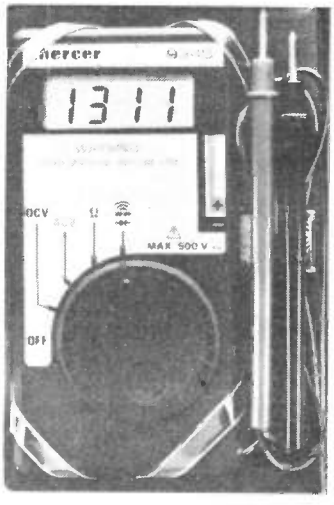
Electronic and Computer Workshop Ltd,
171 Broomfield Road,
Chelmsford,
Essex CM1 1RY.
Tel: (0245) 262149.

DIGITAL MULTIMETER

A new pocket digital multimeter, model 9345, that is claimed to give the same reliable accuracy readings as larger, more expensive instruments is now available from Simpson Electric Co.

The single rotary disc allows selection of the quantity to be measured and provides automatic measurement on all functions. In addition, it measures volts and ohms, has a high contrast LCD digital display, an audible continuity indication, and the range indicator is shown in display. Batteries and a carrying case are included.

Simpson Electric Company,
853 Dundee Avenue,
Elgin,
Illinois 60120,
USA.
Tel: (312) 697 2260.



POWER SUPPLIES

Weir Electronics' 100W oem switched mode power supplies are now available as plug-in Eurocard modules occupying 6U panel height for incorporation into 19 inch rack systems in accordance with equipment practice DIN 41494.

Identified as the EPS-100 series, three basic models are available which are electrically identical to the Weir chassis-mounted power supplies.

Model EPS 100/H (HSS 100) is a five-output unit with an operating efficiency greater than 80% at all but the lowest power output levels. In its basic form the voltages and maximum currents of its five output rails are: (1) +5.1V 12A, (2) +12V 5A, (3) −12V 2A, (4) −5V 1A and (5) +24V 2A. A further eight standard variants on the basic unit are available, giving alternative output voltages to suit a wide range of applications. All outputs are voltage regulated to compensate for line voltage and load changes, with full independent regulation on outputs (1), (4) and (5) to give virtual independence from the effects of loading on other rails.

Model EPS 100/00 LC (SMLC 100) is a four-output power supply intended for simple applications.

The basic model's voltages and current ratings of its output rails are: (1) +5V 10A, (2) +12V 4A, (3) −12V 1A and (4) −5V 1A. There are two further four-output versions and three three-output versions of this power supply for applications where different voltage configurations are required.

There are five standard versions of Model EPS 100/S (SHS 100) with ratings of 5V 30A, 12V 12.5A, 15V 10A, 24V 6.5A and 50V 3A respectively. All versions combine high stability with operating efficiency better than 80%.

All EPS 100 power supplies are designed to meet international RFI and safety standards.

Weir Electronics Ltd,
Durban Rd,
Bognor Regis,
Sussex PO22 9RW.
Tel: (0243) 865991.

GOING MOBILE

Communication Development Specialists Ltd have announced the release of a full facility, cost effective CTCSS panel for the Maxon series of mobile radios.

This panel has the ability to encode and decode CTCSS tones in the entire 67.00-250.3Hz sub-band. The panel has the additional facilities of carrier lockout with warble warning and PTT timer with warble warning and reverse burst to eliminate squelch tail. These options are all defeatable with the shorting links provided.

The unit plugs directly into the option socket and mounts on the integral mounting points.

Communication
Development Specialists,
PO Box 83,
Basingstoke,
Hants RG25 2PX.
Tel: (0256) 83528.

AUDIO PRODUCTS

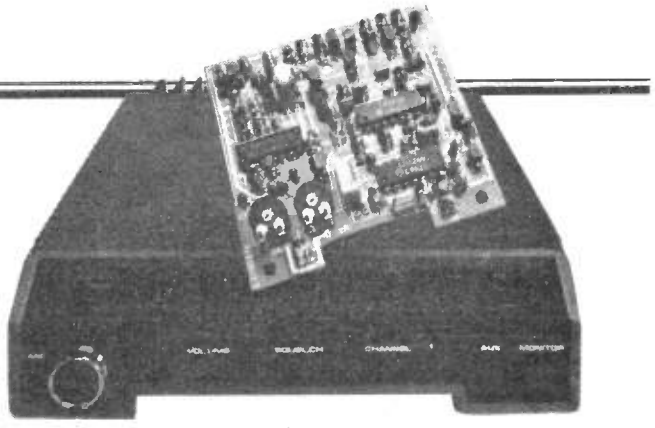
Panasonic has recently introduced four new audio products: the RF-422, RX-CW26L, RF-HX7 and RX-FD80L.

The compact RF-422 FM stereo, AM headphone radio will be available in three fashionable colour variations at a price of around £19.95, and includes FM stereo indicators and a stereo/mono switch.

The RX-CW26L extends Panasonic's already comprehensive range of stereo radio cassette players and caters for the ever growing demand for the twin cassette facility. Available now at around £89.98, the RX-CW26L features an auto-playback relay system, high speed editing, a cue and review facility and a synchro start editing function to ensure both tapes start at the same time.

The RF-HX7 dual purpose headphones with built-in FM stereo tuner are available at around £89.95. The RF-HX7 can be used as normal headphones for a CD player or as a tuner by itself.

The portable RX-FD80L 4 band radio/cassette recorder with CD player is available at £299.95. The FF1 single beam laser used in the CD, resisting



dust and disc errors, ensures what the company claim to be superb listening and recording quality, the latter aided by the tape synchro start incorporated in the CD. The tape section with soft touch mechanism features auto reverse on both the play and recording functions.

Panasonic UK Ltd,
300-318 Bath Road,
Slough,
Berks SL1 6JB.
Tel: Slough 34522.

INTRUDER DETECTOR

A new passive infra-red intruder detector has been announced by Riscomp Ltd. Known as the RP33, it operates by sensing the body heat of an intruder within the protected area.

The detector, which uses the latest Fresnel lens, provides volumetric coverage through an 85° angle, with 24 zones over a range of 12 metres.

Its miniature size of 80 × 60 × 40mm permits it to be easily installed on any flat surface or corner location, whilst vertical adjustment of the detection pattern over a 10° range is provided in order to achieve the most effective coverage in each installation. A further aid to installation is provided by the switchable walk test indicator, which provides a visual indication of the effective range.

Requiring only 15mA operating current from a conventional 12V supply, the unit is suitable for use in most security installations. Supplied with full installation instructions, it costs £23.95 plus VAT.

Riscomp Ltd,
51 Poppy Road,
Princes Risborough,
Bucks HP17 9DB.
Tel: (084 44) 6326.

P.M. COMPONENTS LTD

PHONE 0474 60521

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HA1339A	2.95	SAS570S	1.75	TA7313AP	2.95	TDA1001	2.95
HA1366W	2.75	SAS580	2.85	TA7314P	2.95	TDA1002A	2.95
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LA1230	1.95	SL1310	1.80	TA7609P	3.95	TDA1035	2.50
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LM383T	2.95	STK015	5.95	TBA530	1.10	TDA2523	2.95
LM390N	3.50	STK025	11.95	TBA530Q	1.10	TDA2524	1.95
M51513L	2.30	STK078	11.95	TBA540	1.25	TDA2530	1.95
M5156L	2.95	STK085	8.95	TBA540Q	1.35	TDA2532	1.95
M51521L	1.50	STK415	7.95	TBA550Q	1.95	TDA2540	1.95
MB3712	2.00	STK433	5.95	TBA560C	1.45	TDA2541	2.15
MB3756	2.50	STK435	7.95	TBA560Q	1.45	TDA2560	2.15
MC1307P	1.00	STK437	7.95	TBA570	1.00	TDA2571	2.95
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UPC1185H	3.95		
UPC1191V	1.50		
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UPC1353C	2.45		
UPC1365C	3.95		
UPC2002H	1.95		
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556	0.60		
723	0.50		
741	0.35		
747	0.50		
748	0.35		
7808	0.60		
7805	0.65		
7812	0.65		
7815	0.65		

NEW BRANDED CATHODE RAY TUBES – Please allow additional £3 per tube for carriage

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AW36.11	25.00	D14-181GH/98	68.00	M23-110GH	68.00	M50-120LC	68.00
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CME822GH	25.00	D14-181GM	53.00	M23-112GV	68.00	SE4/D-P7	45.00
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CME3128W	45.00	D14-320GH/82	68.00	M28-13LC	49.00	V5004LD	59.00
CME3132GH	45.00	D14-340GH/KM	45.00	M28-13LG	49.00	V6001GH	65.00
CME3155W	45.00	D14-340KA	45.00	M28-13GR	49.00	V6007DP31	59.00
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CV1450	35.00	D16-100GH/65	69.00	M28-133GH	68.00	V6034WA	59.00
CV1526	19.00	D16-100GH/67	65.00	M31-101GH	68.00	V6040CLA	59.00
CV2185	15.00	D16-100GH/79	69.00	M31-182GR	68.00	V6048J	49.00
CV2191	19.00	D16-100GH97	65.00	M31-182GV	53.00	V6052GR	65.00
CV2193	15.00	D18-160GH	69.00	M31-184W	68.00	V6064BP31	55.00
CV5119	85.00	D21-10GH	65.00	M31-184GH	68.00	V6064CLA	55.00
CV5320	85.00	DB7 36	35.00	M31-184P31	68.00	V6069GH	55.00
CVX389	55.00	DB7 36	35.00	M31-186W	69.00	V6070P31	49.00
D9-110GH	39.50	DG7 5	55.00	M31-190GH	68.00	V7016A	65.00
D10-210GH	45.00	DG7 32	45.00	M31-190GR	68.00	V7030	59.00
D10-210GH68B	65.00	DH3 91	55.00	M31-190LA	68.00	V7031GH	59.00
D10-230GH	35.00	DH7 91	45.00	M31-191GV	68.00	V7031/67A	59.00
D10-230GM	35.00	DP7 5	35.00	M31-220W	68.00	V7035A	49.00
D10/293GY/90	55.00	DP7 6	35.00	M31-270GY	68.00	V7037GH	45.00
D13-30GH	49.50	DN13 78	35.00	M31-271P31	68.00	V8004GR	65.00
D13-47GH/26	69.00	F16-101GM	75.00	M31-271GW	68.00	V8006GH	65.00
D13-47GH	55.00	F16-101LD	75.00	M36-141W	75.00	V8010A	65.00
D13-51GL/26	85.00	F21-130GR	75.00	M36-170LG	75.00	2BP1	13.50
D13-51GM/26	85.00	F21-130LC	75.00	M38-103GR	65.00	3BP1	11.50
D13-450GH/01	55.00	F31-10GM	75.00	M38-120W	65.00	3DP1	11.50
D13-471GH/26	55.00	F31-10GR	75.00	M38-120WA	65.00	4EP1	30.00
D13-610GH	59.00	F31-10LC	75.00	M38-121GHR	65.00	3H/OBM	55.00
D13-611GH	59.00	F31-10LD	75.00	M38-121LA	65.00	3WP1	18.50
D13-611GM	59.00	F31-12LD	75.00	M38-122GW	65.00	5BP1	9.00
D13-630GH	59.00	F31-13GR	75.00	M38-140LA	65.00	5BHP1	30.00
D14-150GH	75.00	F31-13LD	75.00	M38-142LA	65.00	5BHP1FF	30.00
D14-150GM	75.00	F31-13LG	75.00	M38-341P31	65.00	5BHP31	30.00
D14-172GH/84	59.00	F41-123LC	165.00	M38-344P39	65.00	5CP1	10.00
D14-172GR	55.00	F41-141LG	165.00	M40-120W	59.00	6EP7/S	39.00
D14-172GV	55.00	F41-142LC	185.00	M43-12LG/01	65.00	13BP1	13.50
D14-173GH	55.00	M7-120W	19.00	M44-120LC	65.00	13BP4	17.50
D14-173GM	53.00	M14-100GM	45.00	M50-120GH	65.00	17DWP4	25.00
		M14 100LC	45.00	M50-120GR	65.00	32J/1085	69.00
		M17-151GVR	175.00			1273	39.00
		M17-151GR	175.00			1564	39.00
						1844	45.00
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SEMICONDUCTORS

AAY12	0.25	BC208B	0.13	BD520	0.65	BR103	0.55	TIP30C	0.43
AC126	0.45	BC212	0.09	BD538	0.65	BR303	0.95	TIP31C	0.55
AC127	0.20	BC212L	0.09	BD597	0.95	BRC4443	1.15	TIP32C	0.42
AC128	0.28	BC213	0.09	BD701	1.25	BRY39	0.45	TIP33C	0.95
AC128K	0.32	BC213L	0.09	BD702	1.25	BT100A/02	0.85	TIP34B	0.95
AC141	0.28	BC214	0.09	BD707	0.90	BT106	1.49	TIP41A	0.45
AC141K	0.34	BC214C	0.09	BDX32	1.50	BT116	1.20	TIP41C	0.45
AC142K	0.45	BC214L	0.09	BF115	0.35	BT119	3.15	TIP42C	0.47
AC176	0.22	BC237B	0.09	BF119	0.65	BT120	1.65	TIP47	0.65
AC176K	0.31	BC238	0.09	BF127	0.39	BU105	1.95	TIP120	0.60
AC187	0.25	BC239	0.12	BF154	0.20	BU108	1.69	TIP125	0.65
AC187K	0.28	BC251A	0.12	BF158	0.22	BU124	1.25	TIP142	1.75
AC188	0.25	BC252A	0.15	BF160	0.27	BU125	1.25	TIP146	2.75
AC188K	0.37	BC258	0.25	BF167	0.27	BU126	1.60	TIP161	2.95
AD149	0.70	BC258A	0.39	BF173	0.22	BU204	1.55	TIP2955	0.80
AD161	0.39	BC284	0.30	BF177	0.38	BU205	1.30	TIP3055	0.55
AD162	0.39	BC300	0.30	BF178	0.26	BU208	1.39	TIS91	0.20
AD161/2	0.90	BC301	0.30	BF179	0.34	BU208A	1.52	TV106/2	1.50
AF106	0.50	BC303	0.26	BF180	0.29	BU208D	1.85	ZRF0112	16.50
AF114	1.95	BC307B	0.09	BF181	0.29	BU326	1.20	2N1100	6.50
AF121	0.60	BC327	0.10	BF182	0.29	BU326S	1.50	2N1308	1.35
AF124	0.65	BC328	0.10	BF183	0.29	BU407	1.24	2N1711	0.30
AF125	0.35	BC337	0.10	BF184	0.28	BU500	2.25	2N2219	0.28
AF126	0.32	BC338	0.09	BF185	0.28	BU508A	1.95	2N2905	0.40
AF127	0.65	BC347A	0.13	BF194	0.11	BU526	1.90	2N3053	0.40
AF139	0.40	BC461	0.35	BF195	0.11	BU807	2.25	2N3054	0.59
AF150	0.60	BC478	0.20	BF196	0.11	BUY20	2.15	2N3055	0.52
AF178	1.95	BC527	0.20	BF197	0.11	BUY69B	1.70	2N3702	0.12
AF239	0.42	BC547	0.10	BF198	0.16	MJ3000	1.98	2N3703	0.12
AU106	6.95	BC548	0.10	BF199	0.14	MJE340	0.40	2N3704	0.12
AY102	2.95	BC549A	0.10	BF200	0.40	MJE350	0.48	2N3705	0.20
BC107A	0.11	BC550	0.14	BF241	0.15	MJE520	13.95	2N3706	0.12
BC107B	0.11	BC557	0.08	BF245	0.30	MJE2955	0.29	2N3708	0.12
BC108	0.10	BC557B	0.08	BF257	0.28	MPSA13	0.30	2N3733	9.50
BC108B	0.12	BC558	0.10	BF258	0.28	MPSA92	4.95	2N3773	2.75
BC109	0.10	BC639/10	0.30	BF259	0.28	MRF237	14.95	2N3792	1.35
BC109B	0.12	BCY33A	1.60	BF271	0.26	MRF450A	17.50	2N4280	3.50
BC109C	0.12	BD115	0.30	BF273	0.18	MRF453	26.50	2N4427	1.95
BC114A	0.09	BD124P	0.59	BF336	0.34	MRF454	17.50	2N4444	1.15
BC116A	0.15	BD131	0.42	BF337	0.29	MRF455	2.42	2N5294	0.42
BC117	0.19	BD132	0.42	BF338	0.32	MRF475	14.95	2N5296	0.48
BC119	0.24	BD133	0.40	BF355	0.37	MRF477	1.95	2N5298	0.60
BC125	0.25	BD135	0.30	BF362	0.38	OC16W	9.50	2N5485	0.45
BC139	0.20	BD136	0.30	BF363	0.65	OC23	1.50	2N5496	0.95
BC140	0.31	BD137	0.32	BF371	0.25	OC25	1.50	2SA329	0.95
BC141	0.25	BD138	0.30	BF394	0.19	OC26	5.50	2SA715	0.60
BC142	0.21	BD139	0.32	BF422	0.32	OC28	4.50	2SC495	0.80
BC143	0.24	BD140	0.30	BF423	0.25	OC29	5.50	2SC496	0.80
BC147B	0.12	BD144	1.10	BF457	0.32	OC32	1.50	2SC931D	0.95
BC148A	0.09	BD150C	0.29	BF458	0.36	OC42	1.25	2SC1096	0.80
BC148B	0.09	BD159	0.65	BF467	0.68	OC44	1.00	2SC1106	2.50
BC149	0.09	BD160	1.50	BF595	0.23	OC45	1.00	2SC1172Y	2.20
BC153	0.30	BD166	0.95	BF597	0.25	OC70	1.00	2SC1173	1.15
BC157	0.12	BD179	0.72	BFR39	0.23	OC71	0.75	2SC1307	1.75
BC158	0.09	BD182	0.70	BFR40	0.23	OC72	2.50	2SC1364	0.50
BC159	0.09	BD201	0.83	BFR81	0.25	OC75	1.50	2SC1449	0.50
BC161	0.28	BD202	0.65	BFR88	0.30	OC81	1.00	2SC1678	1.25
BC170B	0.15	BD203	0.78	BFR90	1.50	OC84	1.50	2SC1945	3.75
BC171	0.09	BD204	0.70	BFR91	1.75	OC16W	2.50	2SC1953	0.95
BC171A	0.10	BD222	0.46	BFT42	0.35	OC139	12.50	2SC1957	0.80
BC171B	0.10	BD223	0.59	BFT43	0.35	OC171	4.50	2SC1969	1.95
BC172	0.10	BD225	0.48	BFW61	0.60	OC200	4.50	2SC2028	1.15
BC172B	0.10	BD232	0.35	BFW92	0.85	OC201	£5.50	2SC2029	1.95
BC172C	0.10	BD233	0.35	BFX29	0.30	OC205	10.00	2SC2078	1.45
BC173B	0.10	BD234	0.35	BFX84	0.26	R2008B	1.45	2SC2091	0.85
BC174A	0.09	BD236	0.49	BFX85	0.32	R2010B	1.45	2SC2098	2.95
BC177	0.15	BD237	0.40	BFX86	0.30	R2322	0.58	2SC2166	1.95
BC178	0.15	BD238	0.40	BFX88	0.25	R2323	0.66	2SC2314	0.80
BC182	0.10	BD242	0.65	BFY50	0.21	R2540	2.48	2SC2371	0.36
BC182LB	0.10	BD246	0.75	BFY51	0.21	RCA16334	0.90	2SC931D	0.95
BC183	0.10	BD376	0.32	BFY52	0.25	RCA16335	0.80	1SD234	0.50
BC183L	0.09	BD410	0.65	BFY90	0.77	S2060D	0.95	2SD325E	1.65
BC184LB	0.09	BD434	0.65	BLY48	1.75	SKE5F	1.45	3SK88	0.95
BC204	0.10	BD437	0.75	BR100	0.26	TIP29	0.40		
BC207B	0.13	BD438	0.75	BR101	0.49	TIP29C	0.42		

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BA157	0.30	BYX38-600R	0.60	IN4004	0.05
BAX13	0.04	BYX55-600	0.30	IN4005	0.05
BAX16	0.12	BYX71-600	1.75	IN4007	0.06
BB105B	0.30	BZX61	0.15	IN4148	0.02
BT151	0.79	BZY88	0.10	IN4448	0.10
BY126	0.10	BZY95C30	0.35	IN5401	0.12
BY127	0.11	CS4B	8.00	IN5402	0.14
BY133	0.15	CS10B	16.50	IN5403	0.12
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30V 33V 36V 39V 47V
51V 56V 68V 75V

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DK92	1.20
DL35	2.50
DL63	1.00
DL70	2.50
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EBC91	0.90
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ECC86	2.75
ECC88	0.95
ECC91	2.00
ECC180	0.72
ECC189	1.95
ECC801S	3.50
ECC803S	4.95
ECC804	0.60
ECC2000	12.00
ECF80	1.15
ECF82	1.15
ECF86	2.25
ECF200	1.85
ECF202	1.85
ECF801	0.85
ECF805	2.50
ECF806	10.25
ECH3	2.50
ECH4	3.00
ECH35	3.50
ECH42	1.50
ECH81	1.00
ECH83	1.00
ECH84	1.00
ECH2000	1.50
ECL80	0.60
ECL82	0.79
ECL81	0.55
ECL83	2.50
ECL84	0.74
ECL85	0.69
ECL86	0.95
ECL805	0.69
EF22	2.50
EF37A	2.50
EF39	1.50
EF40	4.50
EF42	3.50
EF50	2.50
EF55	4.95
EF70	1.20
EF71	1.50
EF72	1.20
EF73	1.00
EF80	0.55
EF83	3.95
EF85	0.50
EF86	2.25
EF86 Mullard	4.50
EF89	1.50
EF91	1.95
EF92	2.15
EF93	0.95
EF94	0.95
EF95	1.95
EF97	0.90
EF98	0.90
EF183	0.65
EF184	0.65
EF730	1.80
EF731	3.50
EF732	3.50
EF800	11.00
EF805S	13.50
EF812	0.65
EFL200	1.50
EH90	0.72
EK90	9.95
EL32	0.95
EL33	5.00
EL34	2.50
EL34 Mullard/Phillips	4.50
EL36	1.95
EL37	9.00
EL38	4.75
EL41	3.50
EL42	2.00
EL81	6.95
EL82	0.58
EL83	7.50
EL84	0.95
EL85	4.50
EL86	1.25
EL90	2.15
EL91	6.00
EL95	1.75
EL153	12.15
EL95	1.75
EL153	12.15
EL183E	3.50
EL183P	3.50
EL500	1.40
EL504	1.40
EL509	5.25
EL519	6.95
EL802	3.65
EL821	8.50
EL822	12.95
EM1	9.00
EM4	9.00
EM80	0.70
EM81	0.70
EM84	1.65
EM85	3.95
EM87	2.50
EN32	16.50
EN91	1.95
EN92	4.50
ESU150	14.95
ESU872	25.00
EY51	0.80
EY81	2.35
EY83	1.50
EY84	5.95
EY86/87	0.50
EY88	0.55
EY91	5.50
EY500A	1.50
EY802	0.70
EZ35	0.75
EZ40	2.75
EZ41	2.15
EZ80	0.75
EZ81	0.75
EZ90	1.50
F6064	2.95
FW4/800	2.95
G55/1K	9.00
G180/2M	6.95
G232 Mullard	3.95
G240/2D	9.00
GC10B	17.50
GC10D	17.50
GC10/4B	17.50
GC10/4E	17.50
GC12/4B	17.50
GD86W	6.00
GDT120M	5.00
GN4	6.00
GN10	15.00
GR10G	4.00
GS10C	16.50
GS10H	12.00
GS12D	12.00
GT1C	14.00
GT1CS/S	13.00
GTE175M	8.00
GTR150W	1.00
GU20	35.00
GXU1	13.50
GXU3	24.00
GXU50SS	14.50
GY501	1.50
GY802	1.50
GZ30	1.50
GZ31	1.50
GZ32	1.50
GZ33	4.50
GZ34	2.15
GZ37	4.50
HAA91	1.00
HABC80	0.90
HBC90	0.75
HBC91	0.80
HF93	0.75
HF94	1.50
HK90	1.06
HL2K	4.95
HL23DD	4.00
HL90	0.70
HL92	1.50
H133/DD	3.50
HR2	4.00
HY90	1.00
HVR2	3.00
K3118	86.00
KR6/3	45.00
KT8C	7.00
KT33C	3.50
KT36	2.00
KT44	4.00
KT45	4.00
KT61	5.00
KT63	2.00
KT66/CV1075 special yellow ssss pot	19.50
KT66 USA	9.95
KT77 Gold Lion	10.95
KT81	7.00
KT86 USA	10.95
KT88 Gold Lion	18.95
KTW61	2.50
KTW62	2.50
KTW63	2.00
KTZ63	2.50
L102/2K	6.95
L120/2K	12.00
LB7-20	95.00
LS9B	6.95
M502A	60.00
M537A	60.00
M5143	155.00
M8079	6.00
M8082	7.50
M8083	3.25
M8091	7.50
M8096	3.00
M8098	5.50
M8099	5.00
M8100	5.50
M8136	7.00
M8137	7.95
M8161	6.50
M8162	5.50
M8163	5.50
M8190	4.50
M8195	6.50
M8196	5.50
M8204	5.50
M8223	4.50
M8224	2.00
M8225	3.50
ME1401	29.50
ME1402	29.50
ME1501	14.00
MH4	3.50
MHLD6	4.00
ML4	4.50
MS4B	5.50
MU14	3.50
N37	12.50
N78	9.85
OA2	0.85
OA2WA	2.50
OA3	2.50
OB2	0.85
OB2WA	2.50
OC2	2.50
OC3	1.50
OD3	1.70
OM4	1.00
OM5B	3.00
OM6	1.75
ORP43	2.50
ORP50	3.95
P61	2.50
P41	2.50
PABC80	0.50
PC86	0.75
PC88	0.75
PC92	3.50
PC97	1.10
PC800	1.10
PC900	1.25
PCC84	0.40
PCC85	0.54
PCC88	0.70
PCC89	0.70
PCC189	0.70
PCC805	0.70
PCC806	0.80
PCE82	0.80
PCF80	0.65
PCF82	0.60
PCF84	0.65
PCF86	1.20
PCF87	0.40
PCF200	1.80
PCF201	1.80
PCF800	0.40
PCF801	1.35
PCF802	0.60
PCF805	1.25
PCF806	1.00
PCF808	1.25
PCH200	1.50
PCL82	0.85
PCL83	2.50
PCL84	0.75
PCL85	0.80
PCL86	0.85
PCL800	0.80
PCL805	0.90
PD500	3.50
PD510	3.65
PEN25	2.00
PEN40DD	2.50
PEN45	3.00
PEN45DD	3.00
PEN46	2.00
PEO5-25	39.50
PEO5-40N	42.50
PFL200	0.95
PL21	2.50
PL36	1.75
PL38	1.50
PL81	0.72
PL81A	0.72
PL82	0.60
PL83	0.52
PL84	0.78
PL88	1.00
PL95	2.95
PL302	1.00
PL345	12.50
PL500	0.95
PL500	1.10
PL504	1.15
PL508	1.75
PL509	4.85
PL519	4.95
PL802T	3.50
PL820	2.95
PL5557	29.50
PL5727	2.50
PY32	0.60
PY33	0.50
PY81	0.70
PY82	0.70
PY83	0.70
PY88	0.66
PY500A	1.95
PY800	0.79
PY801	0.79
QB3-300	54.95
QB5-1750	139.50
QBL5-3500	595.00
QEO3-10	4.95
QE08-200	£145.00
QF40	65.00
QP25	1.00
QQEO2/5	19.50
QQEO3-12	7.95
QQEO3-20	35.00
QQEO6/40	45.00
QQVO2-6	19.50
QQVO3-10 Mullard	15.00
QQV03-10	5.50
QQVO3-20A	25.00
QQVO3-20B	32.00
QQVO6-40A	27.50
QQVO7-50	63.50
QQZO3-20	42.50
QS75/20	1.50
QS75/40	3.00
QS92/1D	6.00
QS95/10	4.85
QS108/45	4.00
QS150/15	6.95
QS150/30	1.15
QS150/45	7.00
QS1200	3.95
QS1202	3.95
QS1203	4.15
QS1205	3.95
QS1206	3.95
QS1206	1.05
QS1207	0.90
QS1208	0.90
QS1209	3.15
QS1210	1.50
QS1211	1.50
QS1212	3.20
QS1213	5.00
QS1215	2.10
QS1218	5.00
QU37	9.50
QU37	11.50
QVO3-12	4.95
QVO5-25	2.50
QVO6-20	29.50
QV2-250C	45.00
QVO8-100	145.00
QY3-125	65.00
QY4-250	70.00
QY4-400	76.00
R10	4.00
R16	12.00
R17	1.50
R18	2.50
R19	2.50
R20	1.20
R1169	55.00
RG1-125	4.95
RG1-240A	14.50
RG3-250A	3.50
RG3-1250A	35.00
RK2K25	62.50
RK-20A	12.00
RL16	1.50
RPL16	12.00
RPY13	2.50
RPY43	2.50
RPY82	2.50
RR3-250	15.00
RR3-1250	35.00
RS613	45.00
RS685	54.95
RS688	52.15
S6F17	5.95
S6F33	29.95
S11E12	38.00
S30/2K	12.00
S104/1K	10.00
S109/1K	15.00
S130	5.95
S130/P	5.95
SC1/800	5.00
SC1/1100	6.00
SC1/1200	5.00
SC1/1300	6.00
SC1/2000	9.00
SD6000M	45.00
SP4B	4.95
SP41	5.00
SP42	3.00
SS501	35.00
ST11	1.50
STV280/40	11.95
STV280/80	19.95
SU42	4.95
TB2 5/300	85.00
TB2-300	45.00
TB3/2000	395.00
TBL-2-300	275.00
TBL2-500	395.00
TD03 10E	40.00
TD03 10	35.00
TD03 10D	40.00
TD03 10F	40.00
TD1-100A	25.00
TD3-12	4.00
TP25	1.50
TSP4	7.00
TT11	1.50
TT21	45.00
TT22	45.00
TT100	69.00
TTR-31MR	65.00
TY2-125A	85.00
TY4-400	85.00
TY8-600W	365.00
TYS2/250	375.00
U18-20	2.75
U19	11.95
U24	2.00
U25	0.90
U26	0.90
U37	9.00
U41	6.95
U50	2.00
U82	3.00
U191	0.70
U192	1.00
U193	0.65
U251	1.00
U801	0.75
UABC80	0.65
UAF42	1.00
UBF80	0.60
UBC41	2.25
UBC81	1.50
UBF89	1.00
UBL21	1.75
UC92	1.20
UCC84	0.70
UCC85	0.60
UCF80	1.00
UCH21	1.20
UCH41	2.50
UCH42	2.50
UCH81	1.00
UCL82	1.75
UCL83	2.50
UF85	1.20
UF41	1.15
UF42	1.15
UF80	0.80
UF89	2.00
UL84	1.50
UL41	5.50
UL44	3.50
UL84	0.85
UU5	3.50
UU7	8.00
UU8	9.00
UY41	3.50
UY85	0.70
V235A/1K	250.00
V240C/2K	225.00
V241C/1K	195.00
V246A/2K	315.00
V339	3.50
VLS631	10.95
VP133	2.00
VR75/30	3.00
VR101	2.00
VR105/30	1.50
VR150/30	1.15
VT52	2.50
VU29	4.50
VU39	1.50
W77	5.00
W729	1.00
W739	1.50
X24	1.00
X66/X65	4.95
X76M	1.95
XC24	1.50
XC25	0.50
XFW47	1.50
XFW50	1.50
XG5-500	22.50
XL1-5V	1.50
XL628FT	7.50
XNP12	2.50
XR1-1600A	49.50
XR1-3200A	79.50
XR1-6400A	149.50
ZM1020	6.00
Y65	6.95
Y503	25.00
Y602	12.00
Y4070	130.00
YD1100	75.00
YJ1060	265.00
YL1000	9.50
YL1020	42.50
YL1030	59.50
YL1060	95.00
YL1070	195.00
YL1071	195.00
YL1290	59.50
Z77	1.20
Z303C	9.00
Z359	9.00
Z505S	15.00
Z520M	4.00
Z521M	8.00
Z700U	3.00
Z749	0.60
Z759	19.95
Z800U	3.00
Z803U	18.95
Z900T	9.50
ZA1000	12.50
ZA1001	1.50
ZA1002	1.50
ZC1040	8.00
ZM1005	8.00
ZM1020	8.95
ZM1021	8.00
ZM1023	7.95
ZM1041	14.00
ZM1082	9.00
ZM1084	10.00
ZM1177	9.00
ZM1202	55.00
ZM1263	4.00
ZM1612	3.00
1A3	4.50
1AC6	1.20
1B3GT	1.95
1B22	10.00
1B27	55.00
1B35A	45.00
1C5GT	2.50
1FD1	2.50
1G3GT	2.50
1K3GT	2.50
1N1	4.50
1N2	4.50
1P28	25.00
1N5GT	2.50
1P28	25.00
1S2	0.55
1S5	0.70
1T4	1.00
1U5	1.00
1X2B	1.40
1Z2	8.95
2AS15A	11.50
2B22	69.50
2C39A	32.50
2C39BA	39.50
2C40	37.00
2C42	29.50
2C51	0.75
2CY5	1.50
2B7	1.50
2D21	1.95
2D21W	2.50
2E22GY	45.00
2E26	7.95
2J42	93.00
2K25	35.00
2K25 Ray	75.00
2K26	95.00
2K29	250.00
2K56	250.00
3A108A	9.00
3A/107B	12.00
3A/109B	11.00
3A/110B	12.00
3A/141K	11.50
3A/147J	7.50
3A/167M	10.00
3A2	3.95
3A3A	3.95
3A4	1.10
3AL5	0.95
3AT2	3.35
3AU6	0.65
3B2	3.00
3B4	7.00
3B7	4.50
3B24	10.00
3B26	24.00
3B28	12.00
3BZ6	1.50
3C4	2.50
3C45	24.00
3CB6	1.50
3CN3A	2.50
3CS6	0.95
3CY5	1.50
3CX3	2.50
3D6	4.50
3D21A	29.50
3E22	49.50
3EH7	1.95
3EJ7	1.95
3W4GT	2.50
4B32	35.00
4B551B	115.00
4BQ7A	1.75
4BZ6	1.95
4-65A	65.00
4-125A	72.50
4-250A	79.50
4-400A	87.50
4C27	25.00
4C28	25.00
4CB6	1.95
4CX250B	49.00
4CX25OB EIMAC	£59.50
4CX250BM	75.00
4CX250K EIMAC	95.00
4CX350A	95.00
4CX350F	79.50
4CX1500B	398.50
4GS7	2.25
4GV7	2.25
4JC6A	2.95
4J52	75.00
4KT6	1.50
4X150A	35.00
5A/102D	9.50
5A152M	9.00
5A163K	10.00
5A170K	6.25
5A-206K	10.00
5A-180M	9.00
4AM8	4.15
5AM8	2.15
5AN8	1.20
5AR4	2.00
5AU4	1.50
5B.110M	10.00
5B-254M	14.50
5B-255M	19.50
5B255M	19.50
5B/256M	15.00
5B-257M	15.00
5B-258M	14.50
5C22	125.00
5R4GB	5.50
5R4GY	4.95
5T4	5.95
5U4G	2.95
5U4GB	3.50
5V4G	1.50
5Y3GT	1.95
5Z4GT	1.50
6/30L2	0.70
6A/203K	9.00
6A7	4.95
6A8G	1.50
6AC7	2.00
6AF4A	2.50
6AG5	1.50
6AG7	1.95
6AH6	2.50
6AJ4	2.00
6AJ7	2.00
6AK5	1.95
6AK6	2.50
6AL5	0.60
6AM4	3.25
6AM5	6.00
6AM6	1.95
6AN5	4.50
6AN8A	3.50
6AQ5	2.15
6AQ8	0.85
6AR5	5.95
6AR8	3.95
6AS5	1.50
6AS6	2.50
6AS7G	4.50
6AT6	0.75
6AT8	1.75
6AU4	2.00
6AU6	0.95
6AV6	0.75
6AW8A	2.50
6AZ8	4.50
6B7	2.80
6B8G	1.50
6BA6	0.95
6BA7	4.50
6BA8A	3.50
6BC8	1.00
6BE6	0.95
6BG6G	3.00
6BH6	1.95
6BH8	1.50
6BJ6	1.50
6BK4	4.00
6BK7A	1.95
6BL8	1.15
6BM8	0.58
6BN4	1.65
6BN6	1.65
6BN7	4.50
6BN8	3.95
6BQ5	0.75
6BQ7A	0.72
6BL7GTA	3.95
6BL8	1.15
6BR5	0.70
6BR7	4.95
6BR8	2.15
6BR8A	2.15
6BS7	5.50
6BW4	1.50
6BW6	5.35
6BW7	1.50
6BW8	4.00
6BX6	0.48
6BX7GT	3.50
6BZ6	2.50
6BZ7	2.95
6C4	1.25
6C5	1.95
6C6	2.50
6C8G	1.50
6C11	2.50
6C18	2.50
6CA4	4.95
6CA7	3.50
6CB5	3.95
6CB6	1.95
6CD6GA	4.50
6CF6	1.50
6CG7	2.25
6CH6	6.95
6CL3	3.95
6CL6	3.25
6CL8A	2.00
6CM5	1.60
6CM7	2.95
6CS6	0.75
6CS7	0.95
6CW4	6.50
6CY5	1.00
6CY7	2.95
6D6	2.50
6DC6	2.95
6DJ8	0.95
6DK6	1.50
6DQ5	5.95
6DQ6B	2.50
6DW4	2.15
6EA4	4.95
6EA7	2.50
6EA8	2.50
6EB8	1.75
6EM5	2.50
6EM7	2.50
6EU7	£1.95
6EU8	1.75
6EV7	2.95
6EW7	4.50
6EW6	1.50
6F1	2.00
6F5	4.95
6F7	5.50
6F6G	2.00
6F12	1.50
6F13	3.00
6F14	1.00
6F17	2.75
6F21	2.50
6F23	0.60
6F24	1.25
6F25	1.25
6F28	1.25
6F32	1.25
6F33	17.00
6FH8	12.50
6G6G	5.50
6GH8A	0.80
6GK5	1.50
6GK6	1.95
6GM6	0.95
6GS7	2.15
6GV7	2.50
6GW8	0.80
6H1	9.50
6H3N	2.50
6H6	1.95
6H6GT	1.95
6HB7	0.95
6HF5	5.50
6HF8	2.50
6HS6	4.95
6HS8	1.95
6HZ6	2.65
6J4	2.15
6J4WA	3.15
6J5	2.50
6J6	2.05
6JB6A	3.95
6JE6C	6.50
6JM6	3.95
6JS6C	6.50
6JU8	2.50
6J7	2.50
6K7G	2.00
6K8Y/G	3.00
6KD6	6.50
6KM8	2.50
6KT8	2.95
6KZ8	1.95
6L1	2.50
6L19	3.95
6L6GAY Sylvania	5.50
6L6GC	2.95
6L6GC (GE)	4.95
6L6GT	1.95
6LF6	7.50
6LJ8	2.50
6LQ6	6.50
6L15	3.15
6MJ6	4.95
6N7	2.50
6N7GT	2.50
6P15	1.50
6P25	4.00
6P26	4.00
6P28	2.00
6Q7	1.75
6Q7GT	1.20
6R7G	3.15
6S4A	1.50
6SA7GT	1.35
6SC7	1.50
6SG7	2.50
6SH7	1.35
6SJ7GT	1.35
6SK7	1.35
6SK7GT	1.35
6SL7GT	0.85
6SN7GT	1.35
6SQ7	1.35
6SS7	1.95
6U4GT	1.75
6U8	1.15
6U8A	1.50
6V6GT	1.50
6X2N	1.00
6X4	1.50
6X5GT	1.00
6X5GTY	1.00
6X8A	2.25
7A6	4.50
7A7	2.00
7AD7	1.75
7AU7	1.50
7B6	3.50
7B7	2.50
7C6	2.50
7E7	2.50
7J7	5.50
7V7	4.15
7Y4	2.50
8B10	2.50
8BQ5	1.95
8D8	2.50
8EQ7	1.95
8298A	8.50
85A8	1.50
10D2	1.25
10DE7	2.50
10F1	0.75
10GK6	1.95
10P14	2.50
10P18	0.70
10LD12	0.65
11E3	55.00
12A6	3.95
12AD6	1.50
12AG8	1.50
12AL5	1.00
12AT6	1.25
12AT7	1.15
12AT7WA	2.50
12AU6	1.95
12AU7	0.65
12AV6	1.95
12AX7	0.65
12AX7S	7.95
12AX7WA	2.50
12AY7	3.95
12AZ7A	1.95
12B4A	4.50
12BA6	1.50
12BE6	1.95
12BH7A	2.50
12BL6	1.75
12BY7A	2.75
12CA5	1.95
12CX6	1.20
12DQ6B	3.50
12DW4A	3.50
12DW7	2.50
12E1	17.95
12E14	38.00
12GN7	4.50
12HG7A	4.50
12J7GT	3.50
12K5	1.95
12K7GT	1.50
12K8	1.95
12SA7GT	1.95
12SG7	4.75
12SH7	1.95
12SK7	1.95
12SJ7	1.50
12SN7GT	1.85
12SQ7GT	1.95
13D3	3.20
13D7	3.20
13D7	2.50
13D9	3.20
13DR7	2.95
13E1	145.00
13EM7	3.50
7BR3	3.95
17EW8	0.95
17DW4	2.50
17DW4A	2.95
17JZ8	4.50
18D3	6.00
19AQ5	3.50
19AU4GT	2.50
19G3	17.00
19H5	33.50
19Q6	9.00
20A2	10.50
30D1	0.70
20LF6	3.50
20L1	0.95
20P1	0.55
20P3	0.60
20P4	1.95
20P5	1.15
21JZ6	3.15
21LU8	3.75
24B1	39.50
24B9	39.50
25L6GT	1.75
25BQ6	1.75
29C1	19.50
29KQ6	6.50
30C17	0.40
30C18	1.48
30F5	0.95
30FL1	1.00
30FL2	1.35
30FL12	0.95
30FL13	1.10
30FL14	1.25
30L1	0.45
30L15	0.60
30L17	0.80
30P4MR	1.00
30P12	1.00
30P18	0.60
30P19	1.00
30PL1	2.50
30PL13	0.60
30PL14	1.75
31JS6A	5.50
33A/158M	19.50
35A5	4.50
35L8GT	2.00
35W4	0.70
35Z3	1.85
38HE7	4.50
40KD6	5.50
42	6.95
47	6.00
50A5	1.50
50C5	0.95
50CD6G	1.15
50EH5	1.50
52KU	2.00
53CG	15.00
60B5	1.00
60JY6	2.96
61SPT	4.50
75B1	3.50
75C1	2.50
83	8.50
83A1	9.00
84	3.00
85A1	6.50
85A2	2.50
90AV	15.00
92AG	19.50
92AV	15.00
95A1	6.50
108C1	1.50
150B2	6.50
150C2	2.50
150C4	2.15
185T	1.50
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307	5.00
328A	15.00
388A	17.50
404A	10.95
425A5	8.00
431U	4.50
572B	55.00
5636	1.50
6146A	7.50
6158	3.20
6386	14.50
6883B	9.95
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7703	395.00
803	14.95
805	39.00
807	2.50
810	85.00
811A	15.00
813	27.50
813 Phillips	35.00
829B	14.50
832A	14.50
833A	95.00
866A	6.50
872A	20.00
873	60.00
884	5.50
927	15.00
930	9.95
931A	17.50
954	1.00
958A	1.00
1299A	0.60
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2050W	6.95
3545	4.00
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4328D	9.00
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5651	2.50
5654	1.95
5663	1.95
5670	3.25
5672	4.50
5687	4.50
5692	3.50
5696	4.50
5704	3.50
5718	6.15
5725	2.50
5726	2.50
5727	2.50
5749	2.50
5750	1.85
5751	2.95
5763	4.95
5814A	3.25
5829WA	6.50
5840	3.50
5842	11.00
5847	10.95
5879	5.00
5886	13.95
5894	39.50
5899	4.50
5963	2.00
5965	2.25
6005	1.85
6012	16.00
6021	3.65
6057	3.75
6058	3.95
6060	2.25
6062	4.50
6063	2.00
6064	2.95
6067	7.00
6072	4.20
6080	7.95
6132	10.00
6146B	9.50
6688	6.50
6887	9.50
6080	7.95
6080WA	9.50
6096	5.50
6132	10.00
6136	2.50
6146B	9.95
6157	2.50
6201	6.45
6211	2.50
6267	2.25
6550A GE	10.95
6550RCA	15.00
6350	3.50
6688	6.50
6870	11.50
6887	9.50
6873	4.50
7189	3.50
7199	7.50
7239	17.50
7247	4.95
7360	13.50
7527	85.00
7586	15.00
7591A	5.95
7868	4.95
7815	72.95

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Approx 2 watt output mono amplifier uses the popular TBA82OM IC power 9-12VDC

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Plugs directly into 2 pin socket

ALL THREE £2.50 + VAT

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CALLERS WELCOME

ORATOR

Orator, the first integrated voice and data communications management system for IBM-compatible personal computers, is now available from Lion Systems Developments Ltd.

Orator, which is expected to retail at around £800, is an application software-controlled plug-in board. Once installed in a personal computer and attached to a telephone handset, Orator is then connected to the telephone network turning the personal computer into a real time communication centre.

The system provides a wide range of sophisticated voice and data communications features for the personal computer user, such as telephone answering with recorded message time and date logging; data calls with automatic log-on; timer for presetting unattended Orator activities by date and time; voice and data file transfer and storage; terminal emulation; directories with search and short-code dialling, and remote control.

All these functions can operate simultaneously with the user's normal PC software and do not interfere with any features of the telephone system used in conjunction with Orator.

The system's most significant feature, its ability to record and replay voices which are stored digitally on disc, is an innovation deriving from long-term research and development into digital signal processing technology for use in business communications systems. Orator is therefore a natural development of the work being done in networking systems.

In the short term, Lion's plans for Orator include making the system available in the USA, Australia and selected European countries in the latter part of 1987. But the company has an eye to the '90s and the coming of ISDN, when higher speed transmission will open the way to other possibilities such as graphics, fax and image communications.

Lion Systems Developments Ltd,
Oxford Road,
Stokenchurch,
High Wycombe,
Bucks HP14 3SX.
Tel: (024 026) 3951.

VERSATILE I/O SYSTEM

Users of IBM PCs and other popular RS232-interfaced computers can now utilise a versatile and very economical expansion system to collect and generate digital and analogue inputs and outputs (I/O).

The system, available from Electronic and Computer Workshop Ltd, is based on a series of multi-slot motherboards that accept standard I/O function cards. An intelligent RS232-interfaced version, the K2612, compatible with IBM PCs, has been added to the range, allowing many more users to interface their machines to the outside world.

The system is a fully expandable method of connecting a wide range of analogue and digital signals to a computer for data acquisition and control of many types of electrical circuit.

The plug-in series now includes an eight-channel analogue input multiplexer, A/D and D/A conversion, Centronics printer port, eight-channel logic input, real time clock and a general-purpose output card with a choice of relay and triac outputs.

Electronic & Computer Workshop Ltd,
171 Broomfield Road,
Chelmsford,
Essex CM1 1RY.
Tel: (0245) 262149.

POSITION CONTROL

The new IMO/OMRON NC position controller is an I/O unit for use with the IMO/OMRON C500 and C2000 programmable controllers (PCs). PC commands are converted into pulse or voltage outputs for accurate positioning of stepping or servo motors.

The aptly named addition to the IMO range offers precision control of pulse rate, speed, acceleration/deceleration and dwell time.

It can handle motor control at up to 7 speeds and in 200 positions. Single axis control with input commands ranging from 0.0001 to 1 units/pulse (mm inch degree) and 0.0001 to 1 units/sec (pulse/degree) are all available from this new PC module.

IMO Limited,
1000 North Circular Road,
Staples Corner,
London NW2 7JP.
Tel: 01-452 6444.

A/D CONVERTER

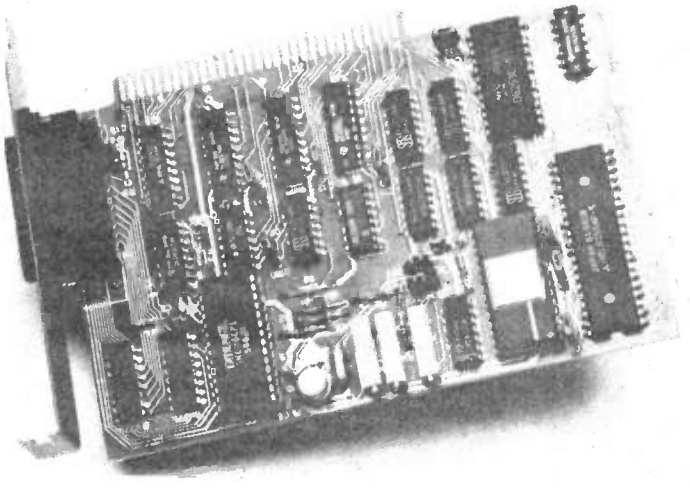
Model PC26 from Amplicon Liveline Limited is a low cost, 16 channel, 12 bit adc card for the IBM PC or equivalent computer.

Supplied complete with sampling software and user manual, the analogue inputs may be sampled at up to 200 times per second using Basic, 2,000 per second using Turbo Pascal or from one per hour to 30,000 per second using an additional software package, PC28A.

Input voltages may be unipolar or bipolar, and the conversion technique is successive approximation with 35 microseconds conversion time. The PC26 is suitable for use with any compatible colour graphics card, enabling data to be easily displayed and assimilated.

Economically priced at £193, the PC26 occupies one slot in the computer.

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



FREQUENCY RESPONSE

Solartron has announced software packages which provide for fully-automated multi-channel measurement and database management supporting applications using Solartron's frequency response analysers. The 1091 Dynamics data management system exploits the power of the 1250 and 1251 frequency response analysers by combining them with the HP 310 desk-top computer and versatile applications software. The system is also available on HP 9816.

The new package allows full user configuration of a frequency response measurement system, enabling the capabilities of Solartron's multi-channel FRAs to be fully utilised by using a computer for set-up and control, and to collect, manipulate and display the large amounts of data involved. It facilitates both remote system set-up from the computer keyboard or from previously stored files, and local set-up from the analyser's control panel.

Features include a comprehensive graphics display facility, allowing colour display of measured frequency response data in Bode, Nyquist, Nichols and Co-Quad formats, as well as user-defined formats. The display axes may be fixed or automatically scaled to optimise the display field. Measurement and graphic display of data are simultaneous, a wide range of cursor functions enhancing the display. A zoom facility is provided for increasing the resolution of a section of a frequency response characteristic.

The system uses a single sine-wave stimulation technique for accurate gain and phase measurements to provide precise characterisation of both simple and complex systems. It can also effectively evaluate the dynamics of self-excited systems by synchronisation to an external signal.

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

HIGH-SPEED SRAM

Rapid Silicon have added the new IMS 1630 high-performance 8K × 8 static RAM to their range of Inmos memory devices.

The IMS 1630 is a very high speed CMOS device that complies with 1.6 micron design rules. It requires no external clocks or timing strobes, features equal address access and cycle times and as well as this is fully TTL compatible.

A chip enable (/E) function is provided and can be used to place the device in a low-power standby mode, thereby reducing power to 25mA (TTL levels). By using CMOS levels, standby power can be decreased even further to only 14mA.

The IMS 1630 is available in three versions with address access/cycle times of 45, 55 or 70ns. Device characteristics include common data inputs and outputs, single +5V ±10% operation, and a fast write cycle when outputs are disabled.

All versions of the device are supplied in a JEDEC standard 28-pin 600-mil ceramic DIP.

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

RADIALL TWINAX

To complement its wide range of Radiall RF connectors, Dage has now introduced a range of Twinax connectors and accessories.

Noted for their high quality and accuracy, complete cable assemblies can be supplied as well as a range of adaptors, terminations and tees. All necessary terminations within an IBM/Twinax cabling system are catered for, the Twinax three-way female tee and the Twinax/BNC adaptor being particularly useful.

Dage (GB) Ltd,
Eurosem Division,
Rabans Lane,
Aylesbury,
Bucks HP19 3RG.
Tel: (0296) 393200.

POWER LINE FILTERS

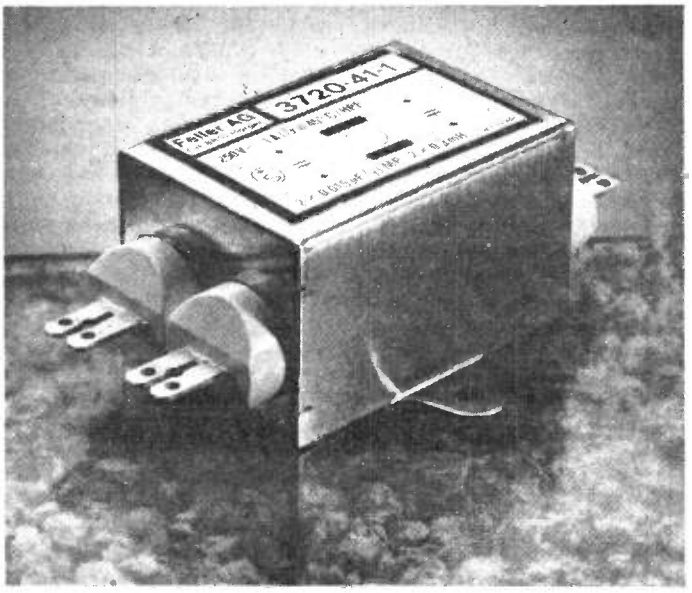
A 3-pole wide-bandwidth power line filter available from Rendar is designed for protection of sensitive circuitry against supply-borne interference.

Featuring very high insertion loss, and offering a range of current ratings, the filter is suitable for many applications including protection of logic circuitry and radio interference suppression of appliances.

This high quality product is made by Feller of Switzerland and is approved to UL, VDE and SEV specifications. A very high degree of protection against interference coupling is provided by the rust-protected metal enclosure. The compact unit, with climatic classification to DIN 40040:HPF, is portable or rack-mountable and offers the option of universal tab or solder connection.

Voltage rating is 250V ac, current rating 1, 3, 6 or 10A.

Rendar Limited,
Durban Road,
South Bersted,
Bognor Regis,
West Sussex PO22 9RL.
Tel: (0243) 825811.



PANEL FUSEHOLDERS

A wide range of panel mounting fuseholders has been announced by Watts International.

The range, from EDK of Japan, caters for all the popular industrial fuse sizes, and offers several types of quality fuseholders with spring-loaded contacts. Fuses are easily accessed via a screw-in knurled cap, or via a flush-fitting bayonet cap by using a cross-head, or standard screwdriver. To ensure that the holders do not rotate when changing fuses, the component body is provided with a flat side, or an anti-rotation spigot. Contact resistances are low.

Providing a wide selection of sealed-body fuseholders, the range offers equipment manufacturers, service departments and stockists a comprehensive choice. Solder tags are provided on the majority of models.

Compatible fuse sizes are 20 × 5.2, 31.8 × 6.35, 30 × 6.4 and 38.1 × 10.31mm diameter. Maximum current capabilities are 6, 10, 15 and 30A. Contact resistances are from 20 to 50mΩ at 2.5V dc/1A, or less. Insulation resistance at 500V dc is 100MΩ.

Watts International Components Limited, Suite 6, Wyvern House, Bognor Regis, West Sussex. Tel: (0243) 868322.

COMPLIANT CONNECTORS

Viking Connectors (UK) Ltd recently announced the availability of two new connector ranges.

D Sub and PC connectors are both available with compliant pin terminations; a technique used for the solderless press fit of connectors into printed circuit boards. The Viking connectors utilise the preferred 'eye of the needle' style of contact, which gives a reliable compression fit between the contact and the PCB interface, making for superior mechanical and electrical performance.

The D Sub connectors will be available in vertical mount styles in 25 socket versions, whilst the PC connectors are on a 0.100in × 0.200in grid spacing in 10-65 double row contact configurations.

PCB edge connectors, designed in 15-65 double-sided positions, are also available. These quality edge connectors utilise a pre-loaded cantilever contact which is front removable, even when mounted on a PCB. Available in either closed or open ended versions and for use in standard PCB mounting holes of between .037-.043in, it is claimed to be a versatile, cost-effective connector.

D Sub connectors, utilising the 'eye of the needle' preferred contact design, are fully intermateable with other D subminiatures. Available in high or low profile versions with either plastic or metal shell housings, they use a flexible twin beam contact configuration for reliability and long lasting connection.

Viking Connectors (UK) Ltd, Chatsworth House, Portland Close, Houghton Regis, Dunstable, Beds LU5 4AW. Tel: (0582) 603600.

VIDEO SWITCHING

An advanced video switching system for medium to large scale OEM applications was announced recently by High Technology Electronics.

The new system, called VSS, is matrix-based for flexibility. Modular in construction, it provides a minimum configuration of four outputs, with expansion to 128 inputs and 256 outputs. Even larger systems can be configured with amplification. The modular concept allows for exact solutions to particular needs which standard, off-the-shelf systems cannot provide. Whatever the size of the system, any output can be connected to any input with microsecond switching speed.

The matrix design allows VSS to avoid contention problems common in many commercial switching systems. The system is suitable for use in many spheres including financial dealing rooms, broadcast and studio applications, and ATE, medical and security environments.

The system allows each station on the system to access all sources, and any number of stations can be switched to read the same page of information. VSS is compatible with all video-based systems, and handles both monochrome and colour signals. Computer-based switching obviates the use of patch panels for reconfiguration, allowing users to change connection schemes under software command, with substantial savings in maintenance and cabling.

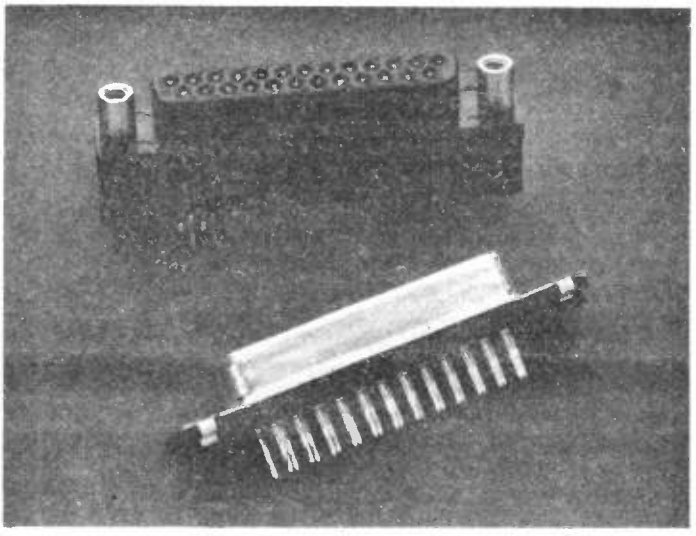
High Technology Electronics Ltd, 303-305 Portswood Road, Southampton SO2 1LD. Tel: (0703) 58155.

LED CHOICE

Three-Five Semiconductor's family of round LED lamps offers a choice of over 60 combinations of colours, lenses and light intensities in industry standard T1 and T1¾ packages.

Red, yellow and green lamps are available in standard and high efficiency/Brite Lite versions, with a choice of tinted or untinted, clear or diffused lenses. Light intensities from 0.5mcd to 80mcd ensure the correct level of contrast for virtually every level of lighting.

Three-Five Semiconductors Ltd, PO Box 131, Swindon SN2 6XD. Tel: (0793) 618835.



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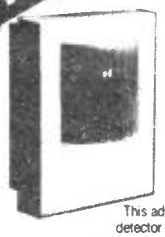
NEW

"PASSIVE INFRA-RED INTRUDER DETECTOR RP33"



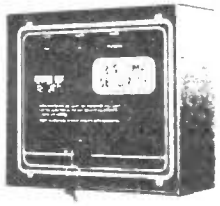
- 12 metre detection range.
- Size only 80 x 60 x 40mm.
- 24 Detection zones.
- Wide 85° coverage.
- Switchable LED indicator.

This advanced new intrusion detector operates by detecting the body heat of an intruder moving within the detection field. The use of a dual element pyroelectric sensor means that changes in ambient temperatures are ignored, thus providing a stable and reliable performance. Easily installed in a room or hallway, the unit will provide effective detection of any intrusion. Operating from a 12V supply and consuming only 15mA, it is ideal for use with the CA 1382, CA 1250 or any equivalent high quality control unit. Supplied with full instructions, its performance compares with detectors costing more than twice the price.

ONLY £23.95 + V.A.T

CA 1382

An advanced control unit with automatic loop testing.



- Fully automatic siren re-set
- Audible entry/exit warning
- Alarm Sounded memory
- 2 separate loop inputs + 24hr circuits.
- Built-in electronic siren.
- Easily installed, full instructions supplied

This latest control panel provides effective and reliable control for all types of security installations. Its advanced circuitry checks the loop circuits every time it is switched on, preventing incorrect operation. Using a simple 'on/off' key switch, it is easily operated by all members of the family. In addition it provides 24 hr. personal attack protection. Housed in a steel case, it is supplied with full operating instructions.

Only £44.95 + VAT

Available in kit form with fully-built electronics, £39.95 + V.A.T.

Digital Ultrasonic Detector US 5063 only £13.95 + VAT

- 3 levels of discrimination against false alarms
- Crystal control for greater stability
- Adjustable range up to 25ft
- Built-in delays
- 12V operation

This advanced module uses digital-signal processing to provide the highest level of sensitivity whilst discriminating against potential false alarm conditions.

Individual Enclosure SC 5063 only £2.95 + VAT

Suitable metal enclosure for housing the ultrasonic module type US 5063. Supplied with the necessary mounting pillars and screws etc

Control Unit CA 1250 Price £19.95 + VAT

This tried and tested control unit represents the finest value for money in control systems, providing the following features

- Built-in electronic siren drives 2 loud speakers
- Provides exit and entrance delays together with fixed alarm time
- Battery back-up with trickle charge facility
- Operates with magnetic switches, pressure pads, ultrasonic or I.R. units
- Anti-tamper and panic facility
- Stabilised output voltage
- 2 operating modes full alarm anti-tamper and panic facility
- Screw connections for ease of installation
- Separate relay contacts for external loads
- Test loop facility

500W Quartz Halogen Floodlight FL 500

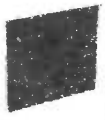
only £14.95 + VAT

Whilst intended for security lighting applications, this unit is suitable for lighting patios, pathways and gardens etc. Supplied complete with 500W lamp, priced only £14.95 + VAT. Protective grill, £1.95 + VAT

Lighting Controller DP 3570 only £13.95 + VAT

This versatile module provides timed switching of loads up to 3A for pre-set times between 10 secs and 5 mins, the timed period being triggered by the opening or closing of an external loop or switch. The built-in 12V 250mA power supply is available for operating external sensors. Priced only £13.95 + VAT. Suitable plastic enclosure £2.85 + VAT

HW 1250 – Enclosure & fixings for CA 1250 only £9.50 + VAT



This attractive case is designed to house the control unit CA 1250, together with the appropriate LED indicators and key switch. Supplied with the necessary mounting pillars and punched front panel, the unit is given a professional appearance by an adhesive silk screened label. Size 200 x 180 x 700mm.

Infra-red System IR 1470

only £25.61 + VAT

Consisting of separate transmitter and receiver both of which are housed in attractive moulded cases, the system provides an invisible modulated beam over distances of up to 50ft operating a relay when the beam is broken. Intended for use in security systems, but also ideal for photographic and measurement applications. Size 80 x 50 x 35mm

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AL 243 – Automatic Light Switch. Switches 3A at 240V – £4.30.

VS 30 – Vibration Contact – £2.30.

IS 128 – Miniature 12V Siren provides 100db output – £5.95.

SL 157 – Siren Module – £2.95.

HS 588 – 5½" Horn Speaker for use with control unit, siren module, etc. – £5.25

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VP3	200	⅛ watt Min Carbon Resistors mixed values	£1.00
VP4	200	½-1 watt Resistors mixed values & types	£1.00
VP16	50	Wirewound Resistors mixed watt values	£1.00
VP112	10	Sub Resistance Box. 36 values 5 ohms-1K ohms	£4.75
VP140	50	Precision Resistors 1% Tol	£1.00
VP181	100	1 and 2 watt Resistors, assorted values	£1.00

CAPACITORS

VP5	200	Assorted Capacitors all types	£1.00
VP6	200	Ceramic Capacitors. Min, mixed values	£1.00
VP8	100	Mixed Ceramic Disc. 68pf-015pf	£1.00
VP9	100	Assorted Polyester/Polystyrene Capacitors	£1.00
VP10	60	C280 Capacitors. Metal foil, mixed values	£1.00
VP11	50	Electrolytics all sorts	£1.00
VP12	40	Electrolytics. 47mf-150mf, mixed volts	£1.00
VP13	30	Electrolytics. 150mf-1000mf, mixed volts	£1.00
VP15	25	.01/250V Min Layer Metal Caps	£1.00
VP146	25	Solid Tantalum Caps, mixed values	£1.00
VP180	25	Tantalum Bead Caps, assorted values	£1.00
VP182	4	1000uf 50V Electrolytics	£1.00
VP192	30	Min Electrolytics mixed values. 47mf-1000mF 6-16V	£1.00
VP193	6	Sub Min Electrolytics. 2 x 1000/2200/3300mF 10-16V	£1.00

OPTOS

VP24	10	.125in Clear showing red LEDs	£1.00
VP25	10	Mixed shape and colours LEDs	£1.00
VP26	15	Small .125in red LEDs	£1.00
VP27	15	Large .2in red LEDs	£1.00
VP28	10	Rectangular .2in red LEDs	£1.00
VP57	25	Opto Special Pack, assorted, super value	£5.00
VP130	6	RED 7 Seg CC 14mm x 7.5mm RDP FND353 LED Display	£2.00
VP131	4	GREEN 7 Seg CA .6in LDP XAN6620 LED Display	£2.00
VP132	5	RED 7 Seg CC .6in LDP XAN6940 LED Display	£2.00
VP133	6	RED Overflow .6in 3 x CA, 3x CC 6630/50 LED Display	£2.00
VP134	5	GREEN Overflow .6in CA. XAN6530 LED Display	£2.00
VP135	5	RED 7 Seg. CA .3in. XAN3061 LED Display	£2.00
VP136	3	DUAL RED 7 Seg. .5in CA DL527 DPR. LED Display	£2.00
VP137	3	DUAL RED 7 Seg. .51in CA DL727 DPR LED Display	£2.00
VP138	20	Assorted LED Displays. Our mix, with date	£5.00
VP147	1	Pair Opto Coupled Modules	£0.60
VP199	4	DL707R LED Displays CA	£1.00
VP203	15	Triangular shape LEDs. Mixed colours	£1.00
VP204	10	Large Green LEDs .5mm	£1.00
VP205	10	Small Green LEDs .3mm	£1.00
VP206	10	Large Yellow LEDs .5mm	£1.00
VP207	10	Small Yellow LEDs .3mm	£1.00
VP208	10	Large LEDs Clear showing red .2in	£1.00

DIODES & SCRS

VP29	30	Assorted volts Zeners. s50mW-2W	£1.00
VP30	10	Assorted volts Zeners. 10W, coded	£1.00
VP31	10	5A SCRs TO66, 50-400V, coded	£1.00
VP32	20	3A SCRs TO66 up to 400V, uncoded	£1.00
VP33	200	Sil Diodes like IN4148	£1.00
VP34	200	Sil Diodes like OA200/BAX13-16	£1.00
VP35	50	1A IN4000 Diodes, all good, uncoded	£1.00
VP49	30	Assorted Sil Rects 1A-10A, mixed volts	£1.00
VP141	40	IN4002 Sil Rects 1A 100V, preformed pitch	£1.00
VP142	4	40A Power Rectifiers, silicon, TO48 300PIV	£1.00

Pak No	Qty	Description	Price
VP143	5	BY187 12KV Sil Diodes in carriers, 2.5MA	£1.00
VP184	3	4A 400V Triacs, plastic	£1.00
VP187	10	SCRs 800MA 200V 2N5064, plastic, T092	£1.00
VP194	50	OA91 point contact Germ Diodes, uncoded	£1.00
VP195	50	OA47 gold bonded Ger Diodes, uncoded	£1.00
VP196	50	OA70-79 detector Diodes, Germ	£1.00
VP197	50	OA90 type Germ Diodes, uncoded	£1.00
VP198	40	BA248 Sil Diodes, 350V 2A, fast recovery	£1.00
VP222	20	3A Stud Rectifiers, 50-400V	£1.00

TRANSISTORS

VP38	100	Sil Trans NPN plastic, coded. With data	£3.00
VP39	100	Sil Trans PNP plastic, coded. With data	£3.00
VP45	50	BC107/8 NPN Transistors, Good, uncoded	£1.00
VP46	50	BC177/8 PNP Transistors, Good, uncoded	£1.00
VP47	10	Sil Power Trans. Similar 2N3055, uncoded	£1.00
VP48	5	Pairs NPN/PNP plastic Power Trans, 4A, data	£1.00
VP50	50	NPN Sil Switching Trans. T0-18 and T0-92	£1.00
VP51	50	PNP Sil Switching Trans. T0-18 and T0-92	£1.00
VP60	100	All sorts Transistors, NPN/PNP	£1.00
VP150	20	BC183B Sil Trans. NPN 30V 200mA Hfe240+ T092	£1.00
VP151	25	BC171B Sil Trans. NPN 45V 100mA Hfe240+ T092	£1.00
VP152	15	TIS90 Sil Trans. NPN 40V 400mA Hfe100+ T092	£1.00
VP153	15	TIS91 Sil Trans. PNP 40V 400mA Hfe100+ T092	£1.00
VP154	15	MPSA56 Sil Trans. PNP 80V 800mA Hfe50+ T092	£1.00
VP155	20	BF595 Sil Trans. NPN EQVT. BF184 HF T092	£1.00
VP156	15	BF469 Sil Trans. NPN EQVT. BF173 HF T092	£1.00
VP157	15	ZTX500 series Sil Trans. PNP plastic	£1.00
VP158	15	ZTX107 Sil Trans. NPN EQVT. BC107, plastic	£1.00
VP159	15	ZTX108 Sil Trans. NPN EQVT. BC108, plastic	£1.00
VP161	25	BC183L Sil Trans. NPN 30V 200mA T092	£1.00
VP162	5	SJE5451 Sil Power Trans. NPN 80V 4A Hfe20+	£1.00
VP163	2	NPN/PNP pairs Sil Power Trans. like SJE5451	£1.00
VP164	4	2N6289 Sil Power Trans. NPN 40V 40W 7A Hfe30+	£1.00
VP165	6	BFT33 NPN Sil Trans. 80V 5A Hfe50-200 T039	£1.00
VP166	5	BFT34 NPN Sil Trans. 100V 5A Hfe50-200 T039	£1.00
VP167	1	BUY69C NPN T03 VCB 500 10A 100W Hfe15+	£1.00
VP168	10	BC478 eqvt. BCY71 PNP Sil Trans. T018	£1.00
VP169	15	BSX521 eqvt. BC394 NPN Sil Trans. 80V 100mA T018	£1.00
VP170	10	Assorted Power Trans. NPN/PNP coded & data	£1.00
VP171	10	BF355 NPN T0-39 Sil Trans. eqvt BF258 225V 100mA	£1.00
VP172	10	SM1502 PNP T0-39 Sil Trans. 100V 100mA Hfe100+	£1.00
VP200	30	OC71 type Germ. AF Transistors, uncoded	£1.00
VP201	25	OC45 Germ. RF Transistors	£1.00
VP202	15	BFY51 type Sil 1A Transistors	£1.00

ICs

VP40	40	TTL ICs all new gates – Flip Flop – MSI. Data	£4.00
VP41	40	CMOS ICs all new. Data	£4.00
VP55	10	ICs 4116 memories	£2.00
VP59	20	Assorted ICs linear, etc all coded	£2.00
VP209	12	74LS90	£2.00
VP210	12	74LS74	£2.00
VP211	10	CD4001B	£2.00
VP212	10	CD4011B	£2.00
VP213	10	CD4017B	£2.00
VP214	10	CD4069B	£2.00
VP215	10	741P 8-pin	£1.50
VP216	10	555 Timers 8-pin	£1.50

TOOLS

VP102	1	13-piece Tool set, Screwdrivers, pliers, etc	£7.50
VP103	1	6-piece STANLEY S/driver set, flat and crosspoint	£3.50

Pak No	Qty	Description	Price
VP104	1	Ratchet Screwdriver set, 4 blades, real value	£1.75
VP139	1	Pick-up Tool, spring loaded	£1.75
VP217	1	Helping Hand	£4.00
VP218	1	Watchmaker's Screwdriver set, 6-piece	£1.75
VP219	1	Miniature Side cutters	£1.55
VP220	1	Miniature Bent-nose Pliers	£1.55
VP221	1	Miniature Long-nose Pliers	£1.55

74 SERIES SALE "ROCK BOTTOM" PRICES

VP223	50	Asst 74 TTL IC's. "ALL GATES" new & coded our mix 7400-7453	£6.00
VP224	100	Asst 74 TTL IC's. "ALL GATES" new & coded our mix 7400-7453	£10.00
VP7413	4	7413 Dual Nand Schmitt Trigger 4-Input	£1.00
VP7440	4	7440 Dual 4-Input, Positive-Nand Buffer	£1.00
VP7470	4	7470 And-gated Positive-edge-triggered Flip-Flop with preset	£1.00
VP7480	4	7480 Gated full Adder	£1.00
VP7481	4	7481 16-Bit Random Access memories	£1.00
VP7490	4	7490 Decade Counter	£1.00
VP7491	4	7491 8-Bit Shift Register	£1.00
VP7492	4	7492 Divide by 12 Counter	£1.00
VP7493	4	7493 4-Bit Binary Counter	£1.00
VP7494	4	7494 4-Bit Shift Register	£1.00
VP7495	4	7495 4-Bit Shift Register	£1.00
VP74111	4	74111 Dual J-K Master Slave Flip-Flop	£1.00
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NEWS DESK

NATO satellite contract

The Space and Communications Division of British Aerospace has been awarded the contract to supply the new generation of military communications satellites which will provide secure military and diplomatic communications for NATO. British Aerospace will be prime contractor for the complete satellite system and Marconi Space Systems, as principal subcontractor, is to supply the advanced communications payloads.

The procurement, which will be managed by the British Ministry of Defence, is the first that NATO has entrusted to a non-American contractor for the supply of satellites to maintain its front-line, spaceborne communications system which operates to fixed and mobile Earth stations.

The satellites will be virtually identical to the United Kingdom's armed forces SKYNET 4 series of communications satellites currently under construction by British Aerospace, and for which Marconi supplies the payloads. Designated NATO IV, the first of the new satellites is to be launched in the early 1990s.

The contract, valued in excess of £100 million, is for two satellites and extends the order book of SKYNET 4 type satellites to five.

Phone home

Cellrent, a new company offering Vodafones for short term hire, recently finalised a joint-marketing agreement with Avis, the world's leading car hire company. Since mid-January, anyone hiring a car from Avis at Heathrow Airport has had the option of hiring a hand-portable Vodafone through Cellrent at the same time.

Cellrent is aiming this service at the international business traveller who wants instant world-wide communications while visiting the UK. However, companies wishing to try Vodafones before committing themselves to buying, individuals and organisations moving premises and waiting for normal telephone services to be installed, film crews working on location and journalists covering major stories are also expected to be attracted by this new service.

Billing for calls made during a hire period is based on the Meterfone facility. This feature allows the number of call charge units used to be read from the handset display. Meterfone automatically adjusts to the different charge rates for London, provincial and international calls, but records no charge to the hirer for incoming calls. At the end of the hire period, the accumulated call charge can be calculated immediately.

Initially Avis-Cellrent will offer the popular Roamer hand-portables on the Vodafone system in a package which includes a spare battery, rapid charger, a comprehensive user guide and a sturdy carrying bag with shoulder strap. Rental starts at £4.95 a day.

Databank card

A databank the size of a credit card and holding 800 pages of text or eight TV pictures will be test marketed by British Telecom this autumn.

Initially, the company will be aiming its Recall cards at four market sectors: health care, for storing medical records, medication usage, and vital personal data on blood group, allergies, and conditions such as diabetes; software distribution, offering up to 2 megabytes of addressable data with intrinsic security and encryption and detectable copying; financial transactions, holding an individual client's records on encrypted data with high security and capable of easy update; access control, providing a tamper-proof personnel security device capable of storing an individual's biometric details.

Data is imprinted in the card either photographically at the time of manufacture or by laser beam later. Old data may be readily cancelled by overwriting.

The cards are intrinsically secure and difficult to corrupt either accidentally or deliberately. They are unaffected by climate, magnetic or electric fields, exposure to light or radioactivity, or frequent handling. Attempts to copy data inserted at the time of manufacture can be detected, and the medium itself is tamper-proof. High security encryption may also be used to give further improvement of Recall card integrity.

A particular feature of British Telecom's service will be the ability to integrate applications of the Recall card with telecommunications networks. To this end the card may be used with British Telecom's M5000, M6000 and M7000 ranges of data terminals.

Airborne telephones

A significant step towards air travellers being able to send and receive telephone and telex messages anywhere in the world was recently announced.

The International Maritime Satellite Organisation's (INMARSAT) Council has authorised a contract for 1.4 million US dollars with Racal Avionics Limited to develop and supply a system for aeronautical communications using the existing INMARSAT satellite network.

The contract includes both the aircraft antenna and electronics equipment which will provide voice and data communications for passengers as well as air traffic control safety services.

This latest Racal contract includes the French company Société Nouvelle d'Equipment du Calvados (SNEC), and Teledyne Controls Inc and Airfone Inc of the USA as subcontractors. As a result of this international collaboration Racal can offer a total and completely flexible sys-

tem to interested airlines.

The first technical trials will take place on board the Racal Jetstream aircraft later this year, with commercial trials following on scheduled British Airways' Boeing 747 flights at the end of 1987. It is anticipated that the system will be ready for introduction to full service by late 1988, when the INMARSAT aeronautical ground Earth stations, which will provide the interconnection from the satellite system to existing telecommunications networks, will be in operation.

RACE delayed

A five year EEC development programme for research and development in advanced communication technologies in Europe (RACE), crucial to the future of Europe's telecommunications and computer industries, is being delayed since agreement has yet to be reached by governments on the overall budgetary framework under which EEC expenditure on research is financed.

Concern at the delay was expressed by Mr J M Price, Director of RACE Project 1006 and the immediate past President of ECTEL (the Association of European Telecommunications and Electronics Industries).

During the last twelve months European industries have demonstrated just how effectively they can work together towards a common and mutually beneficial objective – the main RACE programme. It is this programme that is now being delayed. Based on the results of the Definition Phase, completed in December 1986, the main programme was planned to start in the summer of 1987 and lead to the development of a European framework for an integrated broadband communications network (IBC) by the early 1990s.

The RACE programme is important because Europe is in a technology race against the USA and Japan. If Europe can quickly agree a common framework and standards for IBC, then the competitive position will be strengthened by a large 'common' European base. The USA and Japan are already heavily committed to research and development in broadband communications. Unless a start is made the home market will be lost to other systems which become available earlier.

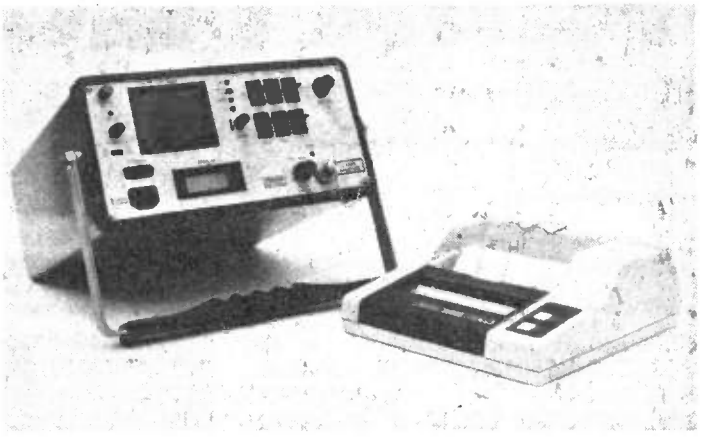
Telex card

Procom 20, the new internal telex card from Communicate in Berkshire, has received official BABT approval.

It comprises a full length add-on card incorporating a telex modem, on-board processor and a 64K memory – driven by Communicate's powerful telex management software.

Procom 20 provides an IBM-compatible PC with the facilities to operate as a fully featured telex terminal, sending or receiving telex in background mode without interrupting the routine applications of the PC.

Priced at £850, Procom 20 is the first PC/telex to sell at under £1,000.



Improved reflections

An improved version of the OFL213S (pictured above) will be on show at the Cossor stand at Olympia in April at *Fibre Optics '87*, which is part of British Electronics Week.

This OTDR (optical time domain reflectometer), which is designed for use with single mode fibres, has improved dynamic range, which means it can see further, faster and with less noise on the display, thus giving an all round improved performance.

The OFL213S and its sister model, the OFL213, for multimode fibres, have the additional facility of interfacing with printers, which gives a permanent written record of the screen read-out, including the cursor position and attenuation losses between specific events.

Diagnosis

The need for engineers to be experienced in aspects of diagnostic engineering has become more apparent during recent years with the increased complexity of plant and machinery and the high associated capital costs. Downtime can be extremely expensive, not simply in the cost of replacement parts but in the loss of productivity.

With this in mind the Institution of Diagnostic Engineers was formed five years ago. In addition to regular informative newsletters which are forwarded to members, plans are being developed to establish an Advanced Diploma in Diagnostic Engineering, but until such a diploma is operating, applicants may join solely on the basis of ability and capability without the need for any advanced academic attainment.

For more information contact Dr Ralph Collacott, 3 Wycliffe Street, Leicester LE1 5LR.

Out of Africa

The government of Sierra Leone has awarded the British-based Incomtel systems engineering group a contract covering the supply of a complete new short wave HF broadcasting system.

This order was won against strong international competition. The company has already designed and installed several HF and MF broadcasting system networks in Africa.

The new broadcasting facility will enable the government of Sierra Leone to provide educational and news broadcasting services right across the country's vast rural areas, in addition to FM and MF transmissions in the cities.

The turnkey system in use comprises two 10kW HF broadcast transmitters, in main/standby configuration, and incorporates a directional log periodic antenna covering a frequency range of 3.3MHz to 9.6MHz. It will provide clear, country-wide coverage and the capacity to broadcast far beyond the borders into neighbouring countries.

AMATEUR RADIO WORLD

Compiled by Arthur C Gee G2UK

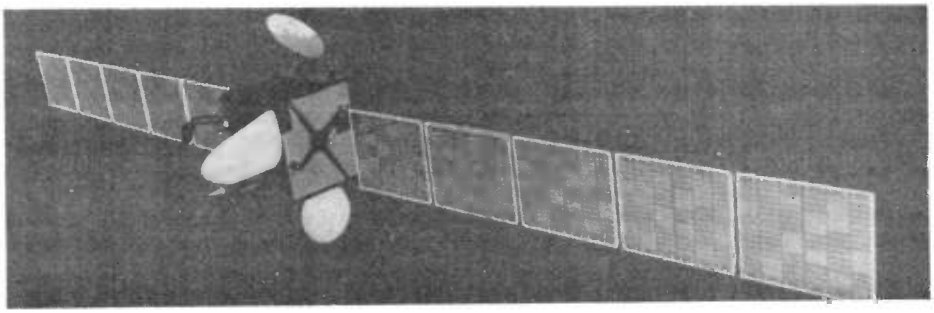
In a recent interview which a representative of the New Zealand amateur radio magazine *Break-In* had with Dr Karl Meinzer DJ4ZC, and which was reproduced in AMSAT-UK's *Oscar News*, number 62, November 1986, some very interesting views were expressed by Dr Meinzer about the future prospects for amateur radio satellites.

Dr Meinzer has been extensively involved with the amateur radio satellite scene right from its beginning. He has been associated with the planning, design, construction, launching and control of all the more recent satellites launched under the banner of AMSAT. His views on some of the more salient plans for the future are as follows:

■ On the application of packet radio to amateur radio satellites, Karl is not too impressed with its advantages for satellite use. He points out that PR, being a union of computers with amateur radio, has attracted a lot of attention. But Karl considers that amateur computing is on the wane in Europe, as doing really useful complex procedures is still hard work! 'The computer does not solve anything in itself. You still have to work at it', he says.

■ Geostationary satellites for future amateur radio satellite plans have a high profile at the moment. However, Karl thinks that they would not really fulfil the needs of amateur radio in the best way. Their cost would be many times that of satellites currently in operation and Karl sees no possibility of amateur radio ever being able to raise sufficient funds to carry through such a project. These satellites would be much more complicated mechanically, the antennas would have to be 'de-spun', attitude-control jets would be required and at least three satellites would be needed to provide proper coverage. Karl is of the opinion that it would be far more sensible to concentrate on improving the Phase 3 type satellites.

A further reason for Karl's rejection of the project is that he feels that amateur radio should be educational, enabling people to learn from their participation in amateur satellite activities. Geostationary satellites would take away much of the instructional value of current orbital calculations, and would become little more than glorified FM repeater systems.



Karl points out that the controlling factor in the future of amateur satellites is cost. Until now, amateur satellite builders have been very lucky in obtaining funds and help from industry and so on for building their satellites. In Germany the government has been very generous, but one cannot expect this sort of help to continue indefinitely. The present amateur radio satellite system will need replacing every five years or so, which will require a substantial budget.

It would not be possible to raise this money from the users, as there is no way of making them pay, especially on a global basis. These costs should be considered as an extension to existing amateur resources, viz, frequencies suitable for long range communications. Karl thinks it would be appropriate for national amateur radio organisations to share these costs at a level corresponding to their membership. Karl dislikes the trend towards nationalism in building satellites and considers it quite the wrong way to go. Producing a satellite as complex as Oscar 10, or one of the new generation with higher power capability, is now beyond the capacity of any individual group.

Karl concludes by saying that he would like to see more people getting interested in space and building satellites. Over the last ten years a technology has been developed which others can build on, and which can be very rewarding for younger people to get involved in and thus learn about space engineering.

AMSAT-UK donation to UoSAT

One of the objects of AMSAT-UK is to help in the establishment of amateur satellite facilities aimed at encouraging interest in this aspect of amateur radio.

To mark the 25th anniversary of the launch of Oscar 1 and the birth of the Amateur Radio Satellite Service, AMSAT-UK agreed at its last committee meeting to make a donation of ten thousand pounds to the University of Surrey's UoSAT Spacecraft Engineering Research Unit to support the development and refurbishment of the UoSAT groundstation. The original ground control station has been in operation continuously since 1981. It has had to be upgraded regularly to provide the necessary facilities to support the growing experimental programme executed by the UoSAT-1 and 2 spacecrafts in orbit, and to provide secondary command for the Oscar-10 and FO-12 satellites. This financial support will make a most significant contribution to this essential aspect of the UoSAT programme.

Dr Martin Sweeting, in expressing gratitude for this support on behalf of all members of the UoSAT Unit, assured AMSAT-UK that it would be put to very good use and would benefit UoSAT users and experimenters world-wide.

New callsign

The Scout Jamborees and camps held at Gilwell Park have for a long time been well known to the amateur radio fraternity through the amateur radio station the Scouts operate during such occasions. They have now been granted a permanent special event callsign for this station, which is a rare honour. The new callsign is GB2GP. This enables any Scout to talk from the station, provided he is under the supervision of a licensed amateur.

Hams on Voyager

From the *Westlink Report*, it was learnt that the two pilots of the Voyager experimental aircraft, which successfully made the first non-stop round the world flight, were radio amateurs.

The two pilots were Dick Rutan KB6LQS and Jeana Yeager KB6LQR. Although there was radio amateur gear aboard the aircraft, no amateur radio communication was expected and none in fact did take place, there being little or no opportunity for such activity. The radio communication that did take place was on 6.550 and 13.312MHz. The Voyager's callsign was AFS6VO. Some radio communication was also carried out via satellite.

The aircraft was built mainly of wood, composition materials and styrofoam. It had a wing span approximating that of a Boeing 747 and carried 1900 gallons of fuel to supply its two engines, located fore and aft.

Student satellite

Following the comments above about the value of actually participating in amateur satellite building as a means of providing education in spacecraft engineering, it is interesting to read that not only the Russians follow this technique with their ISKA satellites; it has also apparently been followed in the USA, though not quite so successfully so far. A small satellite built by Ogden Utah's Weber State College students, and launched by the ill-fated shuttle Challenger 20 months ago, burned up on re-entering the atmosphere on December 16th. The Northern Utah satellite, NUSAT I as it was designated, failed as a technical project, but succeeded as a learning experience according to school officials. It was launched in April 1985 from Challenger at an altitude of 221 miles. Its mission was to test and calibrate Federal Aviation Administration radar equipment, but the satellite failed because of technical problems. The college is planning a new and improved satellite, NUSAT II, which it is hoped will be ready to fly in 1988.

Re-issue of Tx licences

The regulations which control amateur radio have up until now made it difficult, if not impossible, for a licensed amateur who has let his licence lapse to get it back again with the original callsign. The DTI recently announced a change in policy relating to this. They will now permit a previously held licence to be re-issued to the original holder, with the exception of the G5+three letter series, which has been withdrawn for re-use and is thus not available. This facility will apply to previous legitimate licence holders, even if the original qualifications for obtaining a licence were not based on the current City & Guilds Radio Amateur examination.

Radio regulatory report

As part of its efforts to improve openness and consultation, the Radio Regulatory Division of the DTI has produced its first report, which covers its activities over the years 1985/86. This makes extremely interesting reading and it should be read by all who use radio in its many and varied modes. Such topics as amateur radio licences, pirates and court cases, interference, marine and mobile radio systems, TV and broadcasting, satellite links and so on are thoroughly covered.

Statistics covering the increase in use and costs make very interesting reading indeed.

The Radio Regulatory Division of the DTI has now changed its name to the Radio Communications Division, which is intended to reflect its new approach, aimed less at regulation, a phrase suggesting heavy-handed bureaucracy, and more at providing a service to responsible users.

The report is obtainable by sending a 43p stamp to Radio Communications Division, DTI, Waterloo Bridge House, London SE1 8UA. REW

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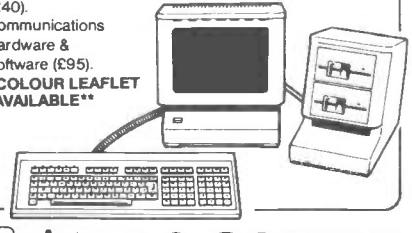

HITACHI Model 305S 3" disc drives. With SHUGART compatible interface (34 way edge connector) & suitable for **BBC** with DFS, **AMSTRAD 664/6128, TATUNG EINSTEIN** & many others. 250K (double density unformatted) per side reversible; 40 track; standard power connector for 12V & 5V; overall power consumption typically 3.7W. Supplied **BRAND NEW** with connector pin-out details etc. but uncased. Data cables only are available for AMSTRAD & BBC (£7.50) and TATUNG (£10.00).

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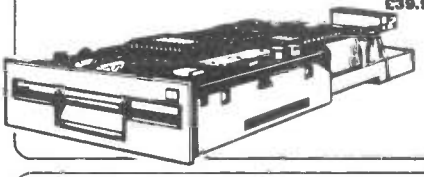

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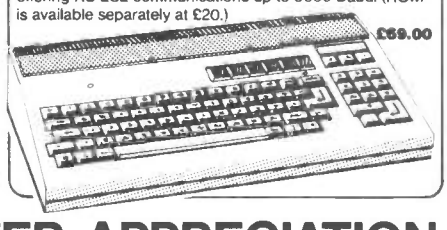

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ATV ON THE AIR

Andy Emmerson G8PTH puts you in the picture

If you have followed my 'use it or lose it' rantings, you will recall the sad situation in Belgium where 70cm and 23cm allocations were reduced to a state where ATV was unworkable. The big news is that our ON friends have back all that they lost and more.

ATV is now permitted between 430 and 434MHz (secondary status), between 434 and 440MHz (primary user) and from 1240 – 1300MHz (secondary). Permitted power levels are 30 or 150 watts, according to licence status.

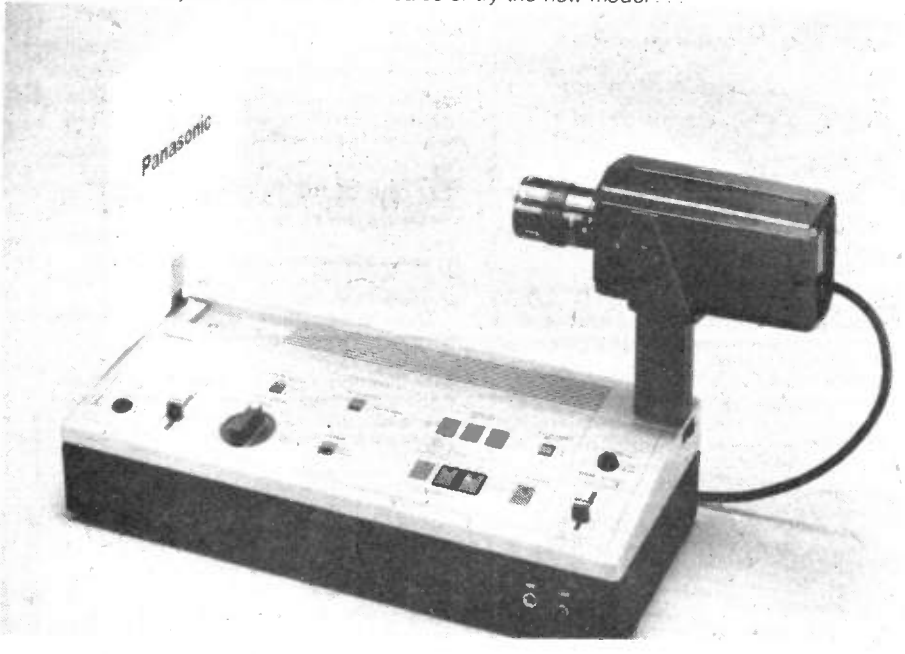
Below 1GHz only mode C3F (AM) is to be used, while above 1GHz both AM (C3F) and FM (F3F) are allowed. Transmissions must be standard 625 lines, with any colour subcarrier on 4.43MHz, in CCIR norm B. Slow-scan and FAX transmissions are allowed on these bands, and also on two metres and HF. So all those protests had a point.

On guard again

So far, so good, but there are several proposals to be made at April's IARU Region 1 conference which threaten our fun. DARC, the German amateur radio club, is proposing an international bandplan for 23cm which sets aside 1270 – 1286MHz for the exclusive use of ATV and makes 1286 – 1291MHz all-mode. This would make in-band TV repeaters on 23cm unworkable and will be resisted. The RSGB's paper makes no recommendations outside the narrow-band sector around 1296/1298MHz, and in fact any so-called international bandplan must recognise that band sizes and usage vary from country to country. We need no EEC-style meddling in amateur radio!

The next problem is packet radio. In the Netherlands there were about 100 packet radio stations at the beginning of last year; by the end there were 1,000! These stations need channels, clearly, but several countries are proposing the use of 433.600 – 433.725MHz and 438.025 – 438.075MHz. Clearly, these transmissions would interfere with ATV, and the Dutch organisation VERON will instead propose the allocation of 430.625 – 430.675MHz for packet radio. In Britain this would not work because of PMR (private mobile radio) and the Fylingdales restrictions, so G3VZV is proposing 432.500 – 432.800MHz, which sees little use by anyone. Problems, problems...

Panasonic have always been noted for the niftiest caption colouriser for inserting titles and graphics into existing video material. The original WV-J10E has now been superseded by a new model but it's still a desirable object. Look out for it in sales or try the new model...



Good news for SSTVers

At last a slow-scan 'bible' has appeared. Called *The Slow-Scan Companion*, this is a worthy addition to the bookshelf of anyone remotely interested in SSTV. The book, which contains a thick 100 pages, has a glossy laminated full-colour cover and stands head and shoulders above most amateur publications.

Written by Grant Dixon G8CGK, John Wood G3YQC and Mike Wooding G6IQM, it has 16 chapters. Topics covered include SSTV standards, transmitting and receiving SSTV, as well as studio and colour techniques. Commercial equipments old and new are reviewed, as well as techniques involving home micros. Also covered are scan converters, solid-state character and test pattern generators and even the good old flying spot scanner (which still has a useful role to play). The book is finished off by a digest of useful circuit modules and a comprehensive index.

All in all it is a superb production, which fills a gap felt for many years and reflects well on its authors and all the others who contributed chapters. Even a slow-scan hater like me found it interesting, so order one now! You can't really wait until you see it at a rally, can you? Cheques should be made out to the BATC for £3.50 and sent to BATC Publications, 14 Lilac Avenue, Leicester LE5 1FN.

More goodies in print

In these monthly columns I can only scratch the surface of our ATV hobby and

if you want to dig deeper you need the journal of the British Amateur TV Club, *CQ-TV*. The latest 100 page issue is out now and a dip into the contents reveals satellite TV news, a 10GHz transceiver, the Camtech 23cm preamp reviewed, SSTV on the Beeb micro, lots of Spectrum circuits and an in-depth feature on video enhancers (do they always enhance?). You can only get *CQ-TV* by joining the British Amateur TV Club, which is not expensive at just £6 a year. To join send an SAE to BATC Membership, Grenehurst, Pinewood Road, High Wycombe, Bucks HP12 4DD.

Repeater news

Wood & Douglas have recently supplied equipment to Switzerland which will be used in the first ATV repeater there. In the UK, applications have been made for new FM television repeaters at Nottingham (GB3NV) and Rugby (GB3RT). I think we shall soon have more ATV repeaters than the Germans or the Americans, who are front-runners in these stakes!

Bob Hope G4ZPP, who is secretary of the Crawley Repeater Group, has written about improvements to GB3CT: 'It seems that although we could be seen over a wider area than we planned, the repeater could not be accessed. We decided, therefore, to purchase a proprietary receiver, and the Wood & Douglas 1250DC50 downconverter plus VIDIF unit seemed to be ideal.

'Alan Wood gave us a handsome discount on the units, and they were purchased and fitted. We found that the sensitivity without a preamp was adequate, as do the Worthing Group (GB3VR), but as they are using beam antennas on a westerly path and we have the omnidirectional Alford Slot it has been decided to add the Microwave Modules bipolar preamp and a further interdigital filter (making two). The extra filter helps to keep out the Pease Pottage radar (three miles away).'

It is good to see commercial firms getting a pat on the back, especially when they help repeater groups. Of course, it may well result in extra sales for them eventually, which can be no bad thing. The gesture is appreciated, though, and in this connection remember that QSL Crystals give free crystals to repeater groups.

Down in 'Brissle'

From 'Brissle', Shaun O'Sullivan G8VPG informs us that construction of GB3ZZ, the Bristol FM repeater, is progressing well. They now have planning permission for the aerials, which have been erected on site. Trials will commence using a temporary transmitter in manned relay station mode. It is hoped that the greater part of the eventual repeater will be on show at the Crick Convention (3rd May at the Post House Hotel, just off exit 18 of the M1 motorway – everyone welcome).

The Bristol group is also selling a new 24cm ATV antenna in aid of club funds. It is a broadband 23/24cm job, and by using inexpensive band IV/V technology a compact and inexpensive 'starter' or portable aerial has been made available. It is an 18 element yagi, end mounting, and has a gain of around 10dBd. SWR is no higher than 1.5:1, with a length of 0.92m and a weight of 0.3kg. It is supplied with a waterproof joint box and mast clamp (up to 55mm diameter) and is sold assembled.

The design is exclusive to the group. The cost is £12.50 collected or £14.75 posted to a UK address. Cheques should be made payable to the Bristol FM TV Group and sent to 15 Witney Close, Saltford, Bristol BS18 3DX.

Footnote

The DTI has just issued the first annual report for its Radio Communication Division (formerly the Radio Regulatory Department). It makes fascinating reading and costs nothing. You can order a copy by phoning 01-275 3072 or by writing to Room 605, Waterloo Bridge House, Waterloo Road, London SE1. Please don't forget to send in reports and photographs – see you next month. REW

NETWORK 934

Andy Emmerson G9BUP

I mentioned last time that I was due to receive a filter claimed to eliminate interference from cellular radio – or at least partially. This has now arrived and it looks solidly built. You'll have to hold your breath a little longer, though, as I have not had it tested yet.

We'll put it through the works and have it swept – this means passing different radio frequencies through it and measuring how much goes in (and comes out). In this way one can determine how efficient a filter is at passing the frequencies one does want (934MHz transmissions) and rejecting those not wanted (cellular radio conversations).

At the same time we measure the insertion loss; anything you connect into the feeder between the radio and the antenna will absorb some of the power, and naturally, we want to keep this loss to an absolute minimum.

Trade news

The filter came, by the way, from Selectronic of Canvey Island. Their proprietor, Mike Machin, has also lent me lots more goodies for review: a power and SWR meter by Diamond-Welz, a new super-dooper preamp from Japan and a high-gain base collinear. As if this was not enough, there's also a new scanner receiver which covers 25-1300MHz, which seems to be the most sensitive yet at 934MHz. So watch this space for test results and full details.

It has been some time, in fact, since I had major new products to report, so this will make a change. On the subject of Selectronic, I should also note that they now have in stock the 23 element yagi from Tonna.

As I mentioned in a previous article, this is one of the best sellers in Switzerland and deservedly so, because it is one of the best-made beam aerials on the market. Its length is 2.44 metres and its gain is 15.9dBd (18dBi if you prefer). VSWR is reported as 1.2:1, which is fine, and the price is £59.95.

They also have a new base station collinear, the PA-28, which offers a massive 15dBd gain thanks to its 28 half-wave elements. This monster will cost you £135 and is really for the DX man – performance with these big arrays is not so good close-in.

They are a bit like lighthouses, beaming all their light as far as possible towards the horizon. If you try to read a newspaper standing beneath a lighthouse you will get very little light, and the same applies to a high-gain

collinear. You will also need a lower gain stick if you work a lot of local mobiles – don't blame the antenna if it doesn't do what it was never intended to do!

I also mentioned recently the phonepatch system introduced by IQD Ltd of Crewkerne. This seems to have been causing a little uneasiness for two reasons. According to informants, systems are already in use in the Bristol, Grantham and New Milton areas and are provoking a little bother. The blame, by the way, can be pointed in two directions.

For a start, the phonepatch system's radio equipment (Delta Ones modified by CTVR Ltd) is supposed to avoid channels already in use, but in practice only S9 signals are registered. In consequence, the phonepatch system 'walks over' DX contacts, to the annoyance of the existing users.

By way of retaliation 934 users are deliberately jamming users of the phonepatch – not a very good situation. The problem would be avoided if the phonepatch transceivers had their squelch adjusted to take account of quieter QSOs already existing.

As I have said before, business users have a perfect right to use 934MHz and we must have peaceful coexistence. Most business users pack up at 5pm and at weekends, while most hobbyists come onto the band outside these times, so why can't people be satisfied?

Even if you share the band with a local taxi firm, look on the bright side: they only need one channel out of twenty and if they are like our local outfit they will be pleased to give rig and time checks if asked.

Is this reasonable? If you disagree, do write and tell us all why! Perhaps the only long-term solution is separate bands for business and hobby users – how about another 20 channels for commercial organisations?

Legal problems?

The other aspect of this phonepatch business is that it may not be legal. IQD Ltd are adamant that it is legal to use their device on 934MHz and certainly it has British Telecom approval. On the other hand, the Department of Trade and Industry, who control the airwaves, consider this a rather grey area. Phonepatching, they say, needs a separate licence under the British Telecommunications Act of 1984, which is not issued to individual users, and is certainly not permitted in the 934MHz licence (nor, for that matter, is it in the amateur licence). What is clear is that it would need a competent independent authority to determine what the law intended, and I wonder if the DTI wishes to go as far as to institute a test prosecution? If you were in the dock, would you have a case against the people who sold you the equipment? I doubt it, so I suggest anyone buying this apparatus demands a letter of indemnity from the supplier, saying that its use is in their view legal. Oh dear, oh dear...

More egg on face

Last month I said that the first 933MHz PRS test and development licence had been issued to Selectronic of Canvey Island. This was said in good faith, but now Jim Finch of Solid State Electronics has shown me his 933MHz licence issued back in August 1986. My one has also come through at last, so we are all happy. All we need now is a public Personal Radio System!

Sign-off

That's it again for this time. Drop me a line and tell me who you have worked lately. You're a shy lot; nobody has sent in their QSL cards but I shall be pleased to print the best designs. What about this plan for a repeater in Worcestershire? Let us all know.... REW

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Hotrodding the medium wave receiver

Some sound advice from Thomas Sinclair

The medium wave and the 160/80 metre bands have long been the faithful standby of the amateur radio enthusiast. The equipment is plentiful, easy to understand, modify and service, and for the most part, cheap. As a hobby, the medium wave band can provide many an enjoyable hour of knob-twiddling in the winter evening hours, searching for Continental and North American DX, as well as experimenting with loop aerials and trying to improve the receiver performance.

Many of the ideas here may be applied to the IF sections of some of the cheaper portable short wave Rxs such as the Vega and others of similar price range.

Figure 1 shows the general layout of the kind of circuit under consideration, which is typical of this price range. The only thing variable is the actual layout on the circuit board, but there should not be any trouble identifying the respective parts. Very few in this price range use ICs as yet, but if an IC is used, then it's best left alone, even if replacement ICs are available. There is a big difference between pulling a lonely transistor with three or four pins and pulling all the pins of an IC, even with desoldering equipment. Of course, some older models will contain pnp transistors with the Far East prefix 'B', '2SA' or '2SB'. If this is the case, the same connections apply, except that the polarities will, of course, be reversed, as will the supply voltages. One other snag which might deter the amateur is that the audio amplifier may not be of the usual transformer type, and might even be of the IC variety, but this should not be a problem. Audio amps are generally pretty robust creatures.

Not everyone would agree, but in the author's opinion the perfect receiver is based on a design dating back to 1929 in which everything from the IF to the audio frequency was made variable. This is desirable on most superhets, not just the medium wave band, because the IF is actually set in the middle of its maximum setting as a compromise to accommodate both extreme ends of the band setting.

For example, if the IF is set for maximum performance at, say, the 500kHz end of the medium wave band, the chances are that weak stations at the other end of the band would not be received, unless the IF was readjusted, and vice versa.

This is exactly what the serviceman does when he aligns the IF transformers with a signal generator and leaves it set at the compromise position, resulting in mediocre reception at the extreme ends of the band with the best performance in the middle. This is perhaps why, on a commercially adjusted set, it is easier to receive Canada, Boston, or the Continental American Forces Network in the 700kHz to 900kHz region in the middle of the band. Trying out this theory during the day, the author was able to pick up weak local stations without an aerial that previously he did not know could be received in his hilly locality. With strong stations coming in at night through skywave propagation the effect is less noticeable until an external aerial is used to DX the weak stations that couldn't be detected before. But, to make everything variable, one has to consider the size of the controls desired and available, and whether there is room or not in the original case to place them. If not, then it may be necessary to consider using a larger case.

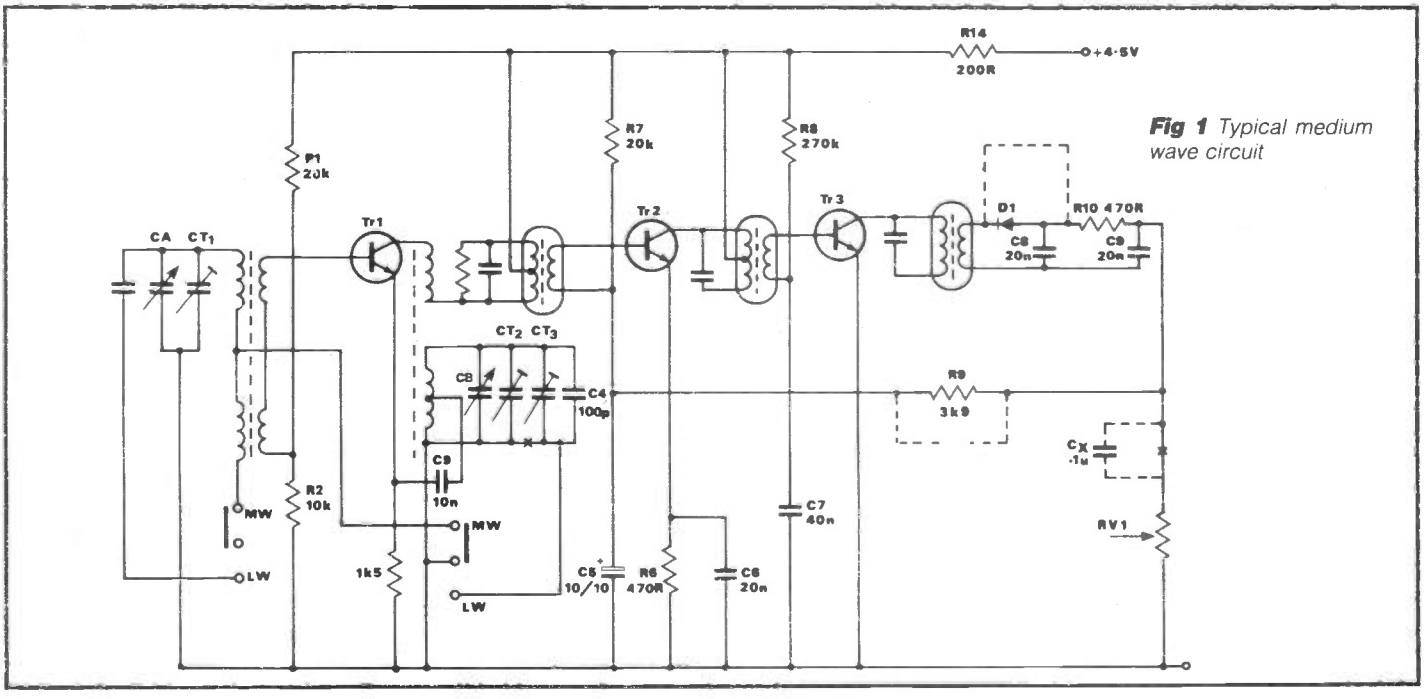

Fig 1 *Typical medium wave circuit*

Many articles of this nature have been written before, but just to go over some old ground briefly, *Figure 2* shows the details for coil windings and a variable condenser to make a three band wave trap that goes between the aerial and the receiver. Readers may see the similarity between this and an aerial tuning unit. Indeed, using an ATU wiring arrangement, the coils can be used for this purpose to good advantage. In fact, it has often been recommended that a quality ATU for Rx/Tx purposes should have separate coils for each band. With a proper switching arrangement the wave trap can be made to serve a dual purpose in this way.

Figure 2a shows the details for an internal aerial coil, since it is usually recommended that a medium wave Rx for DX purposes should not have an internal ferrite rod aerial. This may be true if it is an exceptionally large ferrite aerial, but the ferrite aerials found in pocket trannies are hardly any larger, and in some cases are even smaller, than some of the internal aerials and coils found in old valve and early transistor sets. The secret, really, is screening the aerial from outside interference.

However, using one of the set-ups shown in *Figure 2b* connected to an external aerial it was found that the higher gain of the external aerial tended to override the directional properties of the ferrite aerial. The external aerial used by the author is a wire box aerial designed for 10 metres and earthed at one end, with an open square bit facing roughly east and west in a fixed position. In this set-up it acts as a miniature Beverage aerial. This arrangement would not necessarily be suitable for every location, and not everyone has the space (loft, garden, etc) to erect an external aerial. For this reason a small scale version of the box aerial was evolved. The designs offered here are in no way the equal of their larger cousin, the loop aerial, but they will provide a higher gain than the conventional commercial ferrite rod aerials.

Figure 3a shows details of the miniature box aerial. It leads into the aforementioned wavetrap assembly, which in the larger version in *Figure 5* is independently screened from the rest of the circuitry. The rest of *Figure 5* is only a suggested layout of the various controls discussed in the text. *Figure 3b* shows an experimental version of the 'toaster' aerial which provides less directivity, but a higher gain than its smaller neighbour.

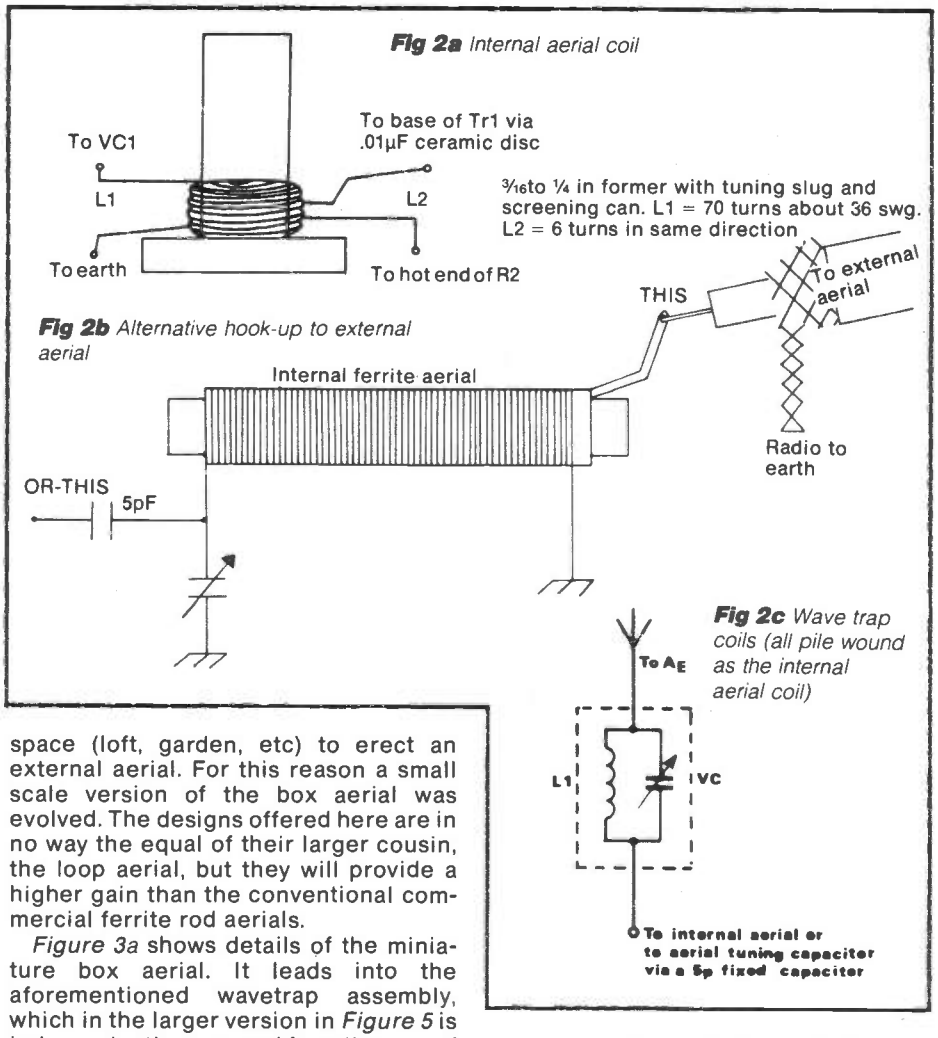

Fig 2a *Internal aerial coil*

Fig 2b *Alternative hook-up to external aerial*

Fig 2c *Wave trap coils (all pile wound as the internal aerial coil)*

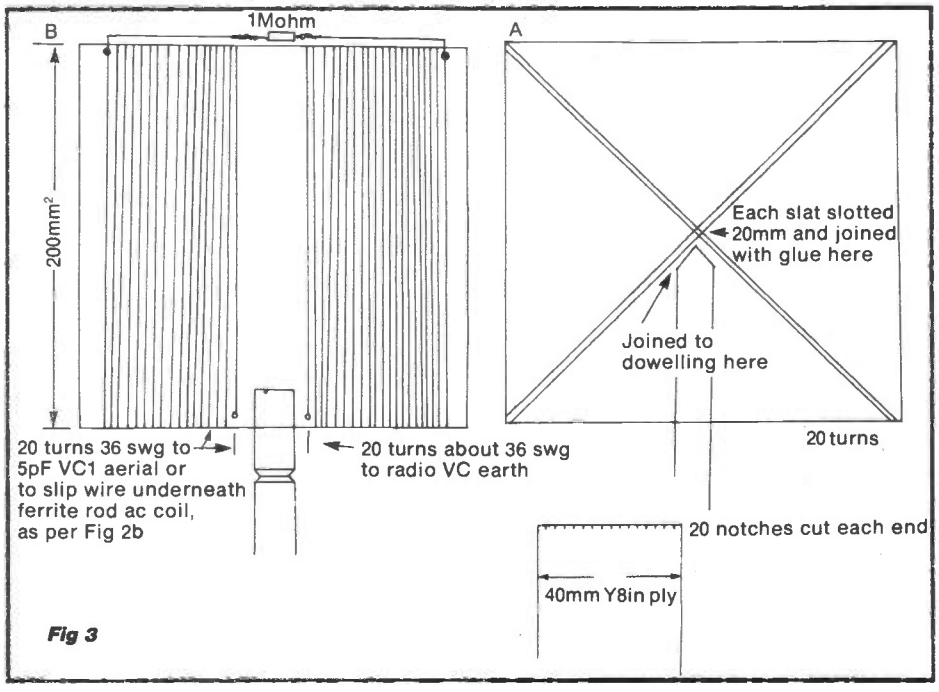

Fig 3

Having decided that a larger case was required, the radio was placed inside it and fitted with a slow motion drive, pointer, and a protractor scale. It was fitted with the protractor scale not only because one was at hand, but also because it has almost twice as many markings as the conventional 0 to 100 scales and makes the marking of stations a little more accurate, especially at the higher end of the band.

Now, with the radio in a larger case, there was room to add another conventional control, namely a bandspread tuning condenser which can be of any value between 5pF and 50pF. A 22pF dual gang was used by the author, as illustrated in *Figure 4a*. Another less well known but cheaper way to bandspread is shown in *Figure 4b*. A 22pF fixed capacitor is placed in series with the main tuning capacitor, and a trimmer is placed in series with the aerial section of the tuning capacitor. An appropriate 2 pole/2 way switch is also connected as shown. This set-up allows the same tuning scale to be used as the main

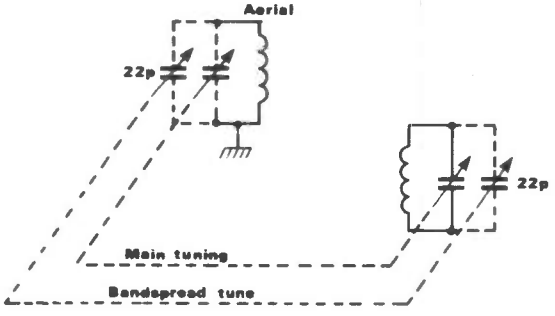

Fig 4a

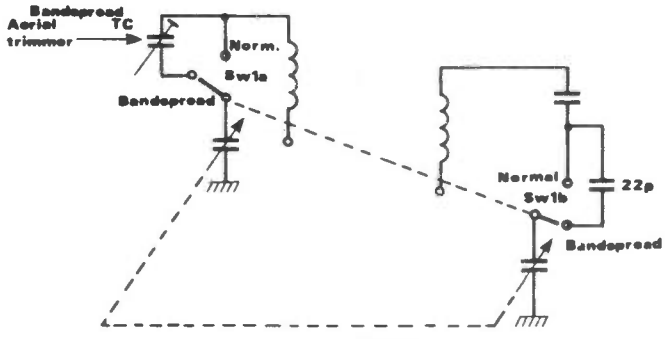

Fig 4b

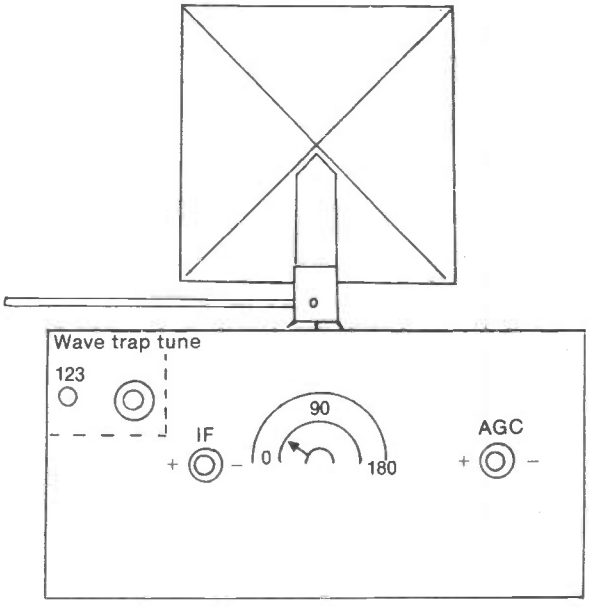

Fig 5 *Suggested layout of front panel*

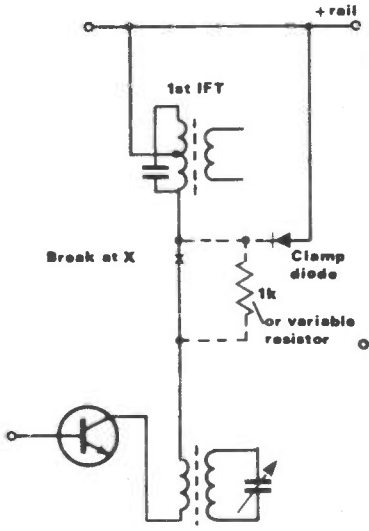

Fig 6a

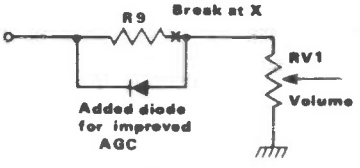

Fig 6b

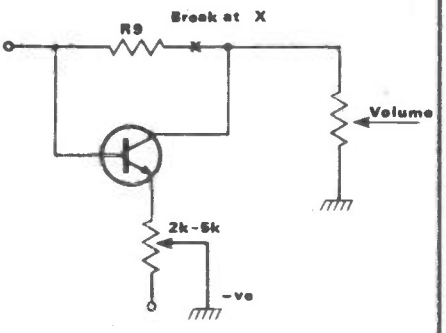

Fig 6c

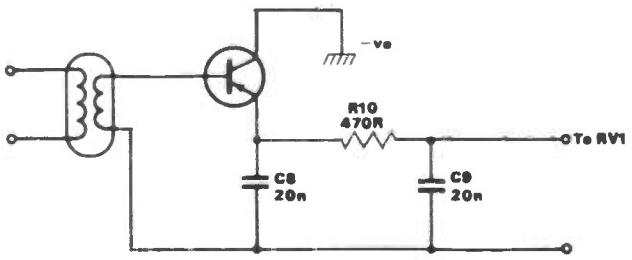

Fig 7 *Here a pnp transistor replaces the conventional diode detector. A 10kohm resistor was needed between collector and earth. If radio uses pnp transistors in the RF sections an npn detector is needed; likewise if audio amp is transformerless type and uses a pnp preamp. Use low noise types*

tuning and avoids the need to purchase an extra variable capacitor. This arrangement tends to raise the frequency and it may be possible, with some very minor adjustments, to get coverage of the 180 metre amateur band.

At this point, it is necessary to give a warning. *Never attempt to adjust the IF transformers or the red oscillator transformer, as these are usually set at the various factory production lines according to a set pattern on an oscilloscope.* Unless an oscilloscope is available, readjusting back to the original state is virtually impossible and it is best to leave them alone. However, the oscillator trimmer capacitor can be adjusted after marking its original location so it can be reset with reasonable certainty. By opening the trimmer and slight readjustment of the aerial trimmer, the 180 metre Top Band can usually be attained.

If the radio is put in a bigger case, the obvious possibility is to add a larger speaker for improved sound quality as well, along with a larger phone jack to take the standard stereo headphones.

Another standard modification is the clamp diode of *Figure 6*, although this is a peculiar version, as putting an isolating resistor between the diode and the positive rail, as is usually the case, made some radios too insensitive to weaker signals. If resistors are placed at both ends this results in excessive noise, so ideally a 2kΩ variable taken to the front panel would give better control. When the potentiometer is set to zero ohms, nothing but the strongest transmissions will pass through giving better local radio sound quality, yet this may prove a useful facility for DXing as well.

Another use for the diode in *Figure 6b* is to improve the automatic gain control (AGC) characteristics. This is a vast improvement over the conventional resistor set-up used in most sets.

Having a total of three IFs on the test receiver the next step was to add a three-gang variable capacitor with a maximum setting of at least 100pF, but with three-gangs it is more usual to have 365pF or 500pF. This, again, was taken to a

front panel control so that maximum gain of the IF transformers at any setting in the MW band could be obtained.

So far, except for the IFs, all the improvements to the clamp diode and the AGC diode were made at the expense of overall gain in the received signal, and the front control panel was starting to look like the control panel of a Boeing 747. Trying to amplify the AGC with a transistor instead of a diode met with little success, but led to the improvement shown in *Figure 6c*, which allowed the clamp diode to be removed altogether and the clamping and AGC control to use one control only. Strong signals were better controlled, and those causing heterodyne whistles, while not eliminated, were certainly reduced so that the system acted like a notch filter or a limited squelch control, in that at full setting only the strongest of signals could get through. This system is not perfect by any means, but as a way of combining the benefits of the other two systems it is simple and worthwhile.

To recover some of the gain lost from all these improvements, the conventional diode in the radio was removed and replaced with a transistor detector, at the expense of some sound quality, because unless the noise is removed at the start it gets amplified with the signal. The first transistor used for the detector was noisy and it was necessary to change it to a transistor with low noise characteristics. It is a pnp transistor, followed by a standard transformer-type audio amp. If the audio amp is transformerless or of the IC type, it may contain a pnp preamp transistor, in which case an npn detector transistor is needed. REW

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by R G W Hathaway

(chartered aeronautical engineer and space consultant)

The existence of the NASA tracking and data relay satellite system (TDRSS) is well known and it is indeed a most valuable link for the management of low Earth orbit (1000Km) satellites and the space shuttle.

Earth observation satellites, for reasons of spatial resolution and Earth coverage, can be conveniently placed in a low height polar orbit. They are slightly disadvantaged in terms of communication visibility because of the lack of coverage from regular geosynchronous satellites such as the Intelsat and Comsat series, whose major function is commercial telephony and television.

A dedicated data gathering satellite in a geosynchronous orbit, which allows for coverage of about 70% of the total orbit trajectory for a low Earth orbit satellite, is therefore proposed for the space station programme which will be operational during the period 1994-1995.

The estimated traffic for the NASA TDRSS satellite when the space station is operational will demand that greater capacity is made available. With some considerable foresight the European Space Agency has assessed the situation and instituted its own data relay satellite (DRS) which is in its conceptual and definition phases. Conventional tracking and data acquisition networks will be greatly enhanced, but the major benefit will be for the Earth observation users, who will have an extremely fast data processing system which can be used to correct visual observations.

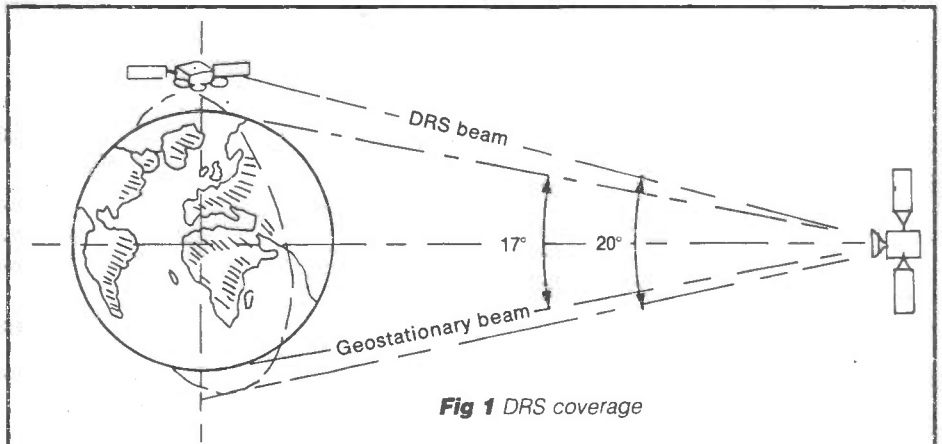

Fig 1 *DRS coverage*

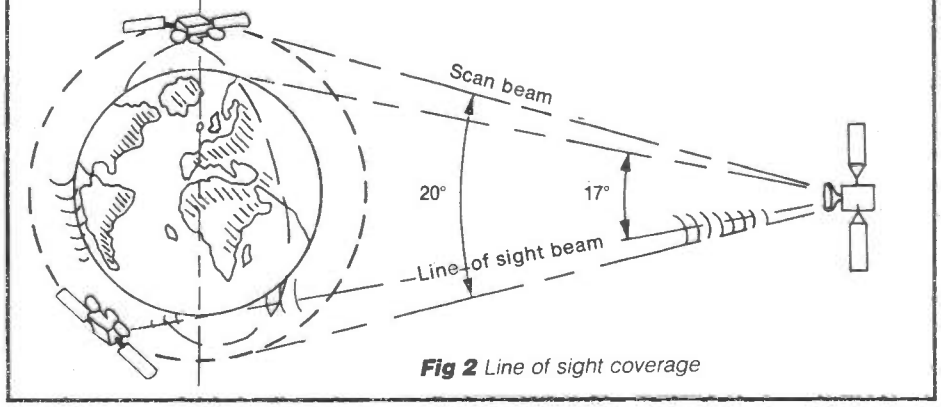

Fig 2 *Line of sight coverage*

Eureca and Olympus

An experimental mission using Eureca (European Retrievable Carrier) and Olympus is planned for 1988, Eureca's first flight. Olympus will be used as the data relay satellite and Eureca as the polar platform, which it adequately simulates although on a reduced scale of size. For this mission frequencies of 18 and 28GHz will be used, and programme tracking of one antenna on the Olympus spacecraft will provide valuable data for the actual DRS, as it will combine operational and tracking procedures.

System concept

For the European mission it is planned to have a two satellite system positioned at 50°W and 65°E respectively, which will provide adequate coverage. A ten year working life, including eclipse periods, is the design aim which will require an extremely high reliability factor. The spacecraft configuration will be suitable for an Ariane/Spelda (dual-launch) launcher and carry a microwave payload operating at S-band, to be compatible with TDRSS, and at Ka-band in order to provide a high data rate service. Simultaneous access to the LEO (low Earth orbit) satellites with four independent beams, two at S-band and two at Ka-band, is required from the antenna system, and this will satisfy the requirement for communication with up to four spacecraft at any one time.

Key elements are the antenna subsystem, which will provide inter-orbit communications links, and a feeder link antenna for the DRS-ground station link. The antenna's RF beam will scan in a 10° half angle cone about the nadir which corresponds with the ability to track LEO spacecraft up to 1000km above the

Earth's surface, as shown in *Figure 1.*

There is another advantage with the DRS system concept and that is the total coverage which is gained by having a 10° half cone angle for the antenna. In addition to the scan coverage, there is the line of sight coverage, which could be used to communicate via the low Earth orbit satellite with areas of the Earth's surface which are not directly visible to the data relay satellite. This is shown in *Figure 2.*

Spacecraft design

To be compatible with the Ariane/Spelda (dual-launch) launch system the spacecraft envelope must fit within the dotted outline shown in *Figures 3* and *4.*

It must also have sufficient power and propulsion capability to initially place it in the correct orbit and then maintain an operational capability in that orbit for up to 10 years. To optimise the power from the solar array and have a station-keeping capability, detailed power and propulsion trade-offs in the early stages of the 'bus' (spacecraft) design are required. Suffice to say that the antenna subsystem will be provided with power and will be maintained in a geostationary orbit, fully stabilised to ensure that the pointing accuracy of the four main beams is within specification.

Antenna system outline

Faced with the requirement of providing four independent beams at S-band and Ka-band, the antenna engineer has to consider several conditions of the operational specification:

- Size of antenna, including shape.
- Power/tracking, to scan in 10° half cone angle feed network and type of tracking.
- Simultaneous access, with up to 4 low Earth satellites.
- Configuration, including number of antennas, stowage and deployment.
- Mechanical/optical devices, mass, reliability and feasibility.

In regular antenna design for, say, a communication satellite, a reflector or disc of parabolic section with an offset or centre-fed feed is usually satisfactory for both transmit and receive capability. This design requires four independent beams and must therefore be approached somewhat differently to a conventional design. One could elect to have four separate main reflectors, each transmitting/receiving at the required frequency, but there are two distinct disadvantages with this approach. Firstly, the mass of four large reflectors each requiring to be independently steered would be prohibitive in terms of overall payload mass, and secondly the physical constraints would not be compliant with the Spelda configuration. It can be seen in *Figure 3* that two antennas with feeds just fit within the dynamic envelope. Faced with such a severe constraint in terms of available space, other solutions must be considered.

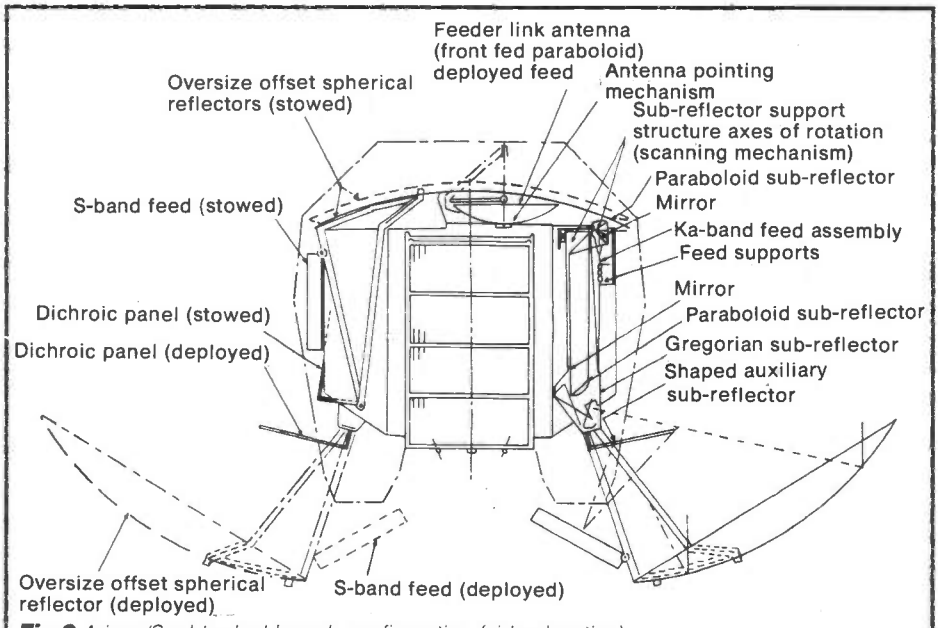

Fig 3 *Ariane/Spelda dual launch configuration (side elevation)*

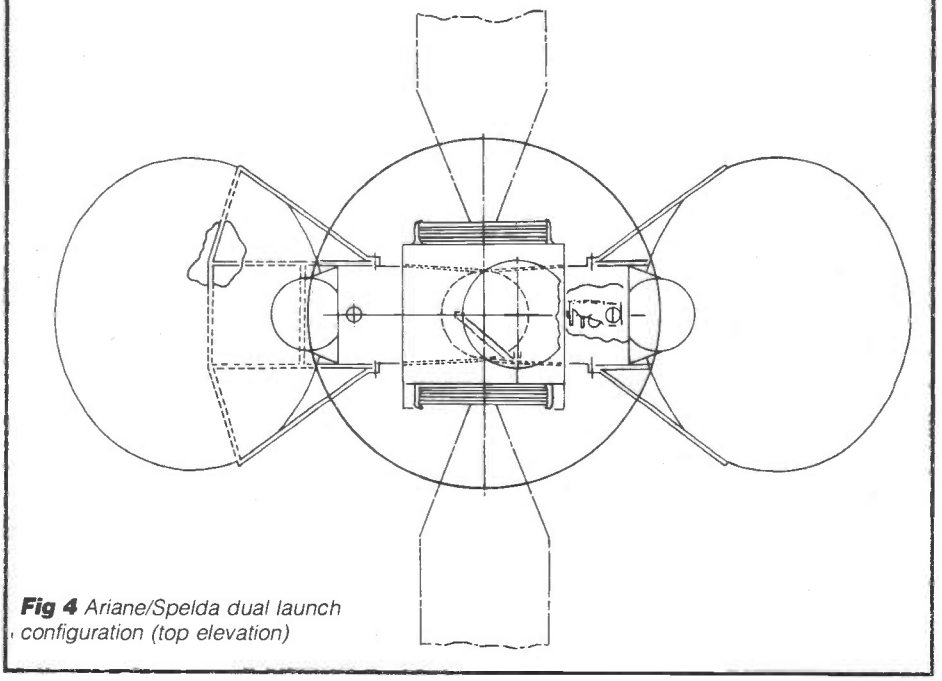

Fig 4 *Ariane/Spelda dual launch configuration (top elevation)*

Quite a sound approach is to consider two separate antenna combinations:

a) 1-Ka/Ka
   1-5/5 or
b) 1-Ka/5
   1-Ka/5

The second combination should be more reliable, because a failure on either antenna will not cause loss of a full communication band 5 or Ka since they are present on each antenna. A possible arrangement of main reflectors, sub-reflectors, mirrors and feeds is shown in *Figure 5.* There would be two such arrangements on each spacecraft providing a total of four beams, each independently steered or focused.

Mechanical aspects

Assuming that the antenna arrangement is one consisting of two antenna combinations, then irrespective of the pairing of the different frequency bands, the mechanical aspects will be similar in detail. The mechanical requirements must consider pointing, deployment and latching both before and after launch. Latching before launch must consider the antenna in the stowed configuration with sufficient stiffness to meet natural frequency requirements. The latch has then to release the antenna so it can then be deployed and locked into its flight position. In order that the antenna beams can be pointed accurately, the spacecraft must be stabilised with the

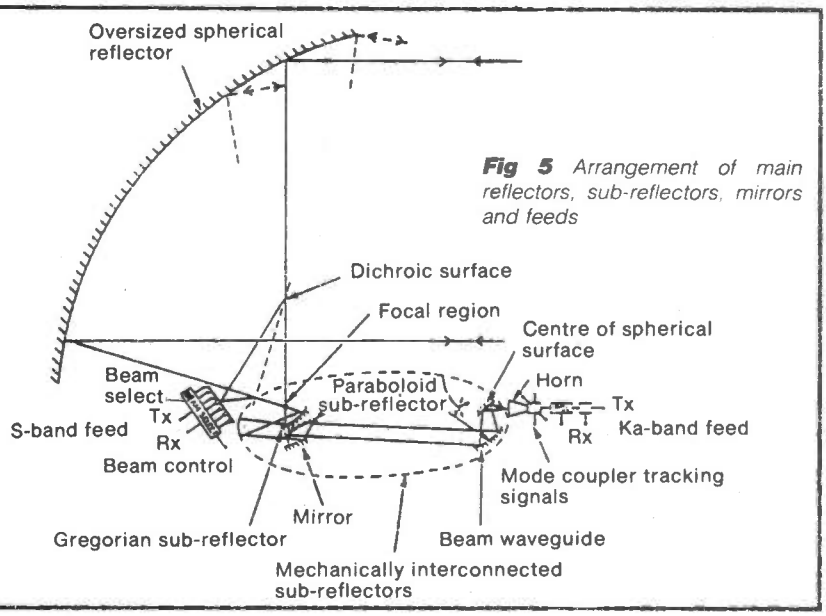

Fig 5 *Arrangement of main reflectors, sub-reflectors, mirrors and feeds*

use of an attitude and orbit control system. The AOCS is not in itself sufficiently accurate or stable to meet the pointing and tracking requirements for a narrow beam system and, therefore, the fine tracking is achieved using a closed loop system.

Cost effectiveness

With the introduction of a new system such as the data relay satellite, the cost element is always important. Indeed, this can often be the single point of acceptance or rejection. It is therefore prudent, when presenting the case for a new system, to have sufficient cost-reduction ideas available in some detail. Some of those ideas could be:

- Select a proven 'bus' or carrier in order to reduce recurring costs.
- Design for a low payload mass and volume to reduce launch costs.
- Define a 10 year lifetime base in terms of reliability and redundancy.
- Operate a low cost system with a minimum personnel payroll.
- Encourage simultaneous access without performance loss.

Cost curves for both the ground and space segments should be presented separately and should show the advantages of the multi-user approach. Finally, having prepared a first attempt at marketing the system, present a listing of potential users with a percentage time/cost return.

In conclusion, the data relay satellite for Europe will go ahead with a pilot mission in 1988 using Eureca/Olympus techniques of a retrievable carrier and one dedicated antenna. The fully operational system will come into use on the Columbus space station in 1994-1997, offering a dedicated service to Earth resources and meteorological customers and others on a basis of cost, which will be mission specific. REW

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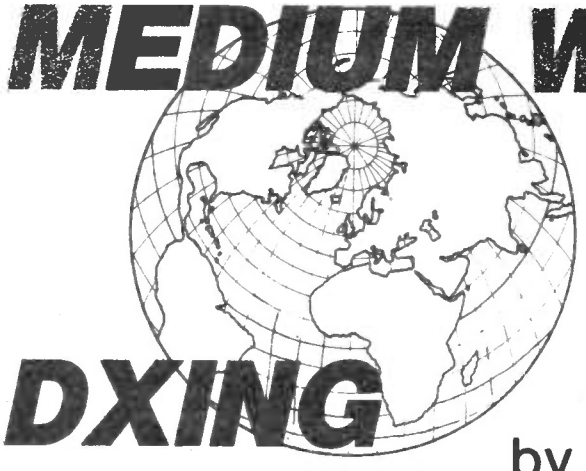
MEDIUM WAVE DXING



by Steve Whitt

Welcome to the column that takes you around the globe with just the simple twist of a radio dial! This month we'll be looking in detail at the broadcasters of the Middle East, and for the newcomer to the world of radio listening I'll try to explain the mystery behind the QSL card.

The Middle East

The Middle East is a distinct region of the world that encompasses a number of countries and societies closely linked by historical tradition and modern allegiances. The common denominators linking many of the Middle Eastern countries are a belief in Islam and a common language, Arabic, of which several dialects exist. Another factor that is common to many of the countries is their oil-generated wealth, which has enabled radio stations to be set up to carry the voice of Islam to the world.

Over the years, as more and more stations have appeared on the MW band competing for a limited number of frequencies, the average power of transmitters has been steadily increased in an attempt to override interference. Today, looking at a list of stations on the MW band reveals that the vast majority of super-power stations are located in the Middle East; indeed there are around 18 stations in this area alone using powers of 1000kW or more. Just compare this with the maximum power of 500kW in use in the UK (by the BBC World Service on 648 and 1296kHz) or even the 50kW upper limit in North America. Some of the more readily heard stations are:

- 702kHz Oman 1500kW
- 900kHz Saudi Arabia 1000kW
- 1134kHz Kuwait 1500kW
- 1413kHz Oman (BBC relay) 1500kW
- 1481kHz Dubai UAE 1500kW
- 1512kHz Saudi Arabia 1200kW
- 1521kHz Saudi Arabia 2000kW

At first sight much of the Middle Eastern broadcasting seems to be influenced by the local dominance of Islam. However, the Koran is not the basis for all programming and you may well be surprised to find out the extent to which English programmes are aired. The following list should make good hunting for the DXer and could be of interest to the traveller heading to this fascinating part of the world (all times are UTC):

- Radio Jordan – 0530-2200hrs daily on 855kHz and local FM stereo
- QBS Doha Qatar – 0300-1100 and 1400-1800hrs on 1233kHz
- Radio Kuwait – 0500-0800 and 1800-2100hrs on 1341kHzP
- Voice of Free Lebanon – 0630, 0730, 0830 and 0930hrs on 963 and 1476kHz
- Voice of United Arab Emirates – 0800-1000hrs on 1314kHz
- Bahrain Broadcasting Station – 0300-2110hrs on 1584kHz

Square one

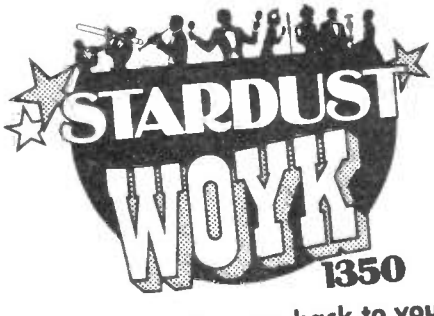
It is in this section that I shall attempt to open the door to MW-DXing, and this month I intend to take a look at QSL cards. These are probably a bit of a mystery to the newcomer, so what do they mean? Let us suppose you've just heard Radio Fiji on your pocket transistor radio, how are you going to convince everyone that you weren't just dreaming? Wouldn't it be good to have something from the radio station confirming that you really did hear them? Well this is where QSL cards come into the picture; a QSL card is usually a picture postcard (although it can also take the form of a letter, a certificate, or a folder) sent to a radio listener by a radio station confirming that reception took place.

In order to get a QSL card from a station there are several things you need to do, but firstly remember that you have to hear the station and then convince station staff that you did hear their signal. Normally, one is obtained by sending a station a reception report giving details of reception conditions and of the programme material heard as proof of reception – naturally you need to say when you were listening (date and times should be in GMT/UTC or in the station's own local time).

Historically, the QSL originated in the days when stations relied on reports from listeners to determine their coverage area. In fact the letters 'Q-S-L' are based upon a radio operator's shorthand code (Q code) system that evolved during the early days of radio. Nowadays, however, many stations use reports from professional monitoring stations and have more accurate coverage predictions available, and consequently the QSL survives largely as a service, from the station's point of view. Additionally, there is a significant difference in QSL policy between the international short wave broadcaster, which issues QSL cards to maintain contact with and to gauge the size of its audience, and the local medium wave station being heard outside its usual coverage area. At best, the latter will treat a far-off reception report with curiosity and will send out a QSL as a public relations exercise. At worst, to a station with few staff and a limited budget, reception reports from DXers can be a downright waste of time. It is therefore vital that MW-DXers follow some simple guidelines when sending out reception reports to stations.

Firstly I would suggest that a personal letter to the engineer or manager together with a detailed report of reception conditions (was the signal strong? What was interfering?) and adequate programme details to prove that you really heard the station ('music and talking' is not good enough) are the basic requirements. Additionally, make a polite request – not a demand – for a QSL card or a letter confirming reception. Remembering that most MW stations are local operations run on limited budgets, it is wise to write to them in their own

Examples of MW station logos



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language (or that used in the programme) and to enclose return postage in the form of an International Reply Coupon (available at Post Offices).

This may all seem a complicated procedure, but if you follow these tips not only should you receive more QSL cards for your own collection, but you will help maintain good relations between radio stations and the DX fraternity in general.

One publication that recently found its way into my in-tray is *Radio Stations in the United Kingdom*, a 24 page A5 format booklet that lists every MW and every FM broadcast transmitter in the UK. Stations are listed in frequency order, but there are detailed cross references to parallel frequencies and to a complete list of addresses and phone numbers. Additional features on the broadcasters, unofficial broadcasters and special event radio are also included in the latest edition (9th) of this publication.

This booklet is comprehensive and very up to date, and ideal for both the serious DXer as well as the casual radio listener. Copies can be ordered for £1 or 4 IRCs from the British DX Club, 54 Birkhall Road, Catford, London SE6 1TE. Don't forget to say we sent you!

DX FILE

Following on from last month's report from Derek Taylor, I had the opportunity to listen to the tape recording of KURM and WPFA, both UK firsts and both heard by Derek on 790kHz. I was impressed by the signals considering that both of these stations run just 500W at night but, of the two, WPFA in Pensacola, Florida was the clearer signal. In fact, to check up on the details of his recording of KURM (from Rogers, Arkansas), Derek decided to phone the station direct. Amazed station staff put Derek live on the air 'all the way from England' and they confirmed that he had indeed heard KURM. I wonder if a verbal verification counts?

Since early January, MW conditions have remained very good with only the occasional fade out. Some of the stations recently heard include:

590kHz WEEI Boston, Ma
680kHz WRKO Boston, Ma
770kHz KKOB Albuquerque, New Mexico
1190kHz WLIB New York (this one is a daytimer!)
1320kHz CFGM Richmond Hill, Ontario (soon to move to 640kHz)
1510kHz WLAC Nashville, Tn
1570kHz XERF Cuidad Acuna, Mexico

Well that rounds things off for another month. 73s till we meet again. REW

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DATA FILE . . .

This month Ray Marston looks at infra-red remote control systems

In a recent edition of *Data File* we presented a concise survey of modern opto-electronic devices and techniques, and included brief mentions of light-beam systems which can (amongst other things) be used as the basis of remote control systems. In the present edition of 'The File' we expand on this theme by showing practical ways of making IR remote control units. We start off, however, by looking at some basic principles.

Remote control basics

Infra-red 'beam' systems can easily be designed to give very effective single or multi-channel remote control operation. *Figure 1* illustrates the basic principle. Here, the hand-held 'control' unit transmits a coded waveform via a broad infra-red beam, and this signal is detected and decoded in the remotely placed receiver, and thence used to activate external devices, etc, via the receiver outputs.

Note from *Figure 1* that the transmitter can remote control a receiver that is placed anywhere within the active area of the IR beam, and that the transmitter and receiver do not need to be pointed directly at each other to effect operation but *must* be in 'line-of-sight' contact; also note that an object placed within the beam can create a 'blind' area in which line-of-sight contact cannot exist.

Code waveforms

Most modern IR remote control systems are designed to give multi-channel operation, with each channel giving digital (on/off) control of an individual function. The transmitter waveforms usually take the general form shown in *Figure 2*, which depicts those of a basic 6-bit multi-channel system. Here, the waveform takes the form of an 8ms repeating 'frame' of seven bits of pulse-coded information, with each bit modulated at about 30kHz. The first bit has a fixed duration of 1ms and provides frame synchronisation for the decoder; the subsequent six data bits appear at 1ms intervals and each give an 'on/off' form of control, with a 'less-than-0.25ms' pulse representing an *off* or logic 0 state and a 'greater-than-0.25ms' pulse representing an *on* or logic 1 state. In practice, this 6-bit code waveform can be used to give either six simultaneous channels or up to sixty-four non-simultaneous channels of remote control, as shown in *Figures 3* and *4*.

When the *Figure 2* waveforms are used to give simultaneous remote control operation, each data bit gives a single channel of operation, as shown in *Figure 3*. Thus, channels 1 and 2 may each be used to give an independent on/off switching function, while channels 3 and 4 may be used to increase or decrease the output of a 'ramping' volume control, and channels 5 and 6 may be used to similarly control the output of a ramping brilliance control, etc.

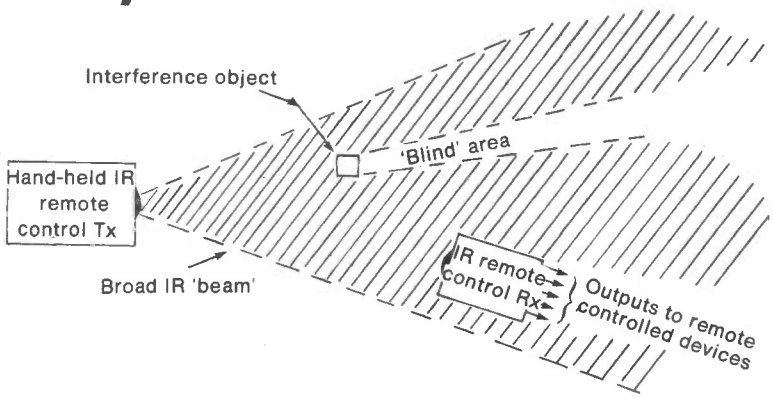

Fig 1 *Basic IR remote control system*

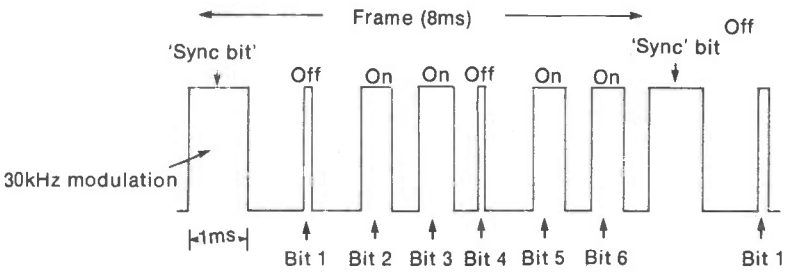

Fig 2 *Typical transmitter code waveform of a '6-bit' remote control system*

Note that within each transmitter frame all six channels may be varied simultaneously.

When the *Figure 2* waveforms are used to give non-simultaneous remote control operation, the six data bits are used (within each frame) to generate a unique 6-bit serial binary code, and each of these codes controls an individual remote control 'channel'; there are a total of sixty-four possible codes, and this system can thus be used to give up to 64 channels of remote control, as shown in *Figure 4*. Thus, channels 1 to 4 may be used to control the on/off action of a pair of switches, and channels 61 to 64 may be used to control the levels of volume and brilliance. The remaining fifty-six channels may be used for a variety of other purposes!

Note that within each transmitter frame only a single channel can be controlled at a time, but since the frames are updated about 120 times per second this is usually only a minor disadvantage.

Channel no	Channel state	Decoded function
1	on off	Switch 'A' on Switch 'A' off
2	on off	Switch 'B' on Switch 'B' off
3	on off	Volume increase
4	on off	Volume decrease
5	on off	Brilliance increase
6	on off	Brilliance decrease

Fig 3 *Typical functions of a 6-channel 'simultaneous' remote control system*

Channel no	6-bit code	Decoded function
1	000 000	Switch 'A' on
2	000 001	Switch 'A' off
3	000 010	Switch 'B' on
4	000 011	Switch 'B' off
–	–	–
–	–	–
61	111 100	Volume increase
62	111 101	Volume decrease
63	111 110	Brilliance increase
64	111 111	Brilliance decrease

Fig 4 *Typical functions of a 64-channel 'non-simultaneous' remote control system*

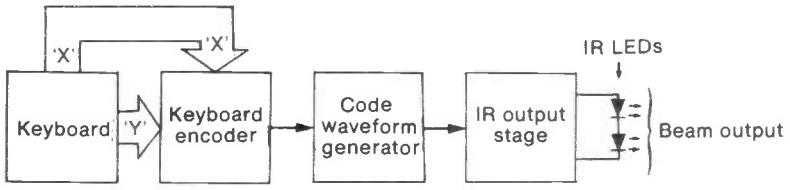

Fig 5 *Block diagram of a typical IR remote control transmitter*

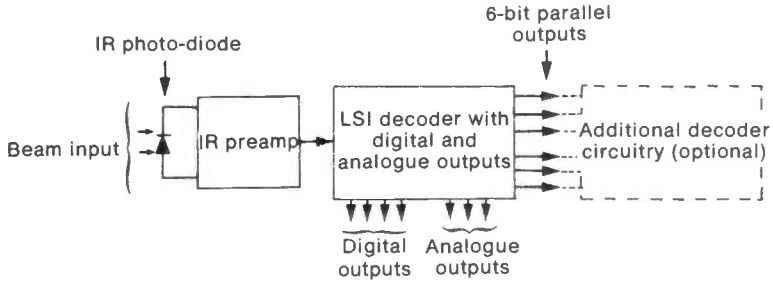

Fig 6 *Block diagram of typical IR remote control receiver*

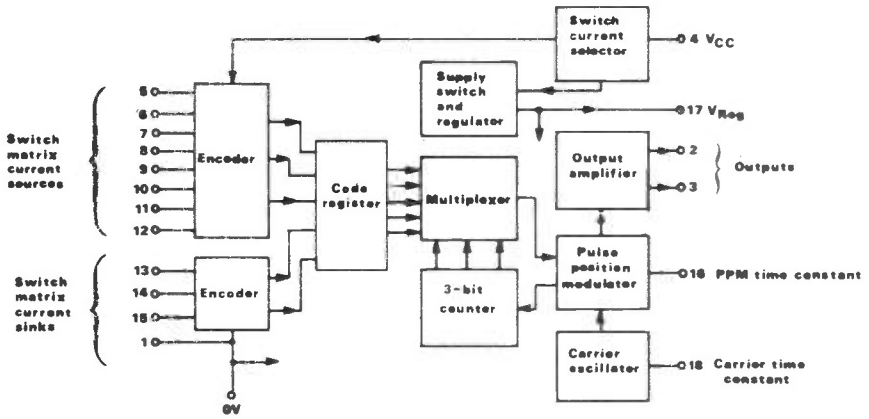

Fig 8 *SL490 transmitter IC block diagram*

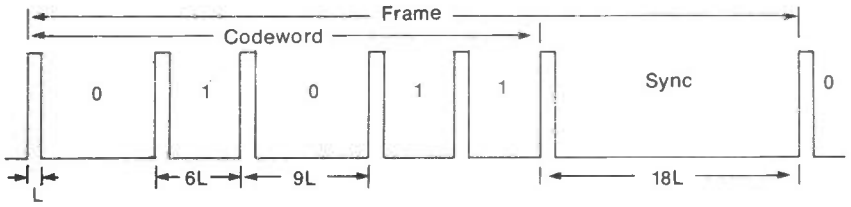

Fig 9 *Typical pin 3 output waveform of the SL490 transmitter IC*

Block diagrams

Figure 5 shows the typical block diagram of a multi-channel IR remote control transmitter. This type of unit is usually fitted with a multi-function keyboard, which has its 'X' and 'Y' outputs continuously scanned via an encoder circuit that controls the input to a code waveform generator system. This latter unit generates the carrier wave signal (typically about 30kHz) and the 6-bit plus sync pulse repeating 'frame' waveforms, which are then passed on to a standard infra-red transmitter output stage.

In the receiver circuit (*Figure 6*) the detected IR signal is first fed to a fairly sophisticated preamplifier stage, which must provide very high gain for long-range operation, but must not saturate if the transmitter is placed only a few centimetres from the receiver. The pre-amp output is fed to an LSI decoder IC, which typically directly provides three or four digital outputs (simple on/off functions) and two or three analogue outputs (volume, brilliance, etc), but also provides a 6-bit output that is a parallel-coded version of the original 6-bit serial code. This 6-bit code can optionally be

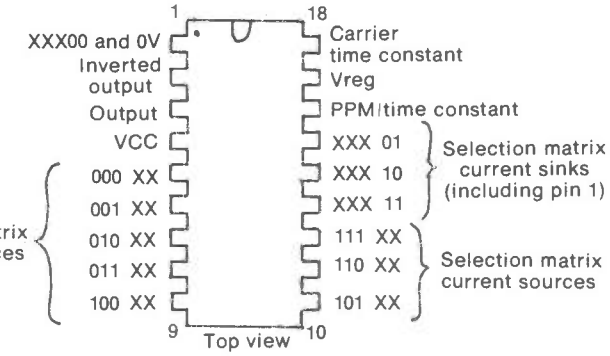

Fig 7 *Outline and pin notations of the SL490 transmitter IC*

independently decoded via additional ICs, if required, to give more remote control functions.

Practical systems

Simple single-channel IR remote control systems can easily be built using discrete components such as bipolar transistors or VFETs, etc. Multi-channel systems with up to six digital channels are only slightly more complicated, and can be built with the aid of simple CMOS ICs such as the 4017B, etc. If more than six channels are required, however, it is best to use dedicated LSI (large scale integration) 'remote control' ICs for the purpose.

Several manufacturers produce dedicated ICs of this type, the best known of these being the 490/922 32 channel range of devices from Plessey, and the IR60 64 channel range of devices from Siemens.

We'll examine the former system in the remaining part of this article, and the latter system in next month's edition of *Data File*.

The Plessey 490/922 system

The basic Plessey system is designed to give up to 32 channels of non-simultaneous remote control via any of a variety of media, including ultrasound, IR beam, fibre optics, and direct cable link. In this article we'll consider IR applications only.

The basic control system consists of one 32 channel transmitter IC (the SL490), one infra-red preamplifier IC (the SL486), and one general purpose receiver/decoder IC (the ML922) that provides three analogue and three digital outputs plus a 4-bit binary output. Four additional 'receiver' ICs (the ML926 to ML929) that each provide simple 4-bit binary outputs (either latched or unlatched) are also available, enabling all thirty-two available channels to be accessed if required.

The SL490 transmitter IC

Figures 7 and *8* show the outline and block diagram of the SL490 transmitter IC, which is housed in an 18-pin DIL package. A bank of up to 32 single-pole

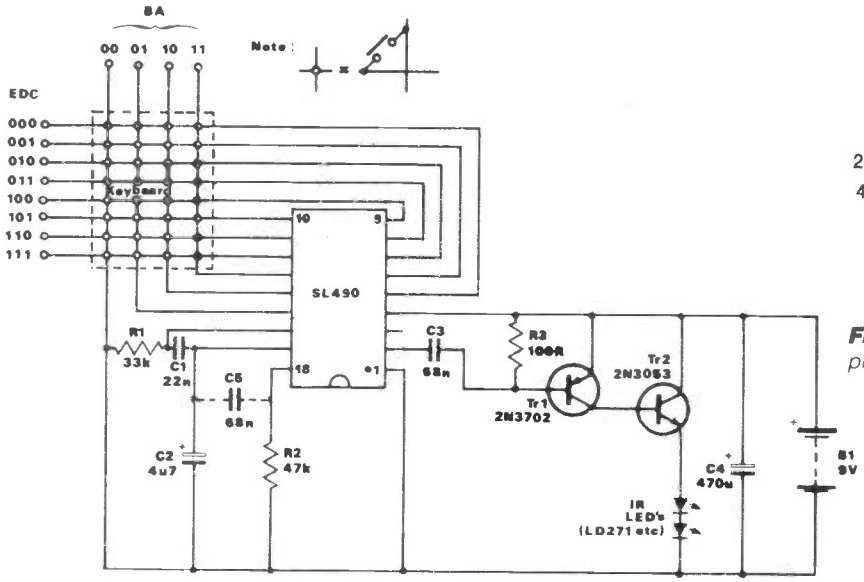

Fig 10 *Multi-channel IR transmitter using the SL490 IC*

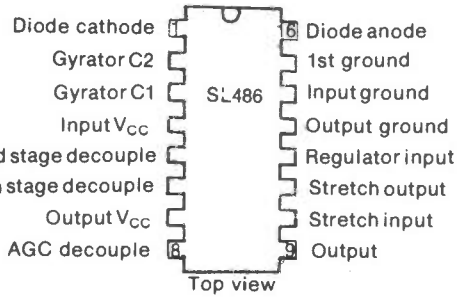

Fig 11 *Outline and pin notations of the SL486 IR preamp IC*

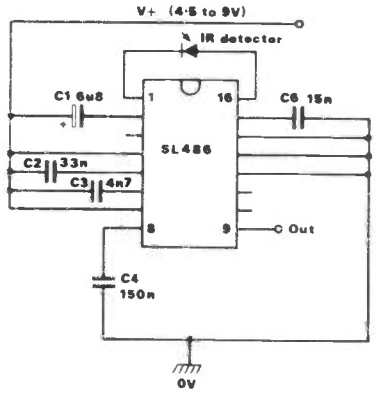

Fig 12 *SL486 application circuit for use with low voltage supplies*

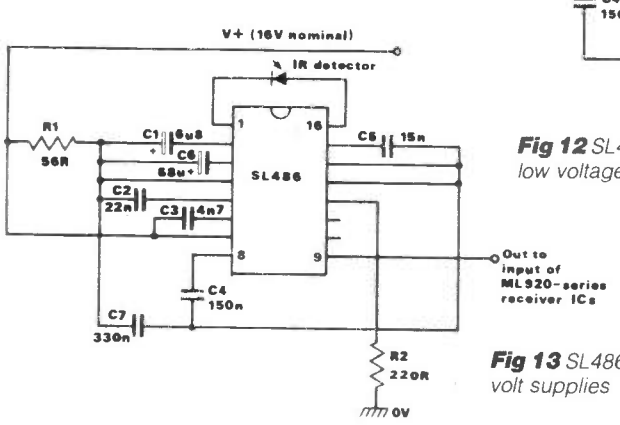

Fig 13 *SL486 application circuit for use with 16 volt supplies*

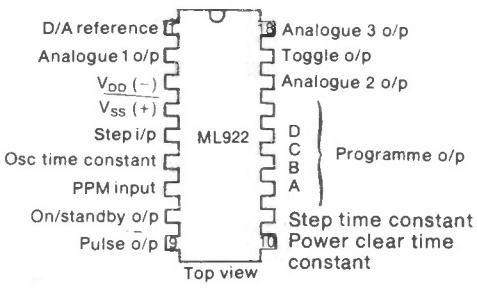

Fig 14 *Outline and pin notations of the ML922 receiver IC*

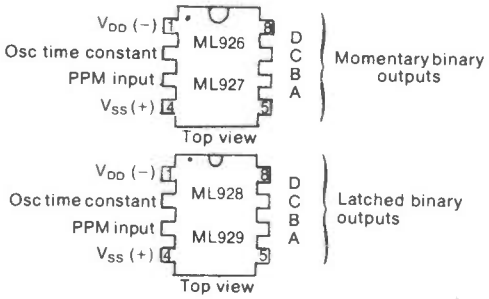

Fig 15 *Outlines and notation of the ML926 to ML929 receiver ICs*

push-button switches (arranged in the form of an 8-row by 3-column matrix) are used as a transmitter keyboard: As each push-button is operated the *encoder* and *code register* sections of the IC detect closure at a matrix crosspoint and generate a corresponding 5-bit (up to 32 different codes) parallel code word, which is repeated at regular intervals until the push-button is released.

Parallel code conversion

The *multiplexer, 3-bit counter,* and *pulse position modulator* sections of the IC (plus the *carrier oscillator* section, if required) then convert this parallel code word into a serial form which, with the addition of a suitable frame 'sync' pulse, is passed on to the output section for transmission via an external IR output stage. The pin 3 output signal takes the general form shown in *Figure 9;* an inverted version of this signal is available at pin 2.

The transmitted code waveform uses so-called 'pulse position modulation' (PPM), in which each frame consists of 6 pulses of fixed length (L), but in which the position or spacing of each pulse depends on the code signal being transmitted. Specifically, a logic 1 code has a spacing of 6L, a logic 0 code of 9L, and a *sync* code of 18L, as shown in *Figure 9.* The actual pulses may be unmodulated or modulated with a carrier signal, as desired.

The practical circuit

Figure 10 shows the practical circuit of a 32 channel IR transmitter (unwanted channels can be deleted by simply omitting the appropriate keyboard switches). Here, R1-C1 determine pulse length L (L=0.14 C1.R1 seconds) and give a period of about 1ms with the component values shown, thus giving a nominal transmission rate of about 20 frames per second. In this specific application the pulse output waveforms are not carrier modulated, but C3-R3 cause the Tr1-Tr2 complementary output pair to conduct for about 15μs at every negative leading edge of the PPM waveform, thus generating high peak currents in the two IR output LEDs. The circuit consumes a typical quiescent current of 8μA in the standby mode.

Note in the above circuit that the pulse output signals can, if required, be carrier modulated by connecting C5 as shown dotted in the diagram, in which case the carrier frequency = 1/(C5.R2). If carrier modulation is used, the *Figure 10* circuit will require an alternative design of output stage.

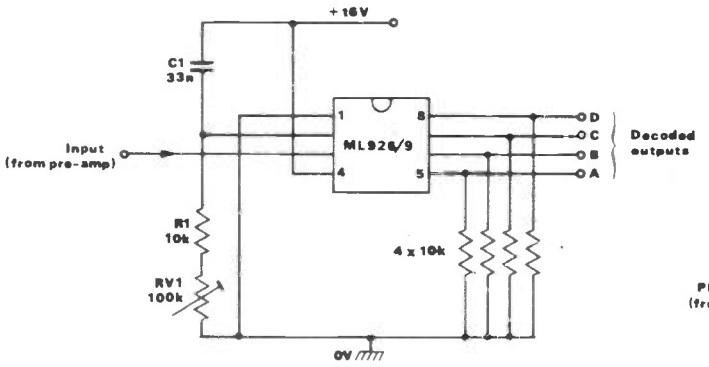

Fig 16 *Simple IR receiver circuit*

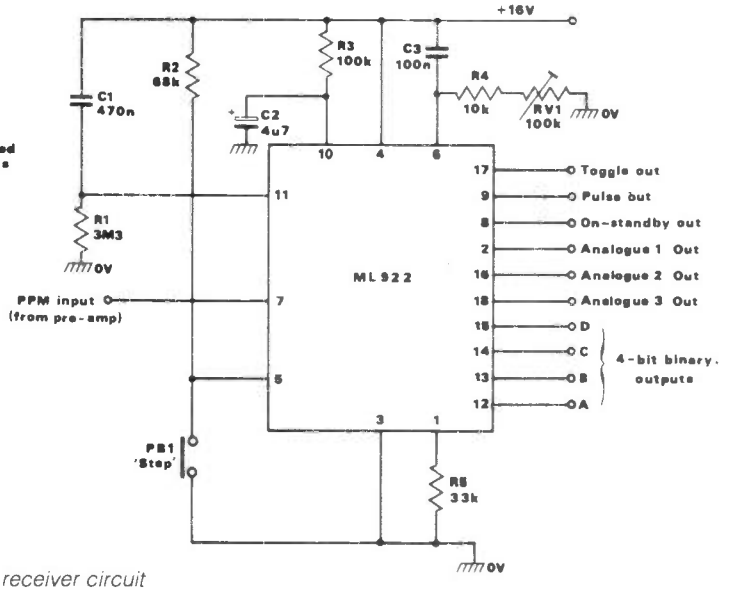

Fig 17 *Versatile IR receiver circuit*

SL486 preamp circuits

The SL486 is a four-stage high-gain IR receiver preamplifier IC featuring a fast-acting AGC circuit, a built-in voltage regulator, and a pulse-stretching output facility. *Figure 11* shows the outline and pin notations of this IC, which can be operated from supplies in the 4.5 to 18 volt range.

Figure 12 shows a 'minimum component' application circuit for the SL486. This design is suitable for use with supplies in the 4.5 to 9 volt range only, and gives an unstretched output; C2, C3 and C5 provide stage decoupling, while C4 controls the AGC time constant and C1 influences the dc 'gyrator' gain of the IC. Alternatively, *Figure 13* shows how the IC can be used with a 16 volt supply that is common with the ML920 series of receiver ICs.

Receiver IC circuits

Five different receiver ICs are available in the ML920 range of devices. Of these, the ML922 is the most versatile. It is housed in an 18 pin package (see *Figure 14*), provides three analogue and three digital outputs plus a 4-bit binary output, and can respond to 21 different codewords.

The ML926 to ML929 range of ICs are less versatile. They are housed in 8 pin packages (see *Figure 15*) and provide simple 4-bit binary outputs. The ML926 and ML927 give unlatched outputs and each responds to 15 codewords (words 00001 to 01111 in the case of the ML926, and words 10001 to 11111 in the case of the ML927). The ML928 and ML929 give latching outputs and each responds to 16 codewords (words 00000 to 01111 in the case of the ML928, and words 10000 to 11111 in the case of the ML929). All five ICs are intended to operate from 16 volt nominal supplies. Actual limits are 14V to 18V for the ML922, and 12V to 18V for the ML926 to ML929 ICs.

On-chip timing oscillator

All five ICs operate in the same basic way. They each incorporate an on-chip timing oscillator, which must be adjusted to match the PPM input signal rate. When a codeword is received, the IC logic checks it for timing and double checks for possible code errors (by comparing consecutive frames) before translating it into a particular control function.

Figure 16 shows the practical circuit of a simple IR receiver using one of the ML926 to ML929 range of ICs. Here, the PPM input signals are fed to pin 3 via a preamp circuit, and the oscillator timing is controlled via C1-R1-RV1 (and should be adjusted via RV1 so that its periodic time is 1/40th of the time of a '0' interval of the PPM signal). The decoded 4-bit binary output signals can either be used directly to give four output channels, or can be further decoded via a 4514B CMOS IC to give up to 16 output channels.

Finally, *Figure 17* shows the circuit of a versatile IC receiver with three digital and three analogue outputs, plus a 4-bit binary output. R3-R4-RV1 control the oscillator timing, C2-R3 give power-up reset action, and C1-R1 control the timing of the PB1 manual-stepping facility. The table of *Figure 18* shows how the transmitter PPM codes relate to the twenty-one functions and the 4-bit output codes of the ML922 IC in the above circuit.

Things to come

In next month's edition of *Data File* we'll look at the Siemens IR60 range of remote control ICs. REW

Fig 18 *Basic 21-command set for the ML922 receiver*

Transmitter code E D C B A	Function	4-bit binary output D C B A
0 0 0 0 X	Programme 1	0 0 0 0
0 0 0 1 X	Programme 2	0 0 0 1
0 0 1 0 X	Programme 3	0 0 1 0
0 0 1 1 X	Programme 4	0 0 1 1
0 1 0 0 X	Programme 5	0 1 0 0
0 1 0 1 X	Programme 6	0 1 0 1
0 1 1 0 X	Programme 7	0 1 1 0
0 1 1 1 X	Programme 8	0 1 1 1
1 0 0 0 X	Programme 9	1 0 0 0
1 0 0 1 X	Programme 10	1 0 0 1
1 0 1 0 0	Analogue 1 +	
1 0 1 0 1	Programme step +	Note:
1 0 1 1 0	Analogue 2 +	'X' = don't
1 0 1 1 1	Analogue 3 +	care digit
1 1 0 0 0	Standby	
1 1 0 0 1	Toggle o/p	
1 1 0 1 1	Normalise	
1 1 1 0 0	Analogue 1 –	
1 1 1 0 1	Programme step –	
1 1 1 1 0	Analogue 2 –	
1 1 1 1 1	Analogue 3 –	

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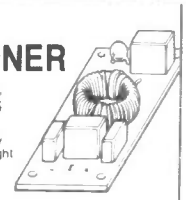
FEATURED IN ETI, SEPTEMBER 1986



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!

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TACHOMETER AND DWELL METER

FEATURED IN ETI, JANUARY 1987

MOTORISTS QUIZ

You are driving along the road one day when the sound of a horn makes you look behind. The driver of a milk float is cursing you for driving so slowly. A while later, an invalid carriage overtakes you, and just as you turn into your drive you hear a tractor driver mutter 'At last I can get out of first gear!'

Do you:

a) Fit a £500 Pie-in-ear in-car stereo with digital flexi-woofers and 24-band ramification?
b) Buy a set of fluffy dice and sticker saying 'My other car is a Macaroni'?
c) Give your car in part exchange for a milk float, invalid carriage, tractor?
d) Tune your engine.

The combined tachometer and dwell meter parts set contains: case with battery compartments, printed circuit board, all components, switches, plug, socket and test leads, battery connector, full instructions. The answer to the quiz, by the way, is e) Buy a bright red Lotus Esprit.

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MAINS CONTROLLER

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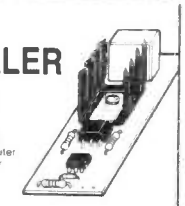

Have you ever wondered what people *do* with all those computer interfaces? Put your computer in control, say the ads. The Spectrabeeb has eight TTL outputs. What on earth can you control with a TTL output? A torch bulb?

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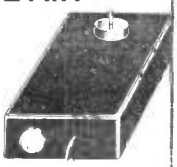
POWERFUL AIR IONISER

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!

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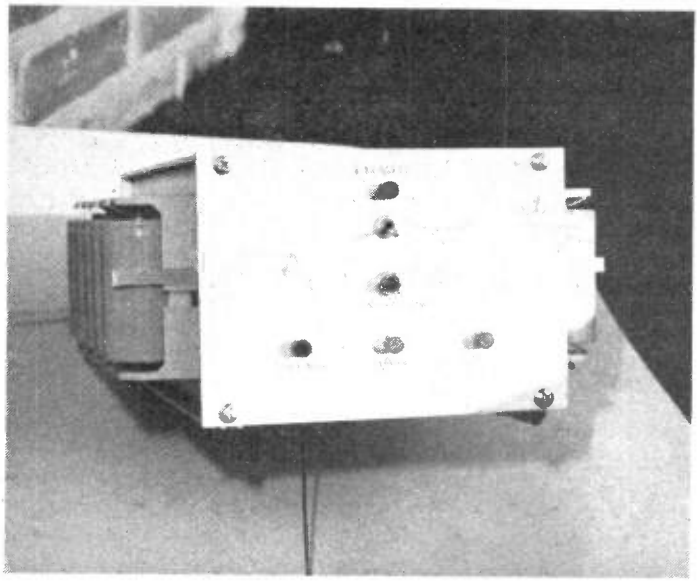
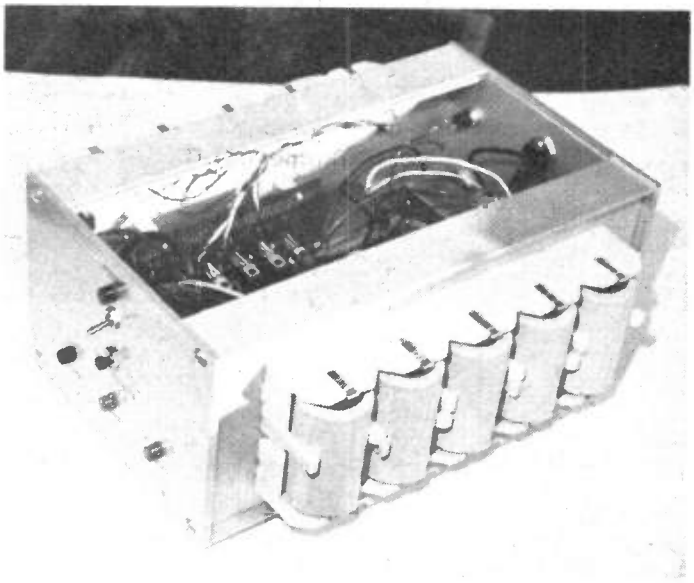




NICAD DISCHARGE/CHARGER

by R S Lambert G6GND

This charger has been developed because of the problem of having to charge 'D' cell nicad batteries used in appliances that are used intermittently over a period of time, so the level of charge remaining is unknown. From my own experience, in any combination of nicad cells, the discharge is never uniform for all batteries in the unit, leaving individual batteries at different states of charge. It seemed logical, therefore, to have a charger that would first of all bring all batteries to a given level, then charge for a pre-determined time with a constant current. Each part of the process should be indicated and if necessary charging would be carried out without a pre-discharge.

Circuit description

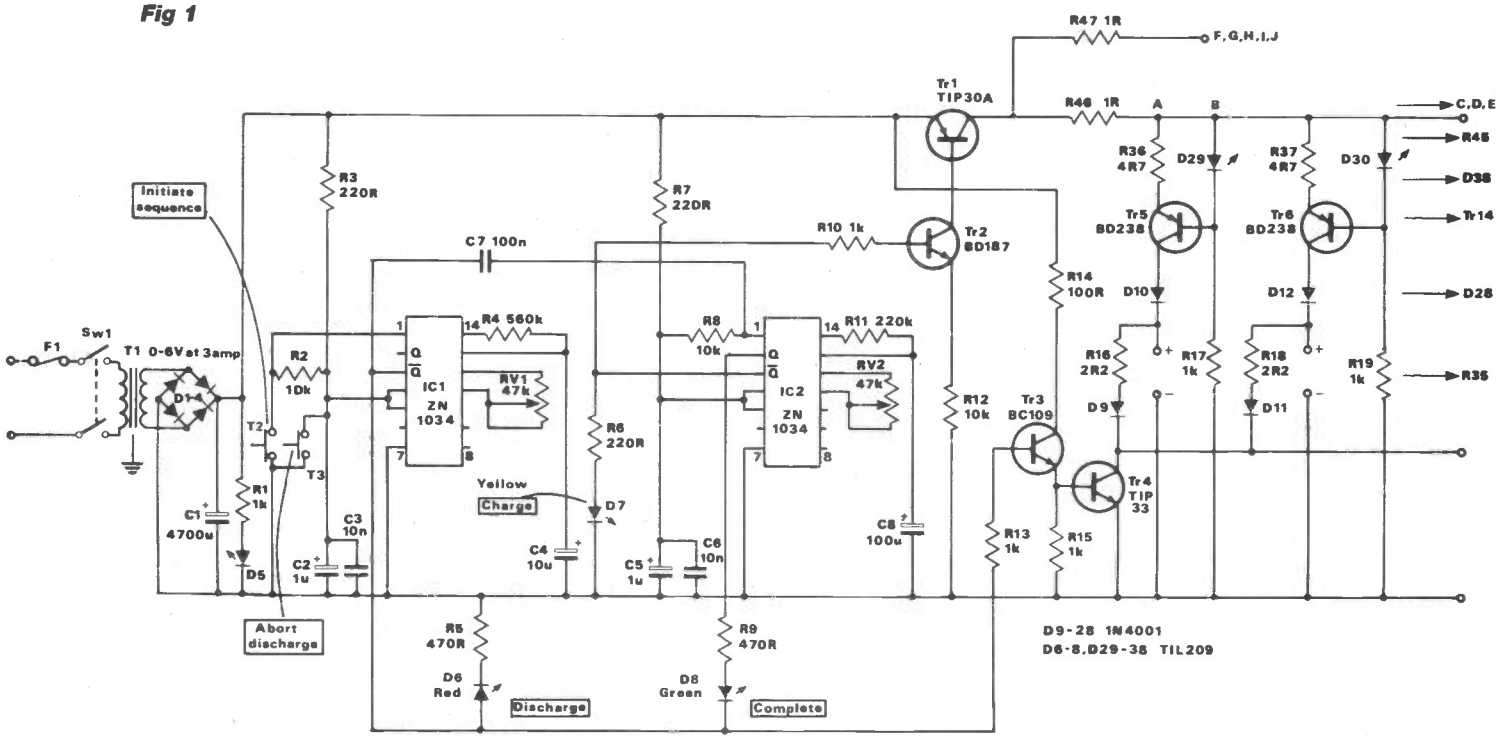
The heart of the charger is two ZN1034 timer ICs. These ICs work on the principle of an R/C oscillation, the oscillations of which are counted on an internal binary counter and after 4095 oscillations the IC switches its outputs.

The IC is identified as in *Figure 2*. The timing is given as T=KRC seconds where K is a constant determined by an external resistor across pins 11 and 12. The ZN1034 has an internal SV shunt regulator allowing it to run from any voltage supply using a suitable dropping resistor with the formulae

$$Rx = \frac{VS - 5}{IS}$$

where VS = supply voltage. IS is output current (50mA max) + 7mA. OV on pin 1 triggers the device.

Fig 1



The discharge time is determined by timer IC1. Pressing T2 starts IC1 counting and at the same time $\bar{Q}$ output goes high, lighting the discharge lamp and also turning on Tr3 which in turn turns on Tr4, thus shunting each battery through its respective discharge resistors R16, 18, 20 etc.

Diodes D9, D11, D13, etc keep the discharged voltage to about 0.6V and prevent wrong polarity damage.

When the internal counter of IC2 has completed 4095 counts output $\bar{Q}$ goes low, putting out the discharge lamp and, because of being connected to pin 1 of IC2, starting this counting.

On commencement of IC2 counting its $\bar{Q}$ output goes high, lighting the charge lamp and turning on Tr2, which in turn activates Tr1, thus feeding constant current generators A,B,C, . . . J from positive rail through limiting resistors R46 and R47. In the prototype each constant current generator provided about 180mA. D10, D12, D14 prevent reverse polarity damage.

Construction and use

The prototype was built on Veroboard with the layout as shown in *Figures 2* and *3*. Two constant current boards are required. Transistors Tr1, Tr2 and Tr4 were bolted to the case with mica washers and heatsink compound. The constant current transistors were twisted through 90° so that they all lay in one plane to enable the aluminium heatsink of *Figure 4* to be bolted to all five transistors on each board.

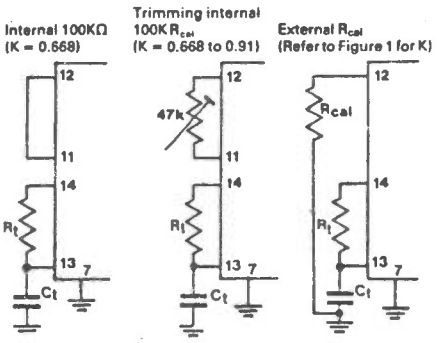


Fig 2 *Timing component connections*

On the prototype, the negative tags of each of the battery holders were linked with thick copper wire and each holder was drilled so that the positive wires could go straight through into the case, without being visible or in the way on the outside.

Of course, layout is not critical and will depend on which case and battery holders are used. The case top should be well ventilated!

The battery holders in the prototype were obtained from *Henry's Radio* of Edgware Road in London and the case from *Marshal Bradley* also of Edgware Road.

When testing the unit for the first time,

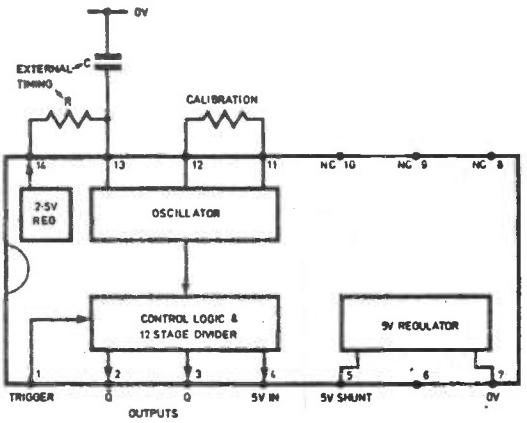
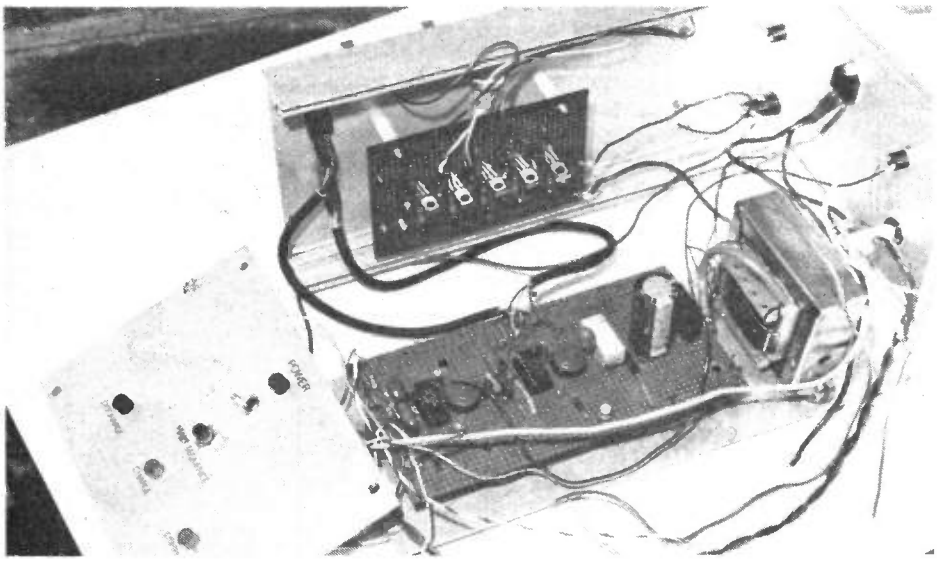


Fig 3 *Block diagram of ZN1034*

shunt the timing resistors with 5.6kΩ resistors, as 30 hours is a long time to wait!

When determining the full charge time an oscilloscope across the timing resistors will show impulses which can be timed and multiplied by 4095 to give total time. If no oscilloscope is available it is possible to see the impulse voltage charges with a digital voltmeter instead. Timing on the prototype was approximately 6 hours discharge and 24 hours charge.

Do make sure that all copper strip



Battery type		Size	Capacity (mAh)	Charge current (mA)	R36 to 45
micro	RO3	AAA	180	18	47Ω
penlight (mignon)	R6	AA	500	50	15
baby	R14	C	1200	120	6.8
			1800	180	4.7
mono	R20	D	4000	400	2.2

COMPONENTS

Resistors
(¼ watt unless otherwise stated)

R1,10,13,15,17,19,21,23,25,27,29,31,33,35	1kΩ
R2,R8	10kΩ
R3,6,7	220Ω
R4	560kΩ
R5,9	470Ω
R11	220kΩ
R12	10Ω 1W
R14	100Ω 1W
R16,18,20,22,24,26,28,30,32,34	2.2Ω .5W metal film
R36-45	*See text* 2.5W silicon
R46,47	1Ω 2.5W

Presets

VR1 and VR2	47kΩ

Capacitors

C1	4,700μF PCB mounting
C2,C5	1μF tantalum
C3,C6,C7	0.1 polyester
C4	10μF tantalum
C8	100μF tantalum

Semiconductors

IC1, IC2	ZN 1034
Tr1	TIP 30A
Tr2	BD 137
Tr3	BC 109
Tr4	TIP 33
Tr5-14	BD 238
D1-D4	4A bridge rectifier
D5,D6,D29-38	Red T/L 209
D7	Yellow T/L 209
D8	Green T/L 209
D9-28	IN 4001

Miscellaneous
T1 0-6V 3A transformer
SW1 double pole single throw miniature toggle
T1,T2 push-to-make switch
F1 fuse holder 500mA fuse

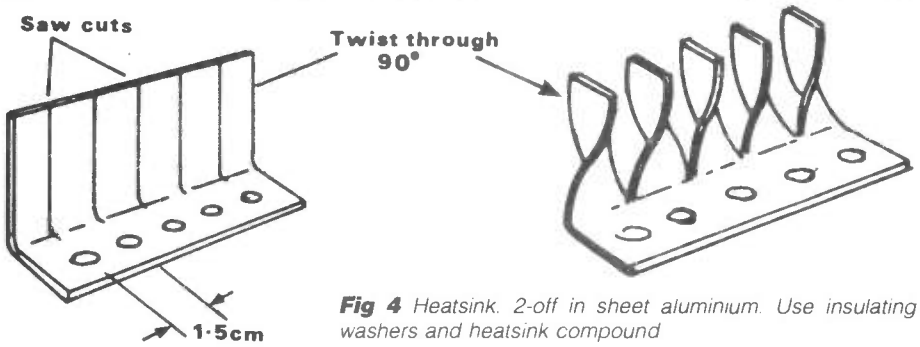


Fig 4 *Heatsink. 2-off in sheet aluminium. Use insulating washers and heatsink compound*

breaks are clean and swarf is not shorting adjoining tracks. This applies to soldering as well.

Of course, the battery holders can be for any type of battery and the constant current generators altered to suit various current requirements, R36 to 45 being chosen to suit requirements. Make sure that *total* current consumption does not go higher than can be handled by Tr1 and T1. Also, choose the discharge resistors to suit the batteries being discharged (see table). REW

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Polystyrene capacitors 63V working E12 series long axial wires
10 pf to 820 pf – 3p. 1000 pf to 10,000 pf – 4p. 12,000 pf 5p
741 Op Amp – 20p. 555 Timer 22p
cmos 4001 – 20p. 4011 – 22p. 4017 ..... 40p

ALUMINIUM ELECTROLYTICS (Mfds/Volts)
1/50, 2.2/50, 4.7/50, 10/25, 10/50 ..... 5p
22/16, 22/25, 22/50, 47/16, 47/25, 47/50 ..... 6p
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

Submin, tantalum bead electrolytics (Mfds/Volts)
0.1/35, 0.22/35, 0.47/35, 1.0/35, 3.3/16, 4.7/16 ..... 14p
2.2/35, 4.7/25, 4.7/35, 6.8/16 15p; 10/16, 22/6 ..... 20p
33/10, 47/6, 22/16 30p; 47/10 35p; 47/16 60p; 47/35 ..... 80p

DIODES (piv/amps)
75/25mA 1N4148 2p. 800/1A 1N4006 6p. 400/3A 1N5404 14p. 115/15mA OA91 ..... 6p
100/1A 1N4002 4p. 1000/1A 1N4007 7p. 60/1.5A S1M1 5p. 100/1A bridge 25p
400/1A 1N4004 5p. 1250/1A BY127 10p. 30/45mA OA90 6p. 30/15A OA47 ..... 8p
Zener diodes E24 series 3V3 to 33V 400 mW – 8p. 1 watt 12p
Battery snaps for PP3 – 6p for PP9 ..... 12p
L.E.D's 3mm. & 5m.m. Red, Green, Yellow-10p. Grommets 3mm – 1½p, 5mm 2p
Red. flashing L.E.D.'s require 5V supply only 30p
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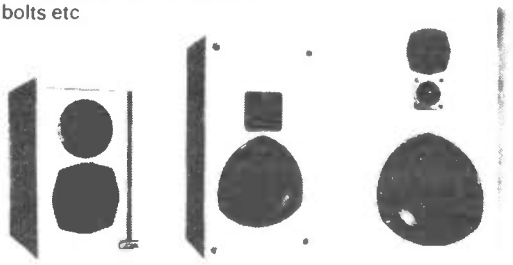

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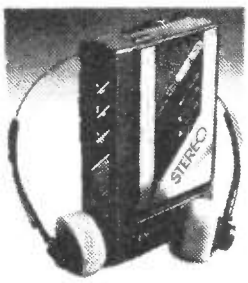

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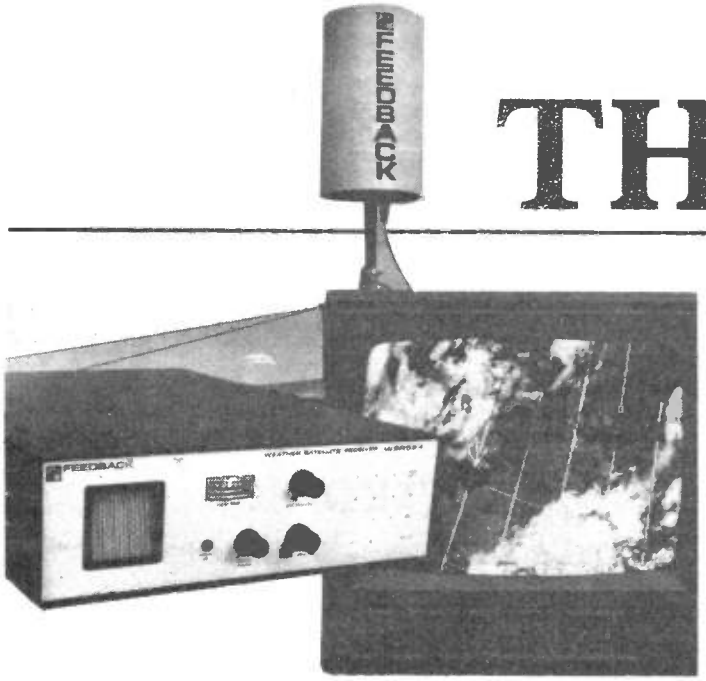


THE WSR524

This weather satellite receiver from Feedback Instruments Ltd is just the thing for the amateur meteorologist

A user review by Ken Michaelson G3RDG

In recent years there has been a rising interest in weather forecasting. The technical progress which has been made in the design of suitable pieces of equipment has reduced the capital outlay necessary and has brought it within the reach of a larger section of the general public than previously.

This is the third satellite decoding unit that I have reviewed, in addition to a FAX weather map decoder for the HF bands. The equipment under review, however, seemed to me to be a different kettle of fish. For a start, the antenna was in a form I had never seen before. It was a fibre glass cylinder measuring 300mm (12in) in diameter and 600mm (2ft) in length. In addition to containing the antenna, which was a quadrafilar helix for the frequencies involved (137.500MHz and 137.620MHz), the cylinder also had the first part of the receiver built into it. The frequencies were converted internally to approximately 10MHz and this was sent down the coaxial cable to the main unit. Power for the antenna electronics passed along the same cable in the opposite direction.

Conversion to 10MHz

The reason for converting the incoming signal to 10MHz was that the lead-in could be much longer (it had been tested with a cable length of 1 kilometre), and it enabled a great reduction in the noise level of the received signal.

The main unit measured 305mm (12in) wide by 95mm (3.75in) high by 395mm (15.5in) deep. It was finished in dark chocolate brown crackle enamel. There were two collapsible legs, 50mm (2in) long, on the underside front to raise the module to eye level. On the left-hand side of the front panel was a 50mm (2in) square opening for the monitor speaker. To the right of this, on the upper level, was the signal level meter, having a horizontal scale calibrated from 0 to 10. To the right of this again was a rotary control labelled 'grid intensity'. On the lower level to the right of the speaker grille was a green LED indicating power on, and to the right again were two more rotary controls, the left being the monitor volume and the right one the 'visible' and 'infra-red' controller. The greater part of the right-hand side of the front panel was taken up by the keypad. This had keys from 0 to 9, minus, decimal point, new data, *, delete and enter.

The rear panel

The rear panel had a number of sockets assembled on it. The top left-hand one was a normal Belling-Lee TV socket, which would go to the television set antenna socket. To the right was a BNC socket, used to input the signal into my monitor. On the far right top level was the antenna socket (also a BNC one), the fuse and the 'on/off' switch, a rocker type which was illuminated in red when the unit was switched on. Below this was the IEC mains input socket, the rotary voltage adjuster, and the 12 volt dc input socket.

Along the bottom were three IDC sockets, labelled port A, port B and port C, provided for the expansion of the system, although the necessary PROMs and firmware were not supplied for this review. Ports A and B were identical and were connected in parallel. They gave access to the internal power supplies and outputs for a digital video recorder, which is currently under development. Port C is intended to output to a computer by changing one of the PROMs in the unit.

As I mentioned above, the antenna was contained in a fibre glass cylinder, together with the front portion of the receiver. A frequency of approximately 10MHz was sent to the main unit where it was again converted to a lower frequency, this conversion selecting the correct channel. Detection was by means of a phase locked loop. The signal was digitised to 64 levels, and the picture information extracted and converted to 16 level data. This conversion used different functions for infra-red and visible picture data.

The data was then passed to the microprocessor, which effected the different contrast settings. The microprocessor was a 63C09 high-speed 8 bit CMOS processor and was used to carry out all the calculations and control the picture memory. The program, written in PL9 and assembly language, performed all the mathematics and controls in real time. The actual mathematics employed used spherical geometry to calculate the position of both satellites continuously and also produced the grid information during reception.

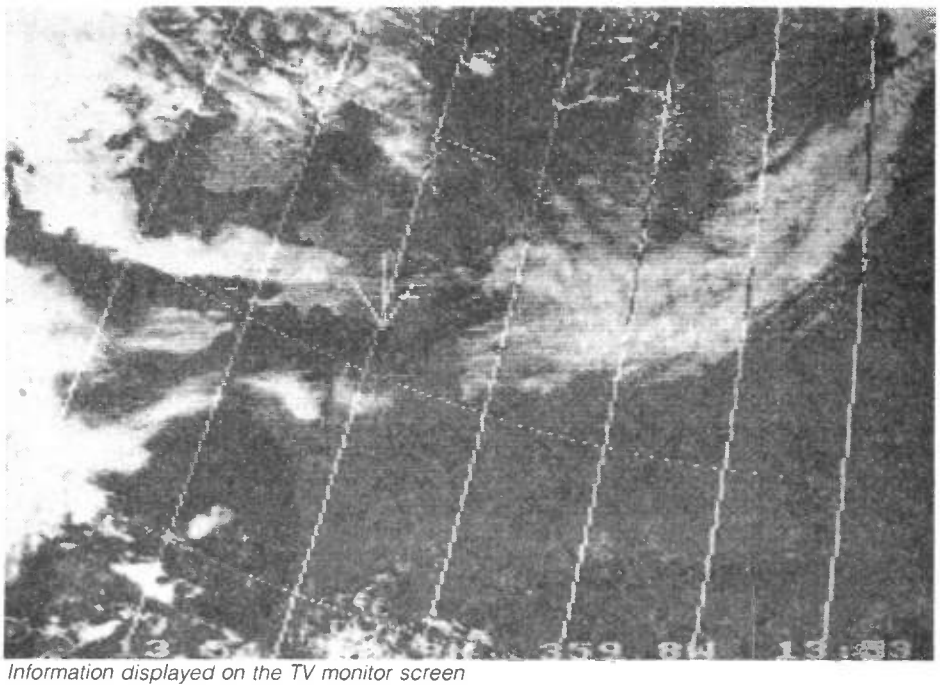
No source listing

The manufacturer states that *no* source listing of the program will be made available to customers, for obvious reasons. The display system used a raster-scanned dynamic memory, which consists of two 256 by 256 by 4 bit planes for the pictures and one 256 by 256 by 1 bit plane for the grid and text. All three planes were read simultaneously and the data from them combined in the digital to analogue converter. The video output, which I mentioned as being available from ports A and B, is a 1 volt peak-to-peak signal with negative composite sync. The WSR524 supplied for this review used non-interlaced line standard, to make the picture flicker-free. This meant that it was not possible to use a video recorder. The manufacturer states that an extra unit will be available soon to convert the output to standard signals for 625 lines and 50 fields, and will

plug into either port A or B on the rear panel.

The WSR524 is a self-contained unit and is completely automatic in action. I found the setting up straightforward, the directions given in the manual being clear and well set out. A substantial aluminium tripod with a hollow tube at its centre was supplied with the unit. The bottom end of the antenna cylinder had a mating tube fixed to it, and all that was necessary was for me to insert this tube into the tripod's hollow vertical one and bingo (!): the antenna was erected. This made the bottom of the antenna cylinder about 1800mm (6ft) from the ground.

There was also a waterproof female BNC socket on the bottom end for the signal take-off. Fifty metres of co-ax were supplied, one end having the mating male waterproof BNC plug and the other end, with a normal BNC plug, attached to the antenna socket on the rear panel of the main module. I ran this cable through a rear window of the house and along a corridor to the shack, and there seemed to be no loss or extra noise with the full length in use.



Information displayed on the TV monitor screen

The monitor

The television set used was a Hitachi model CPT 2046 all mode unit. This can function as a monitor as it has a choice of RGB input or composite input. I tried out the WSR524 using both the normal UHF TV output and the video output on the unit; the video monitor giving a superior performance, of course.

Having connected the antenna to the WSR524 and the WSR624 to the monitor, the next step was to enter the data for the two satellites concerned. The unit is arranged to receive signals from NOAA-9 and NOAA-10 (NOAA standing for National Oceanic and Atmospheric Administration, which is part of the US Department of Commerce), on frequencies of 137.500MHz and 137.620MHz. However, there was no means of tuning the signals, all this information being given to the unit by means of the keypad.

Starting up

When the unit was first activated by the switch on the rear panel, the start-up message was displayed on the screen. This read: 'Feedback Instruments Limited England. Copyright 1986. Press any key to continue'. I then entered the relevant details for the two satellites concerned. Pressing any key caused the words 'DATA FOR SATELLITE ONE. NODAL PERIOD IN MINUTES >' to appear on the display. There are five pieces of information for each satellite which have to be entered into the module: nodal period, orbital inclination, equator crossing time (hours and minutes), equator crossing longitude and orbital decay constant.

A sheet was supplied by the manufacturer giving these figures for both the satellites as at 28th November. The figures were valid for a period of one month from that date. Feedback Instruments Ltd will supply a monthly list of updated figures if desired; otherwise there is a recorded telephone announcement service provided by the National Remote Sensing Centre in the UK. It operates outside office hours (1715-0845 UTC in winter and +1 hour for BST). It is also available all day on Saturdays and Sundays on (025) 683 448.

Follow the prompts

I entered the figures in sequence, following the prompts. Having completed the entry of all the information required, including the number of whole days which had elapsed since the figures had been calculated and the latitude and longitude of my QTH, the entry of the 'primary data' was concluded.

There were two more options available in the WSR524, the first one being 'picture contrast' and the second 'data change security'. There were four variations of picture contrast, from warm and bright to cold and dark, to maximise the dynamic range of the grey levels, and following the suggestion in the manual I used setting 3, which was described as 'temperate conditions as found in mid-latitude in mid-winter'.

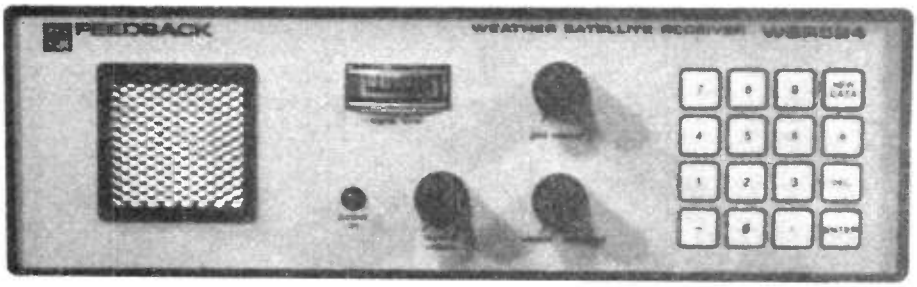
The purpose of the data change security option was to prevent unauthorised people from changing the orbit parameters by design or accident. I did not use this option, but if I had I would have been required to enter any four keys that I wished to be used as a security code. The WSR524 would not respond to any key presses unless I first entered the sequence of figures that I had decided upon. I then followed the commands on the screen, which caused the unit to go into the operating mode with a display on the screen reading 'WAITING FOR SATELLITE F/B 14:11 50.5N 0.2W'.

However, the unit did not function! I was rather puzzled, as it seemed to me that there was no way in which I could make a mistake. All the instructions in the manual were, I thought, fool-proof. A telephone call to Feedback Ltd solved the problem. It appeared that I had been wrong to assume that NOAA-9, which appeared at the top of the list of Keplerian elements given to me with the unit, was satellite No 1 and NOAA-10 satellite No 2. In fact, it was the other way around. This meant that I had to re-enter all the details in the reverse order. I then waited for the next orbit, with the words 'WAITING FOR SATELLITE' still on the screen. Satellites 1 and 2 are decided upon by the frequencies used. No 1 is 137.500MHz and No 2 137.620MHz.

As I stated previously, the equipment was entirely automatic in action. It was quite amazing just to sit there and watch. I left the unit on all night without the monitor switched on, and the next morning turned it on to find that a weather picture had been retained in the memory timed at 0734.

An interesting facility

I have not remarked on another very interesting facility. By the insertion of the latitude and longitude of my QTH, the unit displayed an arrow pointing in the London direction, where I live. The position of the arrow (up or down) showed the direction of the orbit. I thought this was an excellent convenience. Even if one couldn't see England, as it was covered in cloud most of the time, one knew what one was looking at.



Latitude and longitude grid lines were also superimposed on the picture. These could be increased or decreased in definition by the operation of the grid intensity control mentioned previously.

The signal level meter registered about 2 in the standby condition, but as soon as a transmission was detected the reading increased to between 7 and 8. It was not necessary to have the monitor volume control advanced at all because the WSR524 reacted to a signal immediately. When reception took place, the new data deleted the picture already stored in the memory so it was not necessary to set anything back to zero. Since the unit stored both the infra-red and visible pictures separately, it was possible to fade between them, or have a percentage of both on the screen at the same time by operating the visible/infra-red control.

I have only one complaint to make about this unit. I disliked intensely the plastic keys with their tactile response. I found that it was necessary for me to press each key carefully with my finger nail in order to make sure that it was operated. I believe that the action of keying should result in a positive click.

Other than that, I have not remarked on the fact that at the moment it is impossible to make a record of a pass. As I have said previously, the manufacturer is developing an additional module so that video recordings can be made. When this is available, nothing else will be needed to make the WSR524 a completely automatic weather receiver.

I am not able to comment on the use of a computer or a printer with the unit as I have no information about this, but I can only thoroughly endorse the unit as supplied. The owner's manual commences with a general discussion on weather satellites with a drawing of the details of the TIROS-N satellite, includes some interesting weather and satellite pictures, and descriptions of fronts and depressions and high pressure systems. It concludes by giving suggestions for the user to make his/her own forecast.

The operation of this equipment was really fantastic and, as I mentioned earlier, entirely automatic in action. The superimposition of the latitude and longitude grid lines together with the arrow showing the location of the station made weather forecasting a real possibility instead of guesswork. For any amateur meteorologist who wishes to obtain greater information about the weather over an area of up to 2500km radius, this is the unit. At its price of £599.00 excluding VAT and monitor it must make a hit with anyone interested in the science.

Thanks are due to Feedback Instruments Ltd, of Park Road, Crowborough, East Sussex TN6 2QR (telephone (08926) 3322), for the loan of the equipment for the purpose of this review. REW

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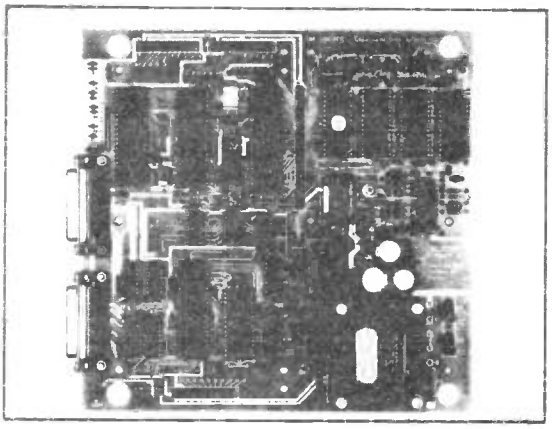

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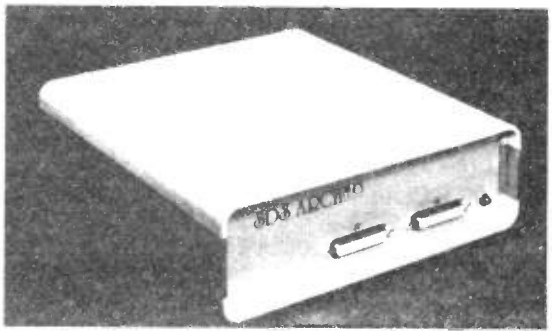

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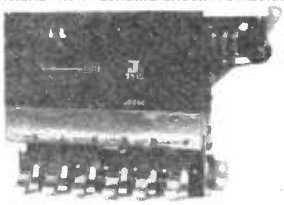

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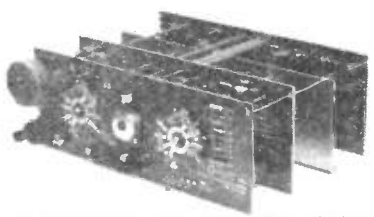

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Transistor transistor logic (TTL)

It seems an obvious step to replace all the input diodes of *Figure 25* by a single transistor of n inputs, since each diode is only a p-n junction. This gives the circuit of *Figure 26*. Today TTL arrays are one of the most popular logic arrays.

The limitation to any gate array is fan out, heat dissipation and propagation delay. Chip sizes are typically 0.05 × 0.05 inches and 0.01 inch thick. Small scale integration (SSI) employs up to 12 gates, medium scale (MSI) up to 100 gates and large scale (LSI) above 100 gates. However, chips of 10,000 gates and over are being manufactured which throws a new meaning on the above definitions.

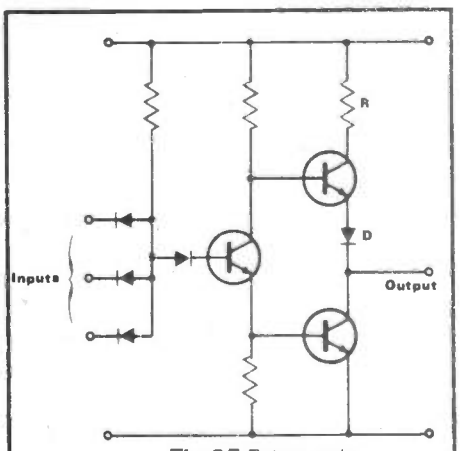


Fig 25 *Totem pole*

Newer machines use Shottky-diode clamped TTL which turns off the gates more quickly by preventing transistor saturation. Emitter coupled logic (ECL) is faster than that employing Shottky diodes and has the additional advantages of low noise output and low impedance, although the power consumption is higher. ECL is also prone to noise pick-up.

Metal oxide semiconductors (MOS)

Modern photolithography processes enable masks of high resolution for etching gates onto a chip. The bipolar transistor uses a bigger unit area compared to a field effect transistor (FET), but the switching is faster. However, servocontrol which works in real time does not require high speed devices. MOSFET dissipates less heat so it is possible to fit more gates on a single chip.

FETs were known in 1930, but the discovery of the point contact device by Bardeen and Brattain in 1935 meant that interest in the FET ceased until 1960, when the techniques of etching and growing oxide layers on the silicon substrate improved.

Figure 27 shows the structure and symbol of a MOS device. The substrate is about 3×10^{-3} mm thick. The source and drain are heavily doped p type regions and formed by diffusing an impurity that forms an excess of holes. The source and drain are separated by a thin metal gate which is coated with silicon dioxide.

Control of the device is achieved by changing the bias on the gate. If there is no bias then the device cuts off, giving zero heat dissipation.

Flip-flops

Just as useful as the Hong Kong made rubber sandal is the semiconductor variety. This is a pair of transistors arranged such that when one pushes, the other pulls or when one flips, the other flops. There are three kinds of multivibrators. The astable or free running, the bistable (flip-flop) which has two stable states and the monostable which requires a trigger pulse in order to switch it on.

Multivibrators are used in digital computers for logic operations and in shift registers for addition, multiplication or simply storing digits temporarily. The monostable (or one shot) is a useful device for delaying a pulse.

A general arrangement for a multivibrator is shown in *Figure 28*, and it can be seen that the output of one transistor feeds into the input of the other. Whether the circuit will oscillate or not depends on the nature of the feedback network. The astable uses capacitors and oscillates, the bistable uses resistors, and the monostable uses a capacitor in one feedback path and a resistor in the other feedback path.

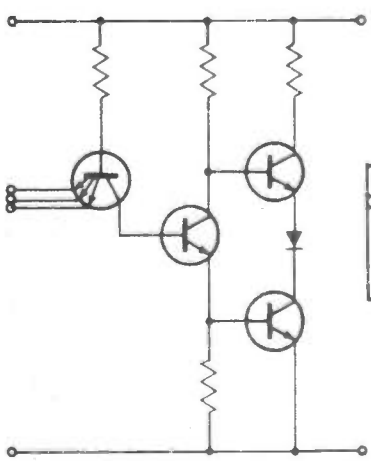
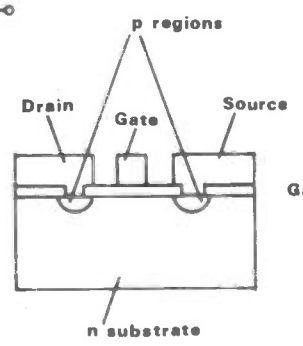


Fig 26 *TTL circuit*



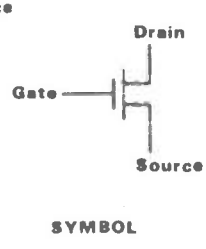


Fig 27 *FET*

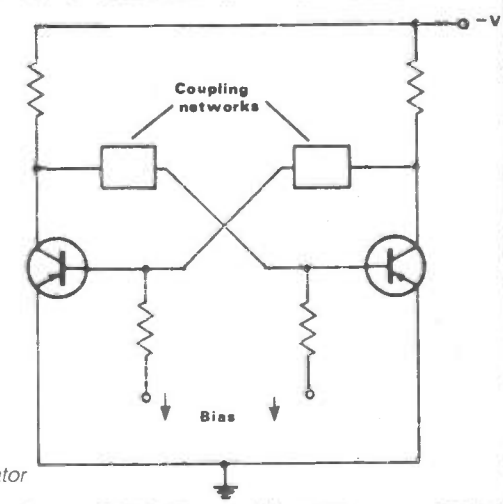


Fig 28 *(right) Multivibrator*

The circuit for a bistable is shown in *Figure 29* and the capacitors are there merely to speed the switching action by putting a spike on the pulse. Since the transistors are not absolutely identical, the current drawn by one will be slightly greater than that drawn by the other.

Let us assume that transistor T1 draws current I1 which increases for a brief instant causing the voltage drop across R1 to increase, hence decreasing the voltage on the collector of T1. This decrease is coupled via R4 to the base of T2, reducing the base-emitter voltage of T2 and its collector current. This reduced current causes a smaller voltage drop across R2 and a larger voltage on the collector of T2. This higher voltage is fed via R3 to the base of T1, driving it into saturation. The above actions continue until T1 is hard ON and T2 is cut OFF. This is one stable state; the other stable state is T2 ON, T1 OFF and this is achieved either by applying a positive pulse to the base of T1 or a negative pulse to the base of T2. This is called 'setting' the multivibrator, and applying further triggers of the same polarities as above will not have any effect. However, changing one or other of the triggers will 'reset' the circuit to its other stable state.

SR flip-flop

The device discussed above is the SR (set-reset) flip-flop and is an example of sequential logic, ie future conditions depend on present states. For instance triggering the transistor which is already set to 1 has no effect. An SR flip-flop using two NOR gates is shown in *Figure 30* and the state table in *Table 12*.

Table 12 *State table for SR*

tn		tn+1	
S	R	Qn+1	$\bar{Q}$n+1
0	0	Qn	$\bar{Q}$n
0	1	0	1
1	0	1	0
1	1	Indeterminate	

tn = time at moment n
tn+1 = time later than tn

From the table, the previous state is Qn and $\bar{Q}$n. Applying a logic 1 to R resets Qn to 0. If it was 0 already then applying a logic 1 to R has no effect. Similarly, applying a 1 to S sets Qn to 1 and $\bar{Q}$n to 0. The big drawback of this circuit is the indeterminate state. Applying 1 to both R and S gets the circuit chasing its own tail.

Clocked SR or T flip-flop

The circuit of *Figure 30* can be expanded so that the gates open only in the presence of a clock pulse, as in *Figure 31*. This does not overcome the indeterminate state but it does change a sequential (asynchronous) circuit to a synchronous circuit since a number of these devices can be clocked simultaneously.

Table 13 *State table for D type FF*

tn	tn+1	
D	Qn+1	$\bar{Q}$n+1
0	0	1
0	0	1
1	1	0
1	1	0

Table 14 *State table for JK FF*

tn		tn+1	
J	K	Qn+1	$\bar{Q}$n+1
0	0	Qn	$\bar{Q}$n
0	1	0	1
1	0	1	0
1	1	$\bar{Q}$n	Qn

D-type flip-flop or latch

Figure 32 shows a D type flip-flop or latch, so called because any input at D which is held for the duration of the clock pulse will be stored at Q, as shown in *Table 13*. The value of Q changes only when the logic at D changes and the indeterminate condition R=S=1 cannot arise since the inverter ensures that R is of the opposite logic to S.

JK flip-flop

The JK is one of the most important and

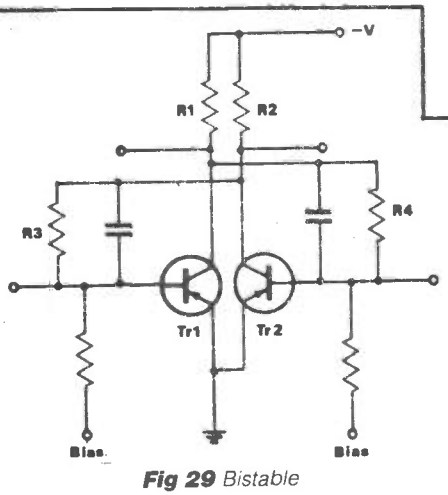


Fig 29 *Bistable*

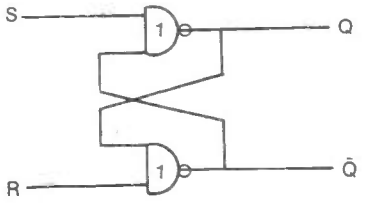


Fig 30 *SR flip-flop*

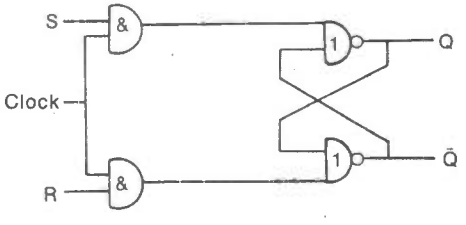


Fig 31 *T flip-flop*

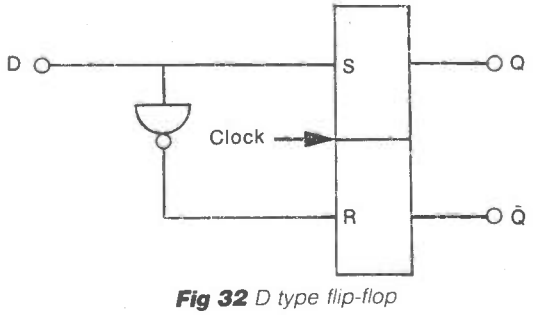


Fig 32 *D type flip-flop*

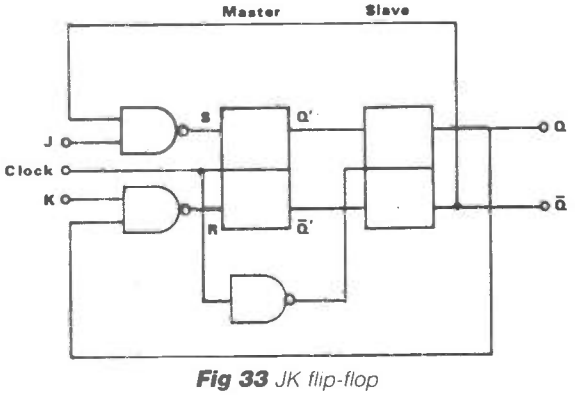


Fig 33 *JK flip-flop*

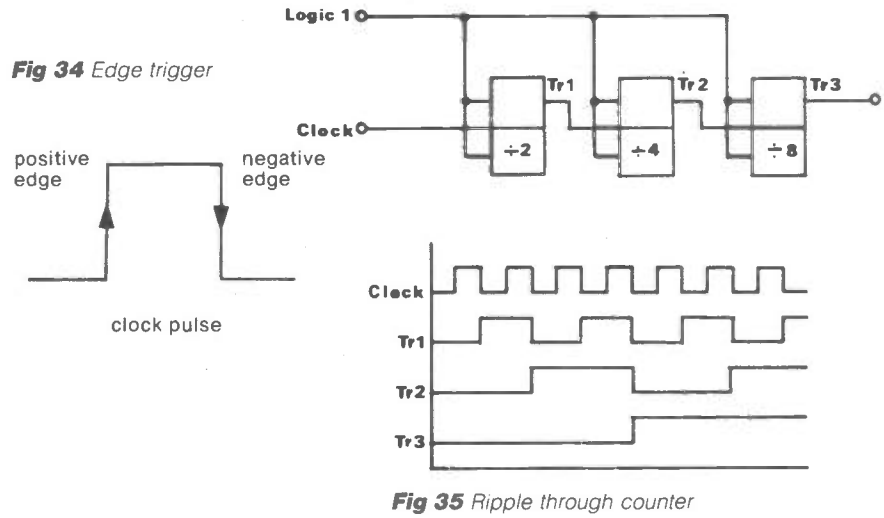


Fig 34 *Edge trigger*

Fig 35 *Ripple through counter*

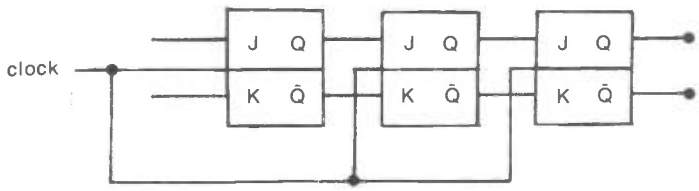


Fig 37 *Shift registers using JK*

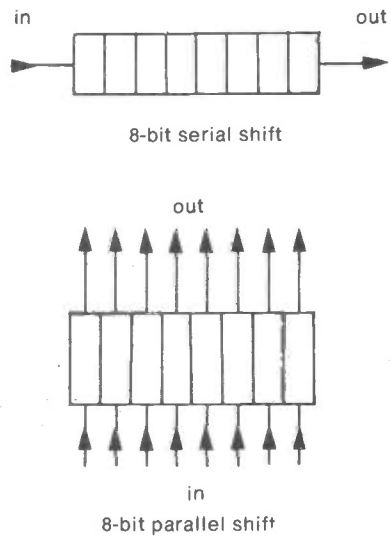


Fig 36 *Serial and parallel registers*

useful of the flip-flops since the indeterminate state of the SR flip-flop is overcome. J=K=1 now produces the opposite effect of J=K=0. *Figure 33* shows the circuit and *Table 14* the action of this circuit. There are two lots of feedback and the action is complicated. There are two types of JK flip-flop, the master-slave and the edge triggered. The edge triggered could be positive or negative edge triggered, ie triggered on the rising or falling edge of a clock pulse *(Figure 34)*.

Ripple through counter

If JK flip-flops are connected as in *Figure 35*, such that the output of one stage acts as the clock input of the next, then the output of one stage is half the frequency of the previous stage as seen from the waveforms. Such a counter is called a ripple through binary counter since the output of one stage depends on the output of the previous stage and the clock effectively ripples through the stages.

Shift registers

Registers are useful for storing values temporarily, like the partial product in a multiplication. Register 'boxes' could be accessed in series or in parallel, as shown in *Figure 36*, depending on how they are hardwired. If they are connected in series, then the only way of entering binary digits is to shift the first digit into succeeding 'boxes', followed by the other digits.

Figure 37 shows JK flip-flops connected in a shift register which can be used for multiplication or division by 2 just by shifting left or right respectively by one bit position. Multiplying by any other combination of bits is simple since we are multiplying by either 1 or 0. If multiplying by 0, that partial product is ignored and the next partial product is shifted by two bit positions. This is where a shift register comes in handy. REW

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A MINIATURE MULTI-BAND AERIAL

By Dr Van Parc-Vizz N.S.F.D. (Hon), PhD Baghdad (F)*
*High Walls, Princetown, Devon HMP PT1

Biography of the author

Van Parc-Vizz was born in East Germany in 1940 and escaped to West Germany with his parents in 1948, where his father took up employment with the West German government. In 1969 he obtained an honorary degree from Leipzig University and completed his formal education in Iraq, where he met his Polish wife, Zenn. He took up employment as a lecturer at Warszawa University, where he continued his research into ionospheric propagation. It was during this period that Van became interested in amateur radio. In 1974 he obtained the call SP1OOF.

The aftermath of the Polish uprising caught up with Van in 1976, and he was forced to take refuge in the United Kingdom. He eventually made his home in the south-west of England in self-employment. His hobbies besides amateur radio include floral decoration and embroidery. Van has only recently applied to the Department of Trade and Industry to exchange his Polish amateur licence for a United Kingdom licence.

Introduction

Amateurs have been experimenting with antenna systems for 60 years or more. In the past few years the rate of progress with new designs has slowed down noticeably, which is only to be expected. As evidence of this, some of the best antennas in use today were designed some 20 to 30 years ago. The amateur, as part of his interest in the hobby, is impelled to continue the search for an improved design. At times of slow progress it is not a bad idea to look at the design of antennas from a new angle. A possible first step in this direction is to erase from one's mind the picture of 'things as they are' and concentrate, for a few moments at least, on the way one would like things to be.

Local restrictions

Planning regulations or restrictive covenants may prohibit the erection of the desired antenna system, and high-rise dwellers have particularly difficult problems. In interpreting regulations there tend to be large areas of uncertainty which are best resolved by common sense and goodwill, but it helps if the antenna is designed to attract as little notice as possible, a large and ugly one creating suspicion.

There are only a few of us who are so isolated from our neighbours that we need give no thought to an antenna's appearance, which is often of greater importance than its electrical qualities. For this reason visual impact has been featured among the basic characteristics of the desired antenna system.

Most amateurs are subject to restrictions in the erection of antenna systems. Those able to erect beams at a height of 15 metres can count themselves lucky, and any sense of frustration they may feel at not being able to double this height will be shared by the vast majority of us. One has therefore the problem of selecting the antenna design which proves to be the best match to any given set of circumstances.

The most urgent need, which will be shown to be one of the easiest to meet, is a substantial reduction in the size, weight and cost of the antenna without compromising performance. There is also an urgent and increasing need to reduce local interfering signal levels and this factor has been incorporated into my design.

New design

My interest in a new design for a multi-band antenna was kindled by a chance meeting with Roger Alban GW3SPA, when spending a holiday in one of the famous hotels located in the south-west of England. Roger is a keen DX operator, working only 160 metres and 10 metres, and required a single antenna system to cover these two bands. The design was made difficult by the constraints placed upon Roger by his adjoining neighbours. They had insisted that they did not want to see any large antenna systems, which they considered to be ugly. Therefore, any conventional design of antenna system was out of the question.

My father, Professor Sebastian Vizz, developed a miniature directional multi-band antenna which was the subject of an article entitled *The Multi-*

slot, which was first published in the *RSGB Bulletin* in April 1965. The design had been based on a defence research project which examined the design of matching waveguide to free space. The basis of the design considered the relationship between the electrostatic and magnetic fields existing within the mouth of a horn feeder and expanded the relationship of these fields to design a compact multi-band HF antenna.

Not popular

This particular design of antenna did not become popular because the logarithmic spacing of the multi-slot grid had to be precise for the antenna to operate efficiently. The logarithmic spacing of the grid gave the antenna a very well-defined directional property. The design data given for this antenna was not guaranteed to work at the first attempt at construction because the antenna was subject to environmental changes of temperature. A new approach was required.

The loop antenna

Perhaps one of the most efficient designs is the loop antenna. Loop antennas have two main advantages over conventional aerials: firstly, they fit into a much narrower space, and secondly they have a higher value of radiation resistance. The width required for a resonant loop is only 0.5 to 0.7 times the length of a straight $\lambda/2$ dipole, assuming no loading in either case.

The main disadvantage of the loop antenna is that it is not unidirectional. However, if two or more loops are connected together and equally spaced, the antenna becomes unidirectional. The disadvantage of this approach is that the radiation resistance will be reduced. However, by moving the feed point away from the centre of the loop at the bottom, the radiation resistance can be increased. The larger the number of loops which are joined together, the smaller the physical dimensions of the loop will be. This is because the mutual coupling between the loops loads each loop with mutual inductance and self-capacitance.

Know your limitations

There is, however, a limit to the number of loops that can be joined together. The spacing between any vertical section of the loop must not be less than the diameter of the wire used multiplied by a factor of 10. The feed point need only be taken from one of the loops. The centre points at the bottom of each loop should be connected together and connected to the braid of the coaxial cable feeding the antenna. The centre points at the top of the loop should be insulated from one another. My antenna, *Figure 1*, consisted of 8 separate loops, each equally spaced and constructed from 8mm diameter central heating pipe. The position of the feed point was calculated for 50 ohm coaxial cable.

The mathematics relating to the calculation of the dimensions for this antenna are complex because of the close coupling between each loop. For this reason, I have given in *Figure 1* the resulting equations for the dimensions to be calculated depending upon personal requirements.

Conclusions

Tests carried out on my antenna show that the angle of radiation is low and gives outstanding performance on all HF bands. The antenna also displays the characteristic of being virtually non-frequency selective, giving a good SWR on all HF bands with the exception of 2 metres, where the SWR climbs to about 1.5:1.

Excellent DX contacts have been obtained on 20 metres over the long haul route. Feeding the antenna in the way described has given it a slight directional property but has not seriously affected its use.

If carefully constructed this antenna will relieve the severe restrictions placed on the amateur who lives in a densely populated housing area, and may convince other amateurs with larger antenna systems that they are no longer a requisite to work DX. REW

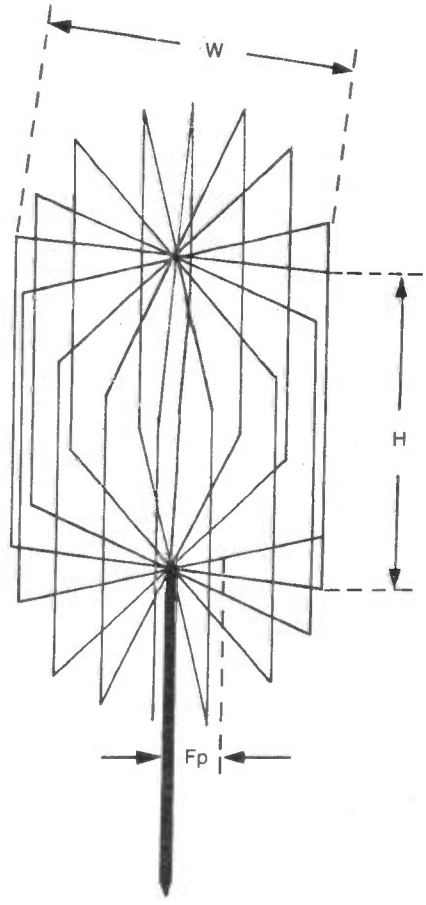

Fig 1 *Construction of the miniature multi-band antenna*

Formula

L = number of loops

$$W = H\left(\frac{\lambda - L}{L}\right) \times \left(\frac{H - 3.038847 \times 10^{7}}{L \times f}\right)$$

$$H = \frac{\lambda}{L \times \pi^2} \qquad Fp = \frac{Z_0 \times W}{(L \times H)^2}$$

Assume $V = 3 \times 10^8$ m/s

All calculations to 5 decimal places
Results are in metres

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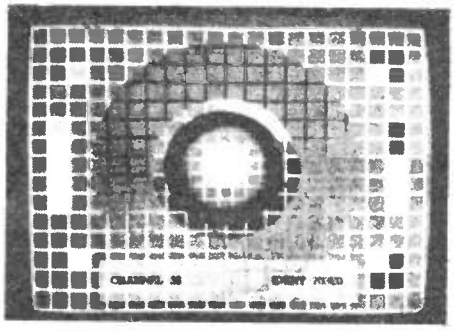
DX-TV RECEPTION REPORTS



Compiled by Keith Hamer and Garry Smith

On the whole, December was an inactive month for long distance TV reception via all modes of propagation. The huge lift in tropospheric conditions noted towards the end of November fizzled out by 1st December, leaving most channels blank.

Sporadic-E propagation also fell drastically short of expectations. Enthusiasts can usually rely upon a flurry of sporadic-E openings around the Christmas period. However, Santa must have overlooked everyone this year!

Most of the DX reception during December came via meteor shower propagation with the best days being the 13th and 14th. Most of the activity, thanks mainly to a peak in the Geminids, was confined to Band I frequencies.

Meteor shower DX

The Geminids often produce an interesting display of signals around mid-December and reception can often be mistaken as being via sporadic-E activity. In our experience, channels throughout Band I seem awash with signals, rather than normal meteor shower conditions where pictures pop up out of the noise at random.

Most of the daytime DX was missed here in Derby on the 14th, although an identification caption from Ceskoslovenska Televize (CST-Czechoslovakia) was spotted later in the day during a strong and sustained period of activity which lasted for at least twenty seconds on channels R1 and R2. A few minutes earlier a pop music programme was located in Band III on channel R7. This coincided with a similar programme on R1 and R2. It is difficult to know from which country it may have originated but Czechoslovakia is a likely contender. There is a channel R7 transmitter in operation about 170km east of Brno at Banska Bystrica.

Simon Hamer in Powys saw quite a display of activity on the 13th and 14th. The signals were clear and sustained enough to positively identify most of them.

Meanwhile, back in Derby, on the 29th a converter was left running on 77.25MHz which is the channel designated 'R3' in Eastern Europe. Two countries appeared within the space of three minutes. Fortunately, both were radiating test cards and could therefore be identified as TVP in Poland with the dark PM5544 and TSS (Russia) with their electronic UEIT test pattern.

DX-TV log for December

This month we are featuring the reception report sent in by Simon Hamer of New Radnor. Other signals were noted but could not be identified.

2/12/86: ORF (Austria) on channel E4 from the Patscherkofel outlet radiating the PM5544 test card which carried the 'ORF FS1' identification.

4/12/86: TSS (Russia) on channels R1 and R2 with programmes.

5/12/86: Programmes from RAI in Italy on channel IA.

13/12/86: TVE (Spain) on E2 with the second network GTE colour electronic test card with the inscription 'tve tve 2'. Reception originated from the 40kW Santiago outlet located in the north-west of Spain; RTP (Portugal) on channel E3 from the transmitter at Lousa with the 'RTP 1' FuBK test card; TVP (Poland) on

PHOTO FILE ● PHOTO FILE ● PHOTO

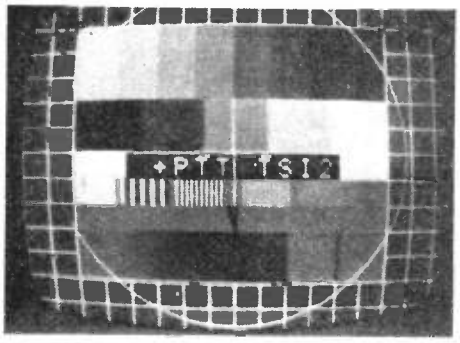


Fig 1 *Swiss studio test card radiated in error from Mt San Salvatore*

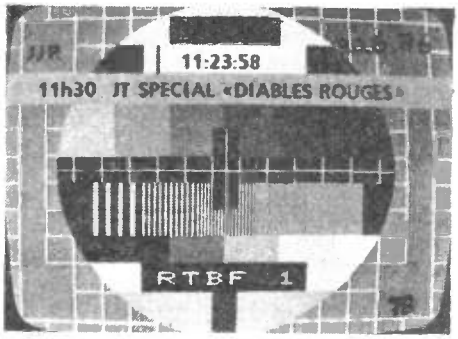


Fig 2 *Belgian PM5544 with digital clock and forthcoming programme details*

Fig 3 *Caption radiated by a private TV service in Denmark*

Fig 4 *Identification caption used by the TV service in Czechoslovakia*

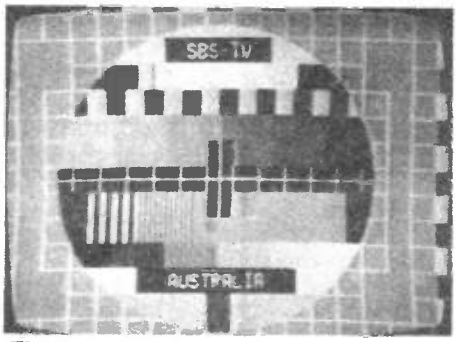


Fig 5 *PM5544 test card transmitted by the satellite TV system, SBS-TV*

Fig 6 *Programme caption broadcast by the American Forces in Berlin*

channels R1 and R2 with the news programme identified by the 'dt' caption (Dziennik Telewizyjny).

14/12/86: SVT (Sweden) on E2 radiating the 'girl's head' test chart at 0730 GMT. SVT were noted later using the Philips PM5534 pattern bearing the 'TV1 SVERIGE' identification; TSS with programmes on channel R1; RAI on channels IA and IB with programmes which were identified by the 'RAI' anti-pirate logo superimposed in the corner of the picture; NRK (Norway) with the PM5534 test card on channel E2 carrying the identification 'NORGE' at the top and the transmitter location 'GREIPSTAD' at the bottom; DR (Denmark) on E3 from the outlet at Fyn showing the 'DR DANMARK' PM5534 test card; RUV from Iceland on channel E4 with the PM5544 carrying the usual 'RUV ISLAND' identification; TDF (France) broadcasting on channel L3 with Canal Plus programmes from the Carcassonne transmitter.

25/12/86: ARD-1 (West Germany) on channel E2 with an identification caption; SVT radiating the PM5534 on E3; RTE-1 (Eire) on channel D from the Mullaghanish outlet, channel F (Mt Leinster) and channel H (Kippure) with a programme in Gaelic.

The old tuning card featuring a girl's head within a circle and a ten-step grey scale band across the lower portion is still in use according to Simon Hamer. It was seen at 0730 on December 14th. It is roughly ten years since this card was in regular use by Sveriges Radio. It was usually radiated just prior to the start of SR programmes. Some enthusiasts managed to catch a glimpse of it during last winter. It could well be that SVT may still transmit it from time to time so keep an eye open during the coming sporadic-E season. It could be one of the few chances to capture it for posterity on video!

By chance, a few old reception reports pertaining to December 1979 were recently unearthed describing conditions during the days of F2-layer DX when the last sunspot peak affected reception. It's hard to believe that TV stations in Australia, Malaysia, the Middle East, Africa, China and across the Atlantic were regularly seen, some on a daily basis. Hopefully, the next peak, which is expected around 1990 (give or take a year or two), will be as eventful as the last. The last peak certainly gave many DX-TV enthusiasts the opportunity to experience the ultimate in reception. A DXer in Leeds (Mike Allmark) saw signals from America on five consecutive days. Here's part of his log just to remind everyone what can be achieved with F2 propagation:

11/12/79: USA programme caption on channel A2 (55.25MHz) at 1550 GMT followed by the 'Flintstones' and NBC News.

13/12/79: Channel A2 vision *and* sound with at least three transmitters received. Programmes consisted of the Flintstones, NBC News and Beverly Hillbillies until 1700 GMT.

14/12/79: Two transmitters noted on channel A2 from 1232 GMT. At 1355, the A2 sound channel was 'noise-free'. On tuning further up the band, channel A3 video (61.25MHz) was present, albeit weak, with two transmitters 'floating' for three or four minutes. Reception on channel A2 was very strong until 1649 GMT.

15/12/79: Unidentified programmes on channels E2 and E3 (very strong), probably from outlets in the Gulf. Signals were also present on channel R1 with 'noise-free' sound. Programmes with weak sound were logged until 1650 on channel A2.

17/12/79: Programmes present from the east until 1400 GMT on channels E2 and E3. A PM5544 test card was also noted on

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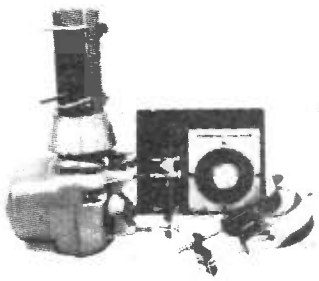

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these channels with three letters appearing in the lower black rectangle (possibly 'UAE') and thought to have originated from the United Arab Emirates.

On December 18th 1979, Hugh Cocks (then resident in East Sussex) went one better with reception from Australia on channel A0 (46.25MHz) at around 1030. A characteristic of this reception was its usually 'blurry' appearance. Hugh didn't positively identify anything from the Americas although the NTSC sub-carrier was 'excellent' on several occasions.

Gösta van der Linden of Rotterdam noted Canada several times during the sunspot peak. The transmissions emanated from CKCW TV at Moncton in New Brunswick on the eastern seaboard. Like most other DXers, Gösta noted that F2 activity was more prominent during mid-October, November and December with minimal reception during January, February and March.

We can almost hear some DXers saying that conditions during December 1979 were the 'good old days' and a far cry from those experienced in 1986. If it's any comfort, there should be only about three to four years to wait for the next sunspot maximum. One wonders, however, if there will be many Band I transmitters still in service by then. We'll have to wait and see . . .

Wrong callsign

In last month's column we mentioned Simon Bryant's reception of an ATV signal from Ramsgate. Simon tells us that the callsign was G6OXB and not G6OBK as he originally thought.

Recording DX-TV reception

Only a few years ago the humble snapshot camera was considered to be an all-important part of the DX-TV set-up. It was the only practical method available of keeping a pictorial record of reception. The launch of the domestic video recorder changed all that. However, it's surprising how many DXers hold the view that to record DX transmissions it is necessary to purchase a multi-standard machine, often at a highly inflated price.

It is fair to say that over the years several domestic video recorders have been widely available with a multi-band tuner fitted as standard, thus giving the DXer the opportunity to record reception in Bands I and III as well as at UHF. Of course, these machines will only record sound in the UK if the incoming signal is to the 6.0MHz intercarrier sound standard; DX from European countries using different sound frequencies (such as 5.5MHz or 6.5MHz) will not record satisfactorily at audio although the picture will be present. Colour information will not pose any real problems for the domestic VCR.

Certain versions of the Hitachi VT11E, Sanyo 9300, many Philips and Grundig models and, more recently, Solavox/Alba 4000 models all feature multi-band tuners as standard and will record video straight from the aerial input. A popular method used by DX-TV enthusiasts is to receive the sound channel separately, either directly from the audio jack output on the DX receiver (assuming it will respond to the required sound system) or from a scanner. The audio is fed into the audio input of the VCR. Unfortunately, not all machines will allow an external audio input to be added to the incoming signals via the inbuilt tuner. The Sanyo 9300 will, provided that the audio is fed into the 'microphone' jack located on the rear panel.

Recording in New Zealand

Duncan Fraser of Upper Hutt in New Zealand has written with details about his DX-TV recording techniques using a standard Panasonic VHS machine. His main receiver is a JVC CX610GB multi-band 6-inch colour portable/monitor bought a few years ago whilst living in the UK. These particular sets are extremely popular throughout the DX fraternity. This is mainly due to the fact that it will resolve Eastern European (6.5MHz), Western European (5.5MHz) as well as UK/Eire (6.0MHz) sound with PAL or SECAM colour.

When strong, good quality DX signals are present the JVC can be used on its own with the audio and video information extracted and fed directly into the VCR's A/V inputs. When weaker signals are present Duncan finds that his D-100 converter, set to narrow bandwidth IFs, enhances the displayed picture on the CX610GB. The sound is taken from a scanner with this arrangement since it wouldn't be present using intercarrier methods due to the reduced IF bandwidth.

For readers with plenty of cash to throw around, an amble down Tottenham Court Road in London will reveal a multitude of retailers offering multi-standard equipment which will record the full Continental standard straight from the aerial. But be warned: you may end up being the proud owner of a video recorder with a modulator output having a 5.5MHz sound/vision spacing which will, of course, not play back through a receiver designed for the UK market. The same applies if you're contemplating nipping over to France to buy a video from a hypermarket. The modulator output will only by suitable for system 'L' transmissions, namely AM sound and positive-going video.

You may be wondering whether it is possible to record SECAM colour transmissions on a standard UK video? Well, there are several machines which will do just that. We've had first-hand experience of the Ferguson 3V22 (that's the one with the protruding keys), the 3V29/30 and the Panasonic NV430. These three VHS machines are all capable of recording SECAM chroma information. Even the humble Sanyo 9300 (Beta system) will cope admirably, which puts paid to a recent rumour that Beta VCRs will not record SECAM.

It must be stressed that the playback must be via a SECAM receiver in order to display the colour.

Broadcast NTSC colour will not record successfully because the subcarrier frequency is much lower than the 4.43MHz used with the PAL system.

Clouds over Sunshine TV

Although Italy has seen the introduction of pirate/private TV on a massive scale (numbered in the hundreds) the story is very different of course here in the UK. One or two groups have attempted to broadcast illegally but efforts by the DTI soon put a stop to all that!

The latest pirate TV station to make a bid for the British airwaves is 'Sunshine TV'. The rather bold plan was for a pre-recorded programme to be transmitted from a Cessna 2-engine, 6-seater plane circling somewhere over Shropshire. According to our information, the broadcast was scheduled to be radiated on channel 34 although previous indications were that 42 was to be used. However, this higher channel is already used by the IBA relay station at Ludlow.

If there were any potential viewers waiting for this channel to burst into life, they were in for a disappointment. The TV station didn't get off the ground – in more ways than one! If anyone has further details about Sunshine TV, please write in via the Editor.

Service information

Italy: In the January 1987 issue of *R&EW* details were given of pirate/private TV stations operating in Band I which have been received by several enthusiasts. The 'TAI' service noted on channel IA is apparently based at Novara and the station name is 'Telealtitalia'. There are no further details available regarding the transmitter's ERP.

Yet another private station broadcasts on channel IA. Based at Vigevano, Telelomellina radiates with an ERP of 200 watts.

United Kingdom: A short news item for our overseas readers. The BBC are planning on introducing a television version of their 'World Service'. Transmissions will consist mainly of news bulletins and will be distributed to viewers around the world via satellite and cable systems. The Government has still to decide whether it will provide the cash. The annual operating costs are likely to be around £9 million.

This month's service information was kindly supplied by David Bocca Corsico Piccolino (Italy) and the BBC. REW

History Quiz Results

At last! The moment you have all been waiting for – the answers to Brian Kendal G3GDU's history competition, featured in our January issue. Read on: you might learn something . . .

As there was a magnificent prize being offered, we deliberately made the quiz rather difficult but, nevertheless, we hope that you all enjoyed delving into the history of radio.

As we waited for your entries to arrive, at first we were a little worried, but soon after Christmas they started rolling in and it was then obvious that you had been making the most of the Christmas holiday to research the answers. We were amazed at the amount of work that had obviously gone into answering the quiz and the quality of the entries.

In marking the papers we bore in mind that history is not always an exact science and that it is not infrequent that two authoritative accounts of an event may well differ. Nevertheless, whether we had marked generously or severely, the top six entries would have remained in exactly the same order.

The worthy winner of the Crotech oscilloscope, by a margin of no less than twenty points, is Graeme Wormald G3GGL of Bewdley, Worcestershire, with a score of 181 points.

The runners up, again with excellent entries, are E L Beamer, of Bridlington, Yorkshire with 161 points, and Vernon Davies G3MSK, of Crawley, Sussex with 158 points. Each will receive a year's free subscription to *Radio and Electronics World* magazine.

To help you with those questions for which your research failed, here is the background and the answers.

1. What had Heinrich Hertz to do with Pitch? (5)

A. Heinrich Hertz was a physicist who was interested in the properties of electromagnetic waves. However, it apparently did not occur to him that they could be used as a communications medium. Among his discoveries was the fact that the waves are polarised, but our question refers to his experiment to discover the refractive index of pitch to electromagnetic radiation. By using a large pitch prism, he measured the RI as 1.69. In his experiments he used a wavelength of 66cm.

2. What was the significance of Lavernock Point and Steepholme Island? (3)

A. Marconi first demonstrated the transmission of radio waves across water between Lavernock Point in South Wales and Steepholme Island in the Bristol Channel. The event is commemorated by an annual event by the Barry Radio Society.

3. Why tap the coherer? (2)

A. The coherer was an early form of detector invented by Professor Branley. It comprised a tube of iron filings which, when subjected to a radio signal, conducted or 'cohered'. Unfortunately, after the passage of the signal, the coherer was insensitive until the filings had been shaken up. Oliver Lodge improved the device by adding a mechanical tapper to keep shaking the filings and thus retain the sensitivity of the detector.

4. Who was G Kemp's employer? (3)

A. G Kemp was Marconi's assistant for many years around the turn of the century. He set up the station in Newfoundland which received the first transatlantic signals in 1901.

5. What was and who invented the 'Telemobiloscope'? (5, 5)

A. The 'Telemobiloscope' was a device patented by a German engineer, Christian Hulsmeyer, in 1904, for the detection of ships at sea by radio. It is generally considered to be the first suggestion for the use of what is now called radar.

6. Which famous doctor had cause to regret the invention of wireless? (3)

A. In August 1910, Dr Crippen murdered his wife and fled by sea to the United States with his mistress Ethel Le Neve on the steam ship *Montrose*. Suspecting this action, detectives radioed the captain of the ship and received confirmation that a person answering to Crippen's description was on board. The detectives boarded a faster ship and were on the quayside when the *Montrose* docked in New York.

7. Whatever happened to the Wireless Society of London? (2)

A. The Wireless Society of London was renamed the Radio Society of Great Britain in November 1922.

8. What was the 'Grid Audion' and who invented it? (3, 3)

A. Professor Fleming developed the diode valve which he called the 'Audion'. Dr de Forest improved this by adding a grid to form a triode which he called the 'Grid Audion'.

9. Who was the first man to transmit a wireless signal from an aeroplane in flight to ground and where? (5, 5)

A. On 28th August 1910, the Canadian aviator J A D McCurdy, flying a Curtiss biplane, transmitted radio signals to an operator on the ground at a range of nearly a mile and a height of 600ft at Sheepshead Bay racetrack, New York.

10. What wavelength did Marconi use for his Salisbury Plain demonstration? (4)

A. In 1896, Marconi used a wavelength of 1 metre for his demonstrations on Salisbury Plain. Soon afterwards, he changed to longer wavelengths and it was not until twenty years later that he again used UHF.

11. What is a Nipkow disc? (2)

A. The Nipkow disc is a mechanical scanning method for low definition television. It comprises a rotating disc with a helix of small holes near the periphery.

12. What was a 'Round' valve? (3)

A. The 'Round' valves were famous in the early 1920s and were so called because they were designed by Mr Round, chief designer of the Marconi-Osram Valve Company.

13. For what was Paul Godley famous? (3)

A. Paul Godley was a well-known American radio amateur (2ZE) who came over to the United Kingdom to take part in the 1921 transatlantic tests. It was claimed that he heard the first transatlantic amateur signal, but subsequent examination of logs showed that W F Burne (2KW) of Sale, Cheshire identified an American signal the previous day.

14. Who was and who now holds the callsign of Hiram P Maxim? (3, 3)

A. Hiram P Maxim was the first president of the American Radio Relay League (ARRL) and held the call W1AW. This is now the callsign of the headquarters of the ARRL.

15. Who lived at 'Coombe Dingle' and how did he affect British broadcasting history? (2, 2)

A. In 1927, Gerry Marcuse (G2NM) obtained permission to 'transmit speech

and music for a period not exceeding six months from 1st September, by means of wireless telephony' from his home 'Coombe Dingle' in Caterham in Surrey. Using a wavelength of 32 metres, these were so successful that they led to the inauguration of BBC short wave broadcasting the following year.

16. A man whose name is well-known in modern semiconductor terminology developed a four electrode valve during WW1. Who was it? (5)

A. Schottky.

17. Who or what was 'Armstrong's nightmare child'? (3)

A. Professor Gosling gave this name to FM (which was developed by E H Armstrong) due to the bandwidth which it needs.

18. Alan Blumlein, one of the greatest geniuses in radio history, patented a device about 1930 which did not become generally available until nearly ten years after his death, but is now in use in almost every home. What was it? (5)

A. In the late 1920s and early 1930s Alan Blumlein was working on the development of gramophone pick-ups. Among his many patents was one for a 45/45 degree stereophonic pick-up – the system used today. Unfortunately, the quality of the shellac discs available at that time was inadequate and it was not until the introduction of modern materials in the post-war period that stereophonic records became a practical proposition.

19. Under what circumstances did Blumlein die? (5)

A. In view of his work in the development of the EMI high definition TV system, Blumlein was engaged in radar research in the war. He was killed in a flying accident whilst testing H23, an airborne radar, over Wales in 1942.

20. Who is normally credited with the invention of the superheterodyne receiver? (3)

A. E H Armstrong.

21. What was a 'Catkin' valve? (5)

A. In 1933 M-OV developed a range of high power transmitting valves which included water-cooled triodes. These were known as CATs (cooled anode triodes). Later, the same construction techniques were applied to receiving valves. These included copper anodes with glass-metal seals and shock-proof metal bases. These were known by the diminutive 'Catkins'.

22. The Marconi-Osram KT series of valves were well-known – what did 'KT' stand for? (3)

A. Kinkless Tetrodes.

23. Who manufactured the 'Melody Maker' receiver? (2)

A. Cossor. Various models of the series ran from the late 1920s until Cossor withdrew from the domestic market in the 1950s.

24. Which is the odd man out: ML4, PM2, UX4, PX4? (3)

A. UX4. This is the designation for an American four-pin valve base. The others are triode valves.

25. In what context was Mazda not international? (3)

A. There are two types of octal valve bases: International and Mazda. Both are basically similar but the spigot of the Mazda base is of greater diameter and the spacing between pins 1 and 8 is larger.

26. Why would the Baird high definition TV system, which competed with that of EMI, have had problems giving time checks? (5)

A. In contrast to the fully electronic EMI TV system, the Baird system used an inter-cine process in which the scene was recorded on cine film, developed and then scanned for transmission. This caused a delay of approximately half a minute – thus the possible difficulty with accurate time checks.

27. Where did the experiment take place which demonstrated to the British Government that radar was feasible? (3)

A. The famous experiment took place using the BBC Daventry transmitter and the receiving equipment was set up in a field at Weedon Bec, some seven miles distant.

28. Before WW2, what condition was specifically associated with amateur transmitting licences in the G2 + 3 letters series? (3)

A. Prior to WW2, G2 + 3 callsigns were issued to AA (artificial aerial) stations, ie non-radiating stations.

29. Who developed what radio device at Birmingham University in 1940? (3,3)

A. In February 1940, John Randall and Harry Boot demonstrated a cavity magnetron in the laboratories at Birmingham University. By August, the GEC Hirst Laboratories at Wembley had developed it further into a device capable of practical use and by the end of the year operational equipment was available.

30. When and why did WW2 British bomber crews play with cat and mouse? (4,4)

A. Cat and Mouse were the code names of the two stations controlling aircraft fitted with the Oboe blind bombing system. The Cat station provided information enabling the aircraft to fly a steady track towards the target, whilst the Mouse station monitored its position and gave the bomb release information. The accuracy of the system was ±50ft. The answers to the question are therefore: when bombing and for blind bombing guidance.

31. Who or what were VIs? (3)

A. VIs, or Voluntary Interceptors, were a number of experienced radio amateurs who, during WW2, were equipped with communications equipment to monitor Enigma and other enemy traffic from their homes. This was kept so secret that their existence was not known to the public until over twenty years after the cessation of hostilities.

32. Who or what was Colossus? (3)

A. Colossus was the code name for the first programmable electronic computer in the United Kingdom. It was installed at Bletchley Park for breaking the Enigma codes and, large and powerful as it was, it did not have the capabilities of even the smallest of present day home computers.

33. Why did British WW2 bomber crews find that if Monica failed, they might have to get assistance from Walter, and if so, then Rebecca was no help? (10)

A. Monica was a rearward facing radar fitted to WW2 RAF heavy bombers intended to warn of impending fighter attack. Walter was the dinghy radio and Rebecca was part of the Rebecca/Eureka homing aid. Thus, if Monica failed, the aircraft might be shot down into the sea, in which case Walter, the dinghy radio, may have to be used and Rebecca, the homing system, could be of no further help.

34. We've all heard of a Drake TR4 – but what was a TR9? (4)

A. The TR9 was an early aircraft R/T equipment. It operated on 6 to 9MHz and used 2 volt battery valves in a 6 valve straight receiver and two valve transmitter circuit. The set was in use before WW2, was used by many aircraft in the Battle of Britain and was withdrawn from service about 1941. Many were available as ex-govt surplus after the war.

35. Why should Crowborough have been proud of its Aspidistra? (5)

A. During WW2, the most powerful transmitting station in the world was installed by the Radio Corporation of America at Crowborough in Sussex. Taking a lead from Gracie Fields' song 'The Biggest Aspidistra in the World', the station gained the name 'Aspidistra', or more affectionately 'Aspie', which stuck until it was withdrawn from service a few years ago.

36. Which amateur band was the first to be withdrawn after WW2? (3)

A. 58.5 to 60MHz was lost to make way for Band I TV.

37. Which is the odd man out and why: Dynatron; Magnetron; Phantastron; Sanatron? (3)

A. Magnetron, which is a microwave oscillator valve. The others are radar timebase circuits.

38. What was Taylor Supermodulation? (3)

A. In an attempt to increase the 'talk power' of AM transmissions, the Taylor system used an additional power amplifier which was quiescent except on the upward modulation cycle. The overall effect was to increase the modulation depth to 200% upwards but remain at 100% downwards, thus avoiding the undesirable effects of overmodulation whilst still remaining within the legal power input limit.

39. In the late 1940s, many amateurs built the 'Inexpensive Televisor' from wartime

equipment. Which equipment was used and what was its original purpose? (4,4)
A. The 'Inexpensive Televisor' used the R1355 as its receiver and the Type 62 indicator unit for display. Both were parts of the airborne GEE equipment, which was a hyperbolic navigational aid and which remained in service until about 1970.
40. The Clapp oscillator was developed independently by a British engineer. What was his name and company? (4,4)
A. Shortly after the Clapp oscillator was announced to the amateur world in 1948, the BBC quietly revealed that the circuit had previously been developed by their engineer Charles Gouriet and that they had been using it for several years.
41. What were the operational limitations placed on a newly licensed radio amateur in the United Kingdom in 1950? (2,2)
A. For the first year, the station would be limited to CW operation and a power of 25 watts.
42. What was the 80 metre 'Pond'? (3)
A. When the 80 metre band was released to amateurs after WW2, operation was not permitted in a section from approximately 3615 to 3685kHz.
43. What is, or was, a Wobbulator? (3)
A. An old term for a frequency modulated oscillator.
44. What are ½th second echoes? (2)
A. A radio signal takes approximately ½th of a second to circumnavigate the world. Under exceptionally good conditions, a ghost round the world signal can sometimes be heard ½th of a second after the main received signal.
45. Using 'Q' code, encode: 'The time is'; 'What is the tone of my transmissions?', and decode: QBA?; QTE. (2,2,2,2)
A. QTR; QRI?; 'What is the visibility?'; 'The true bearing from me to you is . . .'.
46. Name two heads of state who hold radio amateur transmitting licences. (2,2)
A. King Hussein of Jordan (HY1), Rajiv Ghandi (VU2RG) and King Juan Carlos of Spain.
47. What is a 'Red Spot'? (3)
A. The first transistors available on the amateur market were coded with a coloured spot according to their characteristics. A 'red spot' was an audio transistor.
48. The term picofarad has been in use for many years, but what was it called before? (2)
A. The older term was 'micro micro farad'.
49. Loran disappeared from Top Band several years ago. What frequency does the latest version use? (5)
A. When the Loran A system on Top Band was withdrawn, it was replaced by Loran C, operating on 100kHz.
50. Experiments by Canadian scientists using an amateur satellite led to a major United States/USSR co-operative space venture. For what purpose is this and what is the name of the system? (4,4)
A. Canadian scientists found that by measuring the Doppler shift on a station being relayed via the Oscar satellite and having an extremely accurate knowledge of the orbit parameters, it was possible to determine the position of the transmitting station with considerable accuracy. This led to United States/USSR co-operation on a series of Search and Rescue satellites listening on the VHF distress frequencies. The Soviet satellites are in the COSPAS series and the US ones are called SARSAT and are 'piggy back' to the NOAA weather satellites. Within the first two years of operation, this venture had saved over 250 lives.

The final reckoning

You can now tot up your score. If you scored over 100, you have done reasonably well. If your total is over 140, you are a real historical enthusiast, but if you reached 180 we think you can consider yourself a real buff and award yourself the title 'Total Radio Person'.

Thanks

Our thanks go to Crotech Instruments of 2 Stephenson Road, St Ives, Cambridgeshire PE17 4WJ (tel: (0480) 301818) for donating such a splendid oscilloscope, and especially to Managing Director Brian Hollingsworth for his time and co-operation. REW

The lucky winner, Graeme Wormald G3GGL, receives his prize from Brian Hollingsworth, Managing Director of Crotech

Graeme with Brian Kendal G3GDU, the man behind the fiendish quiz

QSO

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

Kilts and bowlers

Following a successful event in 1986, radio amateurs in the Scottish Borders will again be acting as hosts to the 4th Anglo-Scottish Rally in Kelso's Tait Hall on Sunday 3rd May from 11am to 5pm. The organising club will be Kelso Amateur Radio Society, as in past years.

There will be the usual talk-in on S22, traders' stalls, club stands, hot and cold snacks, a bar, raffles, Morse tests, etc.

Entrance will be £1.00. Juniors and accompanying YLs and XYLs are most welcome and will be admitted free. There is something for everyone. Why not spend the bank holiday weekend in the Borders?

For further information, contact Andre Saunders GM3VLB, the organising secretary (tel: (0573) 24664) any evening.

BATC show

The 1987 British Amateur Television Club show is to be held at the Post House Hotel, Crick, nr Rugby (just off exit 18 of the M1 motorway) on 3rd May 1987. All are welcome, admission is free and catering facilities, etc are promised.

To find out more about the BATC and its activities, contact Trevor Brown G8CJS, QTHR.

QRU in Cannock?

An unemployed Cannock labourer is hoping people with old radios they are about to throw out will tune into his appeal instead.

Mr Charles Cowley, of 15 Willow Walk, Huntington, Cannock, Staffs, repairs wireless sets no-one else wants and sends them to the blind.

Mr Cowley has already helped disabled people throughout the country through Charlie Chester's Radio 2 programme.

Working from trade service sheets and service manuals collected over 30 years as a radio enthusiast, Mr Cowley repairs the instruments in a shed at his home, but is now running out and wants people with either working or broken radios, cassette players or televisions to contact him.

Mr Cowley decided to put his radio knowledge to good use when he stopped working.

Anyone with spare parts, broken sets etc, lying around in the shack gathering dust, this is your chance to have that clear-out you've been promising and help a good cause at the same time.

Calling all club secretaries!

We are always pleased to receive news and details of interesting meetings from clubs and individuals. However, to help us to promote your organisation or event, please note the following:

1) Typed press releases on A4 paper are much more legible than scrawled notes on loo paper, and are less prone to misinterpretation.

2) Check that all the relevant information concerning an event is included, such as venue (with full address and directions if necessary), time and date.

3) A contact address, such as that of the club secretary, is essential. Please give a full postal address and phone number if possible.

4) Please bear in mind that we work two months in advance, so items for publication in a specific issue should be submitted at least three months before the event is due to take place.

Slough and Windsor

The Burnham Beeches Radio Club, which covers the Slough and Windsor areas, has organised the following forthcoming events:

- April 6th. Talk on cable television by Joe Delahunty of Windsor TV.
- April 20th. Bank holiday foxhunt. Suitable for all the family, starts at 5pm.
- May 2nd/3rd/4th. Spring holiday 'picnic'. A twice yearly event when a club station is set up and there is much activity both on and off the air. Barbecue and camping, DX and QRP, using club callsigns G3WIR and G6WIR.
- May 18th. Talk on satellites by Neill Taylor G4HLX, Region 6 representative of the RSGB. Plenty of opportunity to talk about the RSGB also.

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

Club contact is Eileen Chislett G6EIL, Publicity Officer. Tel: Maidenhead 25720.

Who's who

In a recent copy of *Radial*, the newsletter of the RAIBC, a 'who's who of amateur radio' was published, listing some interesting radio personalities for members to listen for. For example, did you know that G3KDH was the World Speedway Champion in 1949, that G3DHB is a George medallist, or that G3LEX is a 'Beefeater' at the Tower of London?

This issue also includes an article on the National Wireless Museum at Arreton Manor on the Isle of Wight. Exhibits include vintage receivers and crystal sets, horn loudspeakers, a Baird 'Televisor' and ex-service equipment.

For further details of the RAIBC and *Radial*, contact Kathy Clark G1GQJ at 9 Conigre, Chinnor, Oxon OX9 4JY.

White Rose Rally

This year's White Rose Rally will be held on Sunday 22nd March at the University of Leeds refectory. Doors open at 11.00am (10.30 for OAPs and disabled visitors) and entry by programme will cost 60p.

Attractions will include over 50 trade stands, plus the usual refreshments. Talk-in will be on S22 by special event station GB2WRR. There will also be a demonstration station.

Further details can be obtained by telephoning Mike G0EGM on (0532) 676368, evenings.

Chelmsford

The newsletter of the Chelmsford Amateur Radio Society reports that Mr J S Woods will be presenting a talk on short waves and beams on 7th April.

For details of other meetings, venues, etc contact Roy G3PMX or Ela G6HKM on (0245) 360545.

Amateur of the year

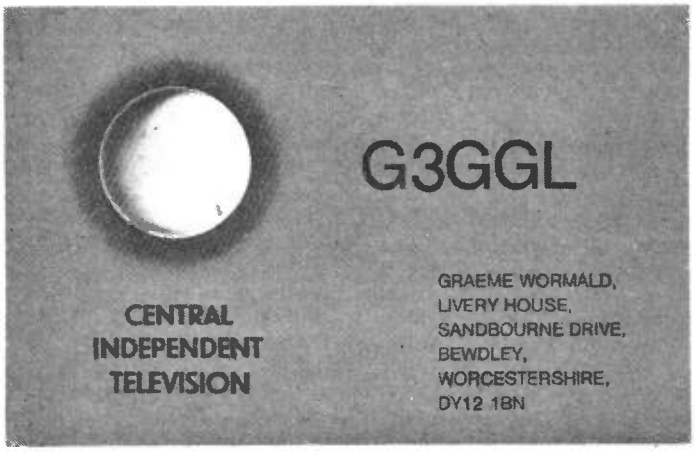
Nico Jansson, PA0DLO, has been named 'Amateur of the year' by the Dutch Amateur Radio Society, VERON. Nico was cited for his outstanding contribution to amateur radio through his superb efforts in support of the Amateur Satellite Service over a protracted period.

The award was made in Amsterdam on 15th November. PA0DLO has been the linchpin of AMSAT activities in Holland for nearly a decade and is a vital intermediary in information flow between AMSAT societies in Eastern Europe, Europe and the West.

Old messages

The Telecommunications Heritage Group recently distributed the first copy of its newsletter, *Exchanges*.

The group was founded in December 1986 to co-ordinate the activities and interests of all people engaged in the preservation and study of the heritage of tele-



QSL card corner *We occasionally like to feature interesting or unusual QSL cards. The one above belongs to the winner of our history competition, Graeme Wormald, who works for a certain well-known independent TV company (guess which?). If you have any unusual examples of such cards, we would love to see them*

communications. The group aims to recruit collectors, historians, dealers, preservation societies and anyone with related interests, ranging from telephones to telegrams, to old kiosks.

For details contact Andy Emmerson at 71 Falcutt Way, Northampton NN2 8PH. Letters expecting a reply should enclose a stamped addressed envelope. To join send £3.00 accompanied by your full name and address to the Telecommunications Heritage Group, c/o Telecom Technology Showcase, 135 Queen Victoria Street, London EC4V 4AT.

Components fair

The Pontefract & District Amateur Radio Society will be holding a Components Fair for the radio and electronics enthusiast on Sunday 5th April at the Carleton Community Centre, nr Pontefract, just off the A1 at Darrington.

Admission will be free (11am to 4.30pm) and there will be trade stands, a licensed bar and other refreshments, a bookstall and talk-in on S22.

Further details are available from C A Mills. Tel: (0977) 43101.

Social evening

The Bury Radio Society is organising a social evening on April 14th and a surplus equipment sale on July 14th. Further details from the Secretary, 36 Dovebank Road, Bolton BL3 1DB.

The Beeb talks

The Felixstowe and District Amateur Radio Society is hosting a talk by Chris Driver G6CMD of the BBC Transmitting Station, Orford entitled 'BBC Transmitter Engineering'. The lecture will be held on April 6th at 8pm in the Scout Hut, Bath Road, Felixstowe. Further details can be obtained from Paul Whiting G4YQC. Tel: (0473) 642595, daytime.

Swindon rally

The Swindon and District Amateur Radio Club's Amateur Radio and Electronics Rally is scheduled for Sunday 10th May and will be held, as in previous years, at Oakfield School, Marlowe Avenue, Swindon.

The event will start at 10am and talk-in will be provided on S22 and SU8/GB3TD on 70cm. Free parking is provided and, in addition to the rally, a film show and other amusements are available for children.

Further information can be obtained from G8SFM, on (066689) 307.

Sinking Lowe

In Ken Michaelson's review of the Trio TS440S all-band transceiver, featured in last month's issue, we omitted to say that the review sample was kindly supplied by Lowe Electronics Ltd, of Chesterfield Road, Matlock in Derbyshire.

We apologise for this oversight and would like to thank Lowe for their co-operation.

Notes from the past

An opinion expressed nearly forty years ago on the restrictions placed on broadcasting in the early 1920s

Official stupidity

The history of British broadcasting is simply a classic example of obtuse obstruction by high officials and lack of imagination by over-powerful Ministers – the very people we pay to plan our future. British broadcasting was born in February 1922 with the Marconi Co station at Writtle (2MT) near Chelmsford. Note that the first American station opened up its programmes in December, 1920.

As if determined to place every possible obstacle in the way of the Marconi Company, their permit to broadcast restricted the power to 10 watts, limited the time to half an hour a week, required that part of the time be devoted to morse signalling and a pause after each seven minutes for a period of three minutes during which they had to switch over to reception on a Government wavelength in case they decided to change their minds about it and forbid the continuance of the programme.

The wheels of the bureaucratic machine grind slow, so the three minute intervals were imposed for nine months and also applied to the 2LO transmitter which started about May of the same year. Here, in an unguarded moment, they generously gave permission for the use of 100 watts, but to offset this they decided to prohibit the broadcasting of music! I forget how long it took to have this absurd restriction lifted, but it ran into months.

When the British Broadcasting Company (run by representatives of a number of radio manufacturers) was started in November 1922, they so succeeded in popularising listening that the Government 'nationalised' it immediately their Charter expired three years later.

Commercial broadcasting in England, indeed. Not a hope!

Errata

In the article entitled *Linear ICs* in the March 1987 issue of *Radio & Electronics World*, readers should note the following corrections:

- In *Figure 4* the 1k resistor should not be connected across pins 3 and 9, but should connect pin 3 to the common pole of the selector switch, Sw1.
- In *Figure 7*, the 1u capacitor should be 1n.
- In the diagrams of the PCB, the lower fixed pin of the variable resistor RV1 should be connected to OV at the point where R3 is connected to OV.

In the article entitled *LW Rod Loop DXer* from the same issue:

- On page 25 there are two references to the rod being 15 inches long. These should read 19 inches as elsewhere in the article.
- On page 26, read 8 inches long for 80 inches in the centre column.
- In *Figures 4a* and *4b*, on the bobbin in the centre, read L1 and L2 for 1.1. and 1.2.

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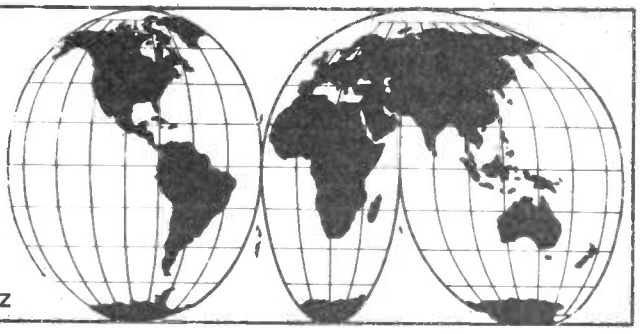
SHORT WAVE NEWS FOR DX LISTENERS



By Frank A Baldwin

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

As intimated in the September 1986 issue of *Radio & Electronics World,* in which details of a few Latin American transmitters currently operating on the 90 metre band (**3200** to **3400**) were featured, the first part of an update dealing with low powered LA stations on the air within this range is presented here. The information given is correct at the time of writing.

Testing for LA signals

A good 'marker' station, the signals from which UK listeners can gauge the current conditions for LA reception on the band, is the often heard and reported HCJB (Herald Christ Jesus Blessing) in Quito, Ecuador on **3220**. Rated at 10kW, it programmes in Quechua from 0830 to 1430 and from 2100 to 0200. From 0200 to 0500 the programme language is Spanish. The LA season for us here in Western Europe, providing the most favourable period during which success may be achieved, extends from around April to September. Quechua is the term used for a linguistic family of west South America, the member languages of which are spoken in Ecuador, Peru, north-west Argentina and much of Bolivia. The official language of the Inca Empire was of this family.

Making a start

With an abundant supply of midnight oil, a selective receiver, an efficient aerial array, acquired operating skill and not a little patience, tune to **3205**. On this channel one may be fortunate enough to hear signals from the Brazilian station Radio Ribeirao Preto. With a power of 1kW, it is on the air in Portuguese from 0700 through to 0400 and is occasionally heard by Western European and UK-based DXers.

In Tovar, Venezuela, Radio Occidente (Radio West) is on the air from 1000 to 0300 (Saturday and Sunday until 0400). Although only powered at 1kW, it is regularly logged by DXers world-wide. The frequency? Oh yes, it is on a variable **3225**.

Seldom heard by us in and near the UK are the signals from the 0.4kW Peruvian Radio El Sol de los Andes (Radio The Sun of the Andes) in Juliaca. The frequency is a variable **3229** and the schedule is from 1000 to 0410, but sometimes varied to 0515.

Radio Clube Marilia in Brazil is on **3235** with a power of 0.5kW from 0800 through to 0400 and rarely reported by us in these northern climes, which is not surprising considering the low power.

Radio Clube Varginha, Brazil on **3245** is on the air from 0900 to 0200 (Sunday until 2200) although it has been reported being heard at 0315.

Radio Luz y Vida (Radio Light and Life) San Luis, Honduras at 0.8kW is scheduled from 1230 to 1630 and from 2200 to 0400. This one is only rarely heard outside the Americas, but a tune to **3249.6** may well prove interesting on one fortunate occasion.

La Voz el Tigre (The Voice of the Tiger), El Tigre, in Venezuela operates from 1000 to 0300 (Sunday from 1000 to 0600) in Spanish with a power of 1kW. It varies around **3253**, which makes the problem of logging this one more difficult to say the least. First – catch your signal!

The 2.5kW Radio La Voz de Oxapampa, Oxapampa, in Peru, serves the local community from 1000 to 0500, but unfortunately rarely entertains those of us residing in Europe. However, a tune to **3260** one early morning could prove fortunate for some weary and up to then dispirited DXer. Listen for the identification La Fabulosa de la Central.

Reactivated during 1985, Radio Mara in Maracaibo, Venezuela at 1kW entertained the locals from 1000 (varies to 1200) to a variable closing time of 0400, but is now reported to be operating around the clock irregularly. Should you be fortunate enough to have good prevailing conditions, you will find it on **3275.1**.

A real DX catch would be the 0.36kW La Voz del Rio Tarqui (The Voice from the River Tarqui) in Cuenca, Ecuador. It is on the air irregularly from 1000 (varies to 1200) to 0300 but has been reported as late as 0740. When radiating it is on **3286.5**. It also sometimes identifies as Radiodifusora Tarqui.

The rarely reported Peruvian Radio Tayabamba, Tayabamba, has a variable sign-on around the 2230 mark and closing between 0430 and 0505 (Sunday also from 1100 to 1500). With a power of 1kW, it is settled on **3290.1**.

Radio Bagua, Bagua, Peru on **3310** is scheduled from 1000 to 0400 with a power of 1kW. Rarely heard far from the signal source, it is thought to be planning an increase of power on this short wave outlet.

Radio San Miguel in Riberalta, Bolivia, is sometimes heard by European DXers and reported on **3310.3**, at which point on the dial, scale or indicated digits it radiates from 0400 to 1700 (variable to 2200) and from 2000 to 0230. The power is 1kW.

AROUND THE DIAL

Switch on the receiver, adjust the appropriate controls to some of the frequencies shown below at the times indicated and listen. Hopefully, success will crown your efforts.

AFRICA

Botswana

Radio Botswana, Gaborone on a measured **3355.7** at 1852 when featuring an interview in SeTswana. With a power of 50kW, Radio Botswana on this channel is scheduled on the air with the Home Service in English and vernaculars from 0345 to 0700 and in English and SeTswana from 1500 to 2100. News bulletins in English at 0510 and 1610 Monday to Friday and at 1910 daily.

Benin

ORTB (Office de Radiodiffusion et Television du Benin), Cotonou on **4870** at 1955, with a Home Service programme in French about local current affairs. La Voix de la Revolution programmes in French and vernaculars from 0500 to 0800 (Saturday from 0545 to 1100) and from 1300 to 2302 (Sunday from 0600 to 2300) with a power of 30kW. There is an English newscast timed for 2000.

Chad

RNT (Radiodiffusion Nationale Tchadienne) N'djamena on **4920** at 2032, OM with a talk in vernacular, N'djamena being mentioned several times. Also heard on a later occasion with the identification 'Ici N'djamena, Radiodiffusion Nationale Tchadienne'. Radio Nationale is scheduled in French and vernaculars from 0500 to 0700 (Sunday from 0500 to 0650) and from 1530 to 2205 with a power of 100kW. At the time of writing, Radio Afghanistan dominates the channel from 1900 to 1930 with its English transmission, this also being logged in parallel on **6020**.

Ghana

Accra on **3366** at 1955, male and female announcers with alternate news items in English concerning the economies of several African countries. Radio Ghana is scheduled in English from 0530 to 0805 (Saturday and Sunday from 0805 to 0900) and from 1730 to 2305 with a power of 50kW.

SHORT WAVE NEWS

SOUTH AMERICA

Brazil

Radio Educacao Rural, Campo Grande on **4755** at 0338, OM with a pop song then an announcement in Portuguese complete with echo effect. With a power of 10kW, this one is on the air from 0800 (Sunday from 0900) to 0500 (Sunday until 0400). There is a newscast in Portuguese every half hour.

Colombia

Radio Caracol, Neiva on **4945** at 0519, OM with a newscast in Spanish of local affairs, place names preceding the various items. With a power of 20kW, Radio Caracol programmes around the clock.

Peru

Radio Andina, Huancayo on **4996** at 0245, local folk songs and Andean pipe music, OM with announcements in Spanish. My favourite Peruvian station, Radio Andina in the Emisoras Cruz del Peru network operates from 0930 to a closing time varying from 0500 to 0600. The power is 2kW.

Venezuela

Ecos del Torbes, San Cristobal on **4980** at 0254, YL with a ballad in Spanish accompanied by music in the local style. At 10kW, Ecos del Torbes is on the air from 0900 (Sunday from 1000) to 0400 but does occasionally work a 24 hour schedule.

ASIA

Burma

BBS (Burma Broadcasting Service) Rangoon on **4725** at 1425, YL with announcements, OM with a song in Burmese. At 1447 retune, YL with talk in English about school discipline then YL with an announcement in Burmese followed by return of the talk in English about the Burmese educational system.

SOUTH-EAST ASIA

Indonesia

RRI Palu, Celebes on **3960** at 1537, OM with announcements in Indonesian, YL with a song complete with music in the local style. At 10kW, RRI Palu radiates from 2130 to 0030 and from 0900 to 1555.

RRI Jambi, Sumatra on **4927** at 1444, OM with songs in Indonesian. This one is rated at 7.5kW and operates from 2200 to 0100 (Sunday until 0700) and from 1000 to 1400 but which can vary to a closing at 1700.

RRI Surakarta, Java on **4932** at 1559, YL with a talk then OM with a newscast in Indonesian, the latter being a relay of RRI Jakarta. The power is 10kW and the schedule is 2230 to 0145 and from 1000 to 1700 but frequently twenty-four hours.

Malaysia

RTM (Radio Television Malaysia) Kuala Lumpur on **4845** at 1440, YL and OM with songs in an Indian vernacular complete with Indian style music. With a power of 50kW, Kuala Lumpur on this channel carries programmes in Indian languages Monday to Friday inclusive from 2100 to 0100, 0515 to 0600, 0800 to 1500, Saturday from 2100 to 0300 and from 0515 to 1500, Sunday from 2100 through to 1500.

PACIFIC

N Marianas

KYOI Saipan on **11900** at 1016, pop songs and music in the English transmission for East Asia, timed from 1000 to 1600. Also logged on **15190** at 0915 in English to East Asia from 0300 to 1000.

NEAR AND MIDDLE EAST

Bangladesh

Dacca on **4980** at 1554, OM with a talk in Bengali. This 100kW transmitter radiates in Bengali from 1130 to 1715 on most days.

India

AIR (All India Radio) Delhi on **4860** at 1539, OM with a news bulletin in English. With a power of 10kW, Delhi is on the frequency with the Foreign Service in Nepali from 0130 to 0215 and with national link-up programmes from 0030 to 0035, 1235 to 1315, 1330 to 1335, 1415, 1420 to 1435, 1445 to 1630 varying to 1730 and from 1730 to 1740. Newscasts in English are timed for 0035, 0230, 1430, 1530 and 1730.

AIR Delhi on **11865** at 2000, OM with the station identification followed by a newscast of both local and world events. This English transmission is directed to West Africa from 1930 to 2030.

Iraq

Baghdad on **15300** at 1327, OM with a talk in the Arabic programme for North Africa scheduled on this channel from 1300 to 1700.

Kuwait

Radio Kuwait on **15505** at 1316, local style songs and music in an Arabic programme directed to Europe and timed from 0615 to 1800.

Saudi Arabia

Riyadh on **15060** at 1332, OM and YL with a drama in the Arabic programme for North Africa timed from 1100 to 1700.

Sri Lanka

SLBC (Sri Lanka Broadcasting Corporation) Colombo on **5020** at 1541, OM with a talk on the Tamil Commercial Service, YL with songs and a backing of local music. The schedule is from 0030 to 0300 and from 1400 to 1730.

EUROPE

Czechoslovakia

Prague on **7345** at 2010, YL with the news in an English presentation to Europe scheduled from 2000 to 2027 daily.

Finland

Helsinki on **11945** at 1402, YL with a news bulletin mainly of local affairs during the English transmission for North America scheduled from 1400 to 1425.

Greece

Athens on **7430** at 1920, OM with the station identification followed by YL with an English newscast timed from 1920 to 1930.

CLANDESTINE

Voice of the National Army of Democratic Kampuchea on **5200** at 1420, YL with a song then OM with an announcement in Vietnamese (?) followed by some music in the local style. Just audible on peaks, the signal suffered from side-splash utility interference.

NOW HEAR THIS

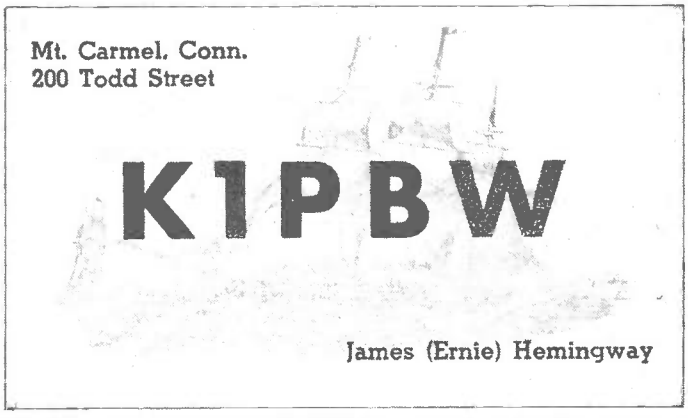
ORTN (Office de Radiodiffusion Television du Niger) Niamey, Niger, La Voix du Sahel, on **5020** at 0550, OM with a talk in French. No sign of the co-channel 50kW Radio Tirana. Niamey is active from 0530 to 0700 (Sunday until 0900) and from 1700 (Saturday and Sunday from 1630) to 2200 (Saturday until 2300). There is a news bulletin in English at 1715 and the power is 100kW.

DOTS AND DASHES

By way of a change, a few forays on a couple of the amateur bands were made during the month. At the CW (continuous wave, more popularly known as morse code) end of the bands, the following were logged:

On Top Band (1.8 to2.0MHz): DK5EN, DJ6EC, EA7DMF, HB9CMF, IK3HRP, IS0QDV, K1ZM, KA1PE, K2WI, K5NA, N1ACH, N4XM, N5RZ, OE5KE, OK1ATP, OL1BIC, RQ2GGC, RT4UA, RW3QQ, RZ3AM, SM7BVO, UA3DRR, UB4MPC, UP1BZZ, UQ2GUB, W1NV, W2GUX, WB2ULI, W9SMY and 4X4NJ.

On forty metres (7.0 to 7.1MHz): CO7PG, CX6BM, DF8ZH/5B4, HK1KXA, N9AG/J6L and TI4SU. REW



The QSL card received for K1PBW for a report on his CW signals on Top Band during the period when signals from across the pond were not so plentiful as they are now. The frequency was 1802, the time 0536, the date 15/12/68

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■ FT102, AM/FM board fitted, FC102 ATU, ex condx, £650. Black Star 600MHz freq counter, £80. Pye pocket phone 70, xtalled RB2, RB11, SU8, spare nicad, charger £50. EC10 Rx mk2 £45. Valves DA100 6 of, offers. Codar AT5 Tx c/w PSU, change over switch £30. Spectrum 48K c/w PSU £30. Steve G0BBZ QTHR. Tel: (0705) 472708

■ Scanner service manuals AOR2002, AOR2001, MX5000, MX7000. All four in one manual £20 + 64p postage. Also other Tandy scanner s/m PRO30, PRO31, PRO32, PRO2021. Op's manual for PRO2004. Tel: (04738) 5526

■ Shack clearance, valves, valves, valves to suit most communication equipment/test equipment etc. Ex Government & USA radios a speciality. Many pre-1940 types. Many CV & CVX types, most half list price. Sid. Tel: Poole 680500

■ Cybernet Delta one 934 transceiver, preamp, Halbar 17 element beam, collinear, mobile mag mount antenna. All in vgc, £360 or consider exchange for HF, 70cms, or six metre transceiver. KW E-ZEE match tuning unit £45. Tel: Woodstock 812278

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■ Telequipment oscilloscope type D43. type C amplifiers. Dawe valve voltmeter type 614B, ranges 0.003 to 30 volts RMS. Offers. Tel: (0788) 860 578

■ Scopex 4S6 and Hartley CD436 scopes; TS175 freq meter, 85MHz to 1.0GHz; Philips Wobbulator GM2877; Lanscope 12 inch 4 channel, long-persistance scope; Rank 'Off Air' VHF/UHF, 405/625 TV recvr, intl loudspkr, use monitor CVout; Altai AF sig gen 0 to 200kHz; Pye 21VR20 tuner/scanner/programmer; HRO Senior and nine coilpacks recond to as new plus manual; Sinclair DM235 multimeter with nicads and PSU; Advance RMS milliWmeter measure to 4.5MHz; BMC 12 inch green monitor; Technotrend h/held static indicator (new £50); Fidelity 14 inch colour monitor CV or RGB in. Shack rebuild so surplus. Make an offer. Tel: (0706) 218290 (eves)

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■ Scanner Amstrad PCW. If you have either then I've got some invaluable logging programs and interesting frequencies to listen in on. Far too much to list here, so for full details send SAE to PO Box 71, Bournemouth, Dorset BH9 1DT

■ Grundig Satellit 3400 professional global receiver. Few hours use only due to illness. Cost new £450. £200. Tel: (021) 708 0675 (eves, not Wed/Sat)

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■ Bush DAC10 (1950/51) brown bakelite cabinet. Push button wavechange. £20. Bush DAC70 (1958/59) black plastic cabinet. Large round illuminated tuning control. £10. Roberts P5 (1948) swivel base. Cabinet is rexine covered. Dial is concealed under a lid. £10. Pre-war trf (make unknown) made about 1930. Wood cabinet. A collector's piece. £30 ono. Marconiphone T19A and Westminster radio. £10 each. Peter Titlow, 13A High St, Leiston, Suffolk. Tel: (0728) 831610 or 831812

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■ ICOM IC25E 25 watt FM mobile Tx/Rx scan mic ICHM10 £160. Sony AIR7 hand-held scanner AM/FM, SW etc, £170. Sanyo Betamax video recorder VT5150. Good picture £125. Maxcom 7E hand-held CB, nicads, charger, mag mount case £40 (legal). 5 band stereo graphic equaliser £25. Mr Fordham, 31c Anerley Park, Penge SE20 8NF

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■ Belcom transceiver LS102L multimode 26-30MHz £140 cash. Tel: 01-578 7069

■ Brother HR5 printer, thermal or ribbon and interface for Spectrum £70. Philips music centre with pair Goodmans speakers £50. The following mags for sale: *Practical Wireless* 1982, 1983, 1986; *RadCom* 1980, 1981 (-3); *Maplin Electronics* Dec 1981 to Feb 1986; *Elektor* 1985 + 10. *Radio and Electronics World* 1984, 1985 + 9. £5 per 12. Gordon Jackson, 109 Culver Grove, Stanmore, Middx. Tel: 01-907 2253

■ Scarab RTTY terminal unit £30. Scarab RTTY/CW interface board for Spectrum plus Scarab RTTY/CW software Tx/Rx for Spectrum £25. Alphacom 32 thermal printer £20. Gordon Jackson, 109 Culver Grove, Stanmore, Middx. Tel: 01-907 2253

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■ Racal RA63 SSB adpt, also circuit for Racal PU99A photo/cpy or original, a complete manual would be great help. Also input plugs & sockets for TA99 linear (Racal). Circuit or manual for Advance Signal Geni model J1/A, ser no ACL975 TK. Racal MA144 ATU, must be original condition, no mods. Top price paid. Will collect UK/EI. EI6DP. Gerard P Fitzgerald, 40 Maigue Way, John Carew Park, Limerick, Ireland. Tel: (061) 43584

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■ *Practical Wireless* March 1969 article/photocopy or mag on the 160 superverter Top Band converter, to use in conjunction with car radio. Will refund costs, expenses etc or return mag with expenses. I will be most grateful. Roy G0BZT. Tel: (09073) 78792

■ Is there someone who has a McMurdo Silver 15-17 series 2 1939 model receiver and would like to sell it? Need not be working but must be complete. Mr Len Iceton, 5 Dorlcote Place, Norton, Stockton, Cleveland TS20 2PP. Tel: (0642) 559845

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■ Kempston Centronics interface 'E'. FMW15 Westminster spares modulator driver, AT10759/2 receiver, FM FET, RF unit. PA Tx unit AT10759/2, all to cover 145MHz. Able to photocopy (prompt return, post paid) info on Solartron scope CD140. Nolton PMR transceiver hi-band PA 2N5591 circuit xtal details req'd. Jack Corston G2BCY, 23 Whitefield Terr, Newcastle on Tyne NE6 5DU. Tel: (091) 2654780

■ Manual for Heathkit scope model 10-103, and manual for Sabtronic model 2000 3.5 digit DMM meter. J R Forster, 51 Ilfracombe Gdns, Whitley Bay, Tyne/Wear NE26 3LZ

■ AM radio R1155, T1154 etc, manuals also. Plugs, leads, anything connected with these, however small, any condition. Tony Howard. Tel: (0908) 73114

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■ Commodore 64 and cassette recorder in good condition. Also interested in joystick and games for same. Details and price to Mark Kingston, 5 Merval Crescent, Clareview, Limerick, Ireland. Tel: (061) 54839

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	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 International 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

ADVERTISERS INDEX

Radio & Electronics World
The communications and electronics magazine

ADVERTISING RATES & INFORMATION

DISPLAY AD RATES

depth mm x width mm	ad space	1 issue	series rates for consecutive insertions: 3 issues	6 issues	12 issues
61 x 90	⅛page	£91.00	£86.00	£82.00	£73.00
128 x 90 or 61 x 186	¼ page	£160.00	£150.00	£145.00	£125.00
128 x 186 or 263 x 90	½ page	£305.00	£290.00	£275.00	£245.00
263 x 186	1 page	£590.00	£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

depth mm x width mm	ad space	1 issue	series rates for consecutive insertions: 3 issues	6 issues	12 issues
128 x 186 or 263 x 90	½ 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: 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
Apr 87	12 Feb 87	18 Feb 87	20 Feb 87	12 Mar 87
May 87	12 Mar 87	18 Mar 87	20 Mar 87	9 Apr 87
Jun 87	16 Apr 87	22 Apr 87	24 Apr 87	14 May 87
July 87	14 May 87	20 May 87	22 May 87	4 Jun 87

CONDITIONS & INFORMATION

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.

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.

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.

FOR FURTHER INFORMATION CONTACT
Radio & Electronics World, Sovereign House, Brentwood, Essex CM14 4SE.
(0277) 219876

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.

£1 BAKERS DOZEN PACKS

Price per pack is **£1.00.*** Order 12 you may choose another free. Items marked (sh) are not new but guaranteed ok

1. 5 – 13 amp ring main junction boxes
2. 5 – 13 amp ring main spur boxes
4. 5 – surface mounting
5. 3 – electrical switches, white flush mounting
7. 4 – in flex ling switches with neons
9. 2 – mains transformers with 6V 1A secondaries
10. 2 – mains transformers with 12V ½A secondaries
11. 1 – extension speaker cabinet for 6½" speaker
13. 12 – glass reed switches
17. 2 – ultrasonic transmitters and 2 receivers with circuit
19. 2 – light dependent resistors
25. 4 – wafer switches – 6p 2 way, 4p 3 way, 2p 6 way, 2p 5 way, 1p 12 way small one hold fixing and good length ¼ spindle your choice
28. 1 – 6 digit counter mains voltage
30. 2 – Nicad battery chargers
31. 1 – key switch with key
33. 2 – aerosol cans of ICI Dry Lubricant
34. 96 – 1 metre lengths colour-coded connecting wire
39. 1 – long and medium wave tuner kit
41. 8 – rocker switch 10 amp mains SPST
45. 1 – 24 hour time switch mains operated (s.h.)
49. 10 – neon valves – make good night lights
50. 2 – 12V DC or 24V AC, 3 CO relays
51. 1 – 12V 2 CO miniature relay very sensitive
52. 1 – 12V 4 CO miniature relay
54. 10 – rows of 32 gold plated IC sockets (total 320 sockets)
55. 1 – locking mechanism with 2 keys
56. 1 – miniature uniselector with circuit for electric jigsaw puzzle
60. 5 – ferrite rods 4" × 5/16" diameter aerials
61. 4 – ferrite slab aerials with L & M wave coils
63. 1 – Mullard thyristor trigger module
66. 1 – magnetic brake – stops rotation instantly
67. 1 – low pressure 3 level switch can be mouth operated
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 your choice
77. 1 – time reminder adjustable 1-60 mins clockwork
85. 1 – mains shaded pole motor ¾" stack – ¼" shaft
89. 1 – mains motor with gear box 1 rev per 24 hours
91. 2 – mains motors with gear box 16 rpm
96. 1 – thermostat for fridge
98. 1 – motorised stud switch (s.h.)
101. 1 – 2½ hours delay switch
103. 1 – mains power supply unit – 6V DC
104. 1 – mains power supply unit – 4½V DC
107. 1 – 5" speaker size radio cabinet with handle
112. 1 – heating pad 200 watts mains
114. 1 – 1W amplifier Mullard 1172
115. 1 – wall mounting thermostat 24V
118. 1 – teak effect extension 5" speaker cabinet
120. 2 – p.c. boards with 2 amp full wave and 17 other recs
121. 4 – push push switches for table lamps etc.
122. 10 – mtrs twin screened flex white p.v.c. outer
124. 25 – clear plastic lenses 1¾ diameter
127. 4 – pilot bulb lamp metal clip on type
128. 10 – very fine drills for pcbs etc.
129. 4 – extra thin screw drivers for instruments
132. 2 – plastic boxes with windows, ideal for interrupted beam switch
134. 10 – model aircraft motor – require no on/off switch, just spin to start
137. 1 – 6½" 4 ohm 10 watt speaker
142. 10 – 4 BA spanners 1 end open, other end closed
145. 2 – 4 reed relay kits 3V coil normally open or c/o if magnets added
146. 20 – pilot bulbs 6.5V 3A Philips
154. 1 – 12V drip proof relay – ideal for car jobs
155. 3 – varicap push button tuners with knobs
169. 4 – short wave air spaced trimmers 2-30f
172. 10 – 12V 6W bulbs Philips m.e.s.
178. 3 – oblong amber indicators with lilliputs 12V
180. 6 – round amber indicators with neons 240V
181. 100 – p.v.c. grommets ⅜ hole size
182. 1 – short wave tuning condenser 50 pf with ¼" spindle
184. 1 – three gang tuning condenser each section 500 pf with trimmers and good length ¼" spindle
188. 1 – plastic box sloping metal front, 16 × 95mm average depth 45min
193. 6 – 5 amp 3 pin flush sockets brown
195. 5 – B.C. lampholders brown bakelite threaded entry
196. 1 – in flex simmerstat for electric blanket soldering iron etc.
197. 2 – thermostats, spindle setting – adjustable range for ovens etc
199. 1 – mains operated solenoid with plunger 1" travel
200. 1 – 10 digit switch pad for telephones etc.
201. 8 – computer keyboard switches with knobs, pcb or vero mounting
206. 20 – mtres 80 ohm, standard type co-ax off white
211. 1 – electric clock mains driven, always right time – not cased
216. 1 – stereo pre-amp Mullard EP9001
232. 2 – 12V solenoids, small with plunger
236. 1 – mains transformer 9V 1 amp secondary C core construction
241. 1 – car door speaker (very flat) 6½" 15 ohm made for Radiomobile
241. 2 – speakers 6" × 4" 4 ohm 5 watt made for Radiomobile
243. 2 – speakers 6" × 4" 16 ohm 5 watt made for Radiomobile
244. 1 – mains motor with gear-box very small, toothed output 1 rpm
245. 4 – standard size pots, ¼ meg with dp switch
249. 1 – 13A switched socket on double plate with fused spur
266. 2 – mains transformers 9V ½A secondary
267. 1 – mains transformers 15V 1A secondary p.c.b. mounting
291. 1 ten turns 3 watt pot ¼ spindle 100 ohm
296. 3 car cigar lighter socket plugs
298. 2 15 amp round pin plugs brown bakelite
300. 1 mains solenoid with plunger compact type
301. 10 ceramic magnets Mullard 1" × 3/8 × 5/16
303. 1 12 pole 3 way ceramic wave charge switch
305. 1 tubular dynamic microphone with desk rest
308. 1 T.V. turret tuner (black & white T.V.)
310. 2 oven thermostats
313. 5 sub miniature micro switches
314. 1 12" 8 watt min fluorescent tube white
315. 1 6" 4 watt min fluorescent tube white
316. 1 round pin kettle plug with moulded on lead
453. 2 – 2½ in. 80ohm loudspeakers
454. 2 – 2½ in. 8ohm loudspeakers

FROZEN PIPES Can be avoided by winding our heating cable around them, 15 mtrs connected to mains cost only about 10p per week to run. Hundreds of other uses as it is waterproof and very flexible. Resistance 60ohms/metre. Price 28p/metre or 15m for £3.95.

CAR STARTER/CHARGER KIT

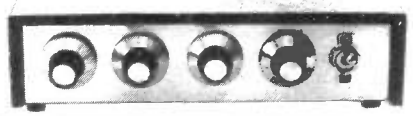
Flat Battery! Don't worry you will start your car in a few minutes with this unit – 250 watt transformer 20 amp rectifiers, case and all parts with data **£17.50** post £2

Ex-Electricity Board. Guaranteed 12 months.

VENNER TIME SWITCH

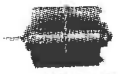
Mains operated with 20 amp switch, one on and one off per 24 hrs. repeats daily automatically correcting for the lengthening or shortening day. An expensive time switch but you can have it for only **£2.95** without case, metal case – **£2.95**, adaptor kit to convert this into a normal 24hr. time switch but with the added advantage of up to 12 on/offs per 24hrs. This makes an ideal controller for the immersion heater. Price of adaptor kit is **£2.30**.

SOUND TO LIGHT UNIT



Complete kit of parts of 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 ¼" 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.

12 volt MOTOR BY SMITHS



Made for use in cars, etc. these are very powerful and easily reversible. Size 3½" long by 3" dia. They have a good length of ¼" spindle –
1/10 hp **£3.45**
1/8 hp **£5.75**. 1/6 hp **£7.50**

25A ELECTRICAL PROGRAMMER

Learn in your sleep. Have radio playing and kettle boiling as you wake – switch on lights to ward off intruders – have a warm house to come home to. You can do all these and more. By a famous maker with 25 amp on/off switch. A beautiful unit at **£2.50**

THIS MONTH'S SNIP

BENCH ISOLATION TRANSFORMER. Torroidal wound 400 watt but very compact. Has a separate 10V winding which can be added or subtracted to give fine voltage control. Normally £40, our price £10 plus £2 post, ref 10P9.

TANGENTIAL BLOWER HEATERS

We can supply:
1-2KW—quite definitely the smallest tangential blow heater we have ever had, measuring approx. 6 × 6 × 4. This could be just the thing for a small bedroom or to fit under desk or table if you suffer from cold legs. In addition to normal heating functions if put into a simple enclosure this could be a pipe unfreezer (much safer than a blow lamp) possibly even a paint stripper, hair dryer or hand dryer. Price is £5, plus £1 post, ref 5P23.
2-5KW—width approx. 8" (plus motor), elements made up of two 1-2kw sections, so with switch supplied you can have 2kw, 1kw or cold blow. Over heat cut-out eleminates fire risk should fan stop or air flow be impeded. Fan blades are metal. Price £5 plus £1.50 post, ref 5P62.
3KW—width approx. 13" plus motor, element made up of 1kw and 2kw section, supplied with 4 section rocker switch, allowing 3kw, 2kw, 1kw and cold blow. Price £6.95 plus £2.00 post.
2KW D.I.Y. SPECIAL—if you want a really cheap tangential heater, this is your opportunity, made for 115v mains, to use it on 230v. Simply join elements in series, needs only simple on/off switch, as you will only have one heat level 2kw and no cold blow. Price £2 plus £1 post, ref 2P66.
VERY LOW RUNNING COST—only a 300w element. So would cost only approx. 1½p per hour to run. Should be enough for an airing cupboard or a hot box for seed germination. Might even be enough to keep a damp corner dry. Normal construction approx. 4½" plus motor wide. Price £5 plus £1 post, ref 5P78.
500W–115V TRANSFORMER to isolate you or yours from mains to earth shock dangers. We are able to offer these transformers at less than the price of an auto transformer. Our price for the 500w mains to 115v isolation transformer is £10 plus £5 post, ref 10P6.
RESIN CURED FILLER/BUILDER/STICKER made by the famous Holts company, suitable for repairs, not only to car bodies but also to sinks and wash basins, water tanks, drain pipes and gutters, tiles, roofs, filling holes in walls and concrete, repairing cracks in gates, window frames, etc. etc. It is weather resistant and adheres well to metals, wood, concrete and some plastics. Special bargain price 2 large tubes for £1, ref BD464.
STEPPER MOTOR. By American Phillips corporation. Step angle 7.5°. Coil resistance 27 ohms. Operating volts 10–14. Size approx. 2½" dia by 1⅞" deep on a square mounting plate. This is in fact two bi-directional motors with P.M. rotors. Applying correct pulse causes a 7.5° step angle of spindle. Number of steps through which it rotates and a speed at which it rotates is determined by the applied impulses. Properly used this provides an ideal method of speed and position control. Brand new and unused price £5, ref 5P81.
BIG GLASS FIBRE SHEETS. Virtually unbreakable, size 4' × 3' approx. Flat, approx. 1/16" thick. Intended for pcb's but ideal for roof repairs, car port, greenhouse etc. £2 each. Minimum quantity we can despatch is 10. Carriage cost £6.50 per 10. £8.50 for 15.

IONISER KIT

Refresh your home, office, shop, work room, etc. with a negative ION generator. Makes you feel better and work harder – a complete mains operated kit, case included. **£11.95** plus £2.00 post.

TELEPHONE BITS

Master socket (has surge arrestor – ringing condenser etc) and takes B.T. plug **£3.95**
Extension socket **£2.95**
Dual adaptors (2 from one socket) **£3.95**
Cord terminating with B.T. plug 3 metres **£2.95**
Kit for converting old entry terminal box to new B.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**

MINI MONO AMP on p.c.b. size 4" × 2" (app.)

Fitted volume control and a hole for a tone control should you require it. The amplifier has three transistors and we estimate the output to be 3W rms. More technical data will be included with the amp. Brand new, perfect condition, offered at the very low price of **£1.15 each, or 13 for £12.00**

£2 POUNDERS*

2P2 – Wall mounting thermostat, high precision with mercury switch and thermometer
2P3 – Variable and reversible 8-12v psu for model control
2P4 – 24 volt psu with separate channels for stereo made for Mullard UNILEX
2P6 – 100W mains to 115V auto-transformer with voltage tappings
2P8 – Mains motor with gear box and variable speed selector. Series wound so suitable for further speed control
2P9 – Time and set switch. Boxed, glass fronted and with knobs. Controls up to 15 amps. Ideal to program electric heaters
2P10 – 12 volt 5 amp mains transformer
2P12 – Disk or Tape precision motor – has balanced rotor and is reversible 230v mains operated 1500 rpm
2P14 – Mug Stop kit – when thrown emits piercing squawk
2P15 – Interrupted Beam kit for burglar alarms, counters, etc.
2P17 – 2 rev pr minute mains driven motor, ideal to operate mirror ball
2P18 – Liquid/gas shut off valve mains solenoid operated
2P19 – Disco switch-motor drives 6 or more 10 amp change over micro switches supplied ready for mains operation
2P20 – 20 metres extension lead, 2 core – ideal most Black and Decker garden tools etc
2P21 – 10 watt amplifier, Mullard module reference 1173
2P22 – Motor driven switch 20 secs on or off after push
2P26 – Counter resettable mains operated 3 digit
2P27 – Goodmans Speaker 6 inch round 8ohm 12 watt
2P28 – Drill Pump – always useful couples to any make portable drill
2P31 – 4 metres 98 way interconnecting wire easy to strip
2P32 – Hot Wire amp meter – 4½ round surface mounting 0–10A – old but working and definitely a bit of history
2P34 – Solenoid Air Valve mains operated
2P38 – 200 R.P.M. Geared Mains Motor 1" stack quite powerful, definitely large enough to drive a rotating aerial or a tumbler for polishing stones etc.
2P43 – Small type blower or extractor fan, motor inset so very compact, 230V
2P46 – Our famous drill control kit complete and with prepared case.
2P49 – Fire Alarm break glass switch in heavy cast case
2P51 – Stereo amplifier, 3w per channel
2P55 – Mains motor, extra powerful has 1½" stack and good length of spindle
2P62 – 1 pair Goodmans 15 ohm speakers for Unilox
2P64 – 1 five bladed fan 6½" with mains motor
2P66 – 1 2Kw tangential heater 115v easily convertible for 230V
2P67 – 1 12v–0–12v 2 amp mains transformer
2P68 – 1 15v–0–15v 2 amp mains transformer
2P69 – 1 250v–0–250v 60 mA & 86.3v 5A mains transformer + 50p post
2P70 – 1 E.M.I. tape motor two speed and reversible
2P72 – 1 115v Muffin fan 4" × 4" approx. (s.h.)
2P75 – 1 2 hour timer, plugs into 13A socket
2P82 – 9v–0–9v 2 amp mains transformer
2P84 – Modern board with press keys for telephone redialler
2P85 – 20v–0–20v ½A Mains transformer
2P88 – Sangamo 24 hr time switch 20 amp (s.h.)
2P89 – 120 min. time switch with knob
2P90 – 90 min. time switch with edgewise engraved controller
2P94 – Telephone handset for EE home telephone circuit
2P95 – 13A socket on satin chrome plate
2P97 – mains transformer 24V 2A upright mounting
2P98 – 20m 4 core telephone cable, white outer
2P99 – 500 hardened pin type staples for telephone cable
2P101 – 15V mains transformer 4A upright mounting
2P105 – capillary type thermostat for air temperature with c/o switch
2P108 – mains motor with gear box giving 110rpm
2P109 – 5" wide black adhesive pvc tape 33m, add £1 post if not collecting

OVER 400 GIFTS YOU CAN CHOOSE FROM

There is a total of over 400 packs in our Baker's dozen range and you become entitled to a free gift with each dozen pounds you spend on these packs.

A classified list of these packs and our latest "News Letter" will be enclosed with your goods, and you will automatically receive our next news letters.

£5 POUNDERS*

5P1 12 volt submersible pump complete with a tap and switch, an ideal caravan unit
5P2 Sound to light kit complete in case suitable for up to 750 watts.
5P3 Silent sentinel ultra sonic transmitter and receive kit, complete.
5P6 12V alarm bell with heavy 6" gong, suitable for outside if protected from direct rainfall. Ex GPO but in perfect order.
5P12 Equipment cooling fan – mini snail type mains operated.
5P13 Ping pong ball blower – or for any job that requires a powerful stream of air – ex computer. Collect or add £2 post.
5P15 – Uniselector 4 pole, 25 way 50 volt coil
5P18 – motor driven water pump as fitted to many washing machines
5P20 – 2 kits, matchbox size, surveilance transmitter and FM receiver
5P23 – miniature (appr. 2½" wide) tangential blow heater, 1-2kw
5P24 – ½hp motor, ex computer, 230V, mains operation 1450rpm. If not collect add £3 post
5P25 – special effects lighting switch. Up to 6 channels of lamps can be on or off for varying time periods
5P27 – cartridge player 12V, has high quality stereo amplifier
5P28 – gear pump, mains motor driven with inlet and outlet pipe connectors
5P32 – large mains operated push or pull solenoid. Heavy so add £1.50 post
5P34 – 24V 5A toroidal mains transformer
5P35 – modern board from telephone auto dialler, complete with keypad and all ICs
5P37 – 24 hour time switch, 2 on/offs and clockwork reserve, ex Elec. Board loading up to 50A. Add £1 post
5P41 – 5" extractor fan, very quiet runner (s.h.), gntd 12 mths.
5P48 – telephone extension bell in black case, ex-GPO
5P51 – 200W auto transformer 230V to 115V torroidal
5P52 – mains transformer 26V 10A upright mounting, add £2 post
5P54 – mains motor with gear box, final speed 5rpm
5P58 – Amstrad stereo tuner FM and LM and S. AM
5P60 – DC Muffin type fan 18 to 27V, only 3W
5P61 – drill pump mounted on frame, coupled to mains motor
5P62 – 2½kw tangential blow heater, add £1.50 post if not collecting
5P73C high pressure mains operated gas or water valve with tube connection suitable soldering
5P74 6rpm 60W mains motor and gearbox with instant stop
5P79 30rpm 80 watt mains driven motor with gearbox
5P82 1 25rpm mains 60w motor with gearbox
5P84 1 delay time switch, adjust 0–20 seconds
7P1 1 instant heat solder gun—mains with renewable tip and job light
10P10 1 9" extractor fan 115V so supplied with adaptor

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.

J & N BULL ELECTRICAL

Dept RE, 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. **Bulk orders:** write for quote.

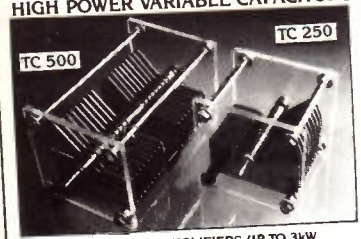
TELECOMMS BUMPER CATALOGUES

CB £1
AMATEUR £1
934 MHz £1

Each catalogue is packed full of info. and includes a £2 voucher.

NEVADA AMATEUR PRODUCTS

HIGH QUALITY BRITISH MADE
HIGH POWER VARIABLE CAPACITORS

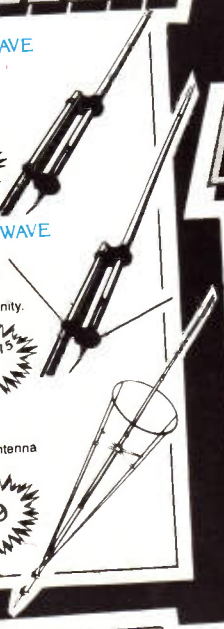


IDEAL FOR ATU's OR AMPLIFIERS UP TO 3kW

TC500 Variable capacitor
CAPACITY:- 26-500 pF
VOLTAGE:- 7.8kV Max
SIZE:- 101 x 105 x 165mm
AIR GAP:- 2mm
£28 plus £2 p&p

TC250 Variable capacitor
CAPACITY:- 13-250 pF
VOLTAGE:- 7.8kV Max
SIZE:- 101 x 105 x 88mm
AIR GAP:- 2mm
£19.95 plus £1 p&p

29 MHz BASE ANTENNAS



NEVADA TC52 ½ WAVE
This top class half wave uses high grade aluminium and a low loss coil handling up to 1 KW.
WIND RESISTANCE:-75 MPH
GAIN:- 2.5 dB
FREQ:- 28-30MHz
£19.95
plus £4 p&p

NEVADA TC58 5/8 WAVE
Using high grade aluminium and a low loss coil complete with small radials this antenna is our most popular amongst the 29MHz fraternity.
POWER:- 1kW
GAIN:- 3.5 dB
FREQ:- 28-30MHz
LENGTH:- 6.6 MTRS
£29.75
plus £4 p&p

SALIUT 3/4 WAVE
Using a unique base hoop this antenna offers exceptional ground wave coverage on 10 FM
POWER:- 2kW
GAIN:- 4.5 dB
FREQ:- 28-30MHz
LENGTH:- 9.1 MTRS
£59
plus £4 p&p

2 MTR EQUIPMENT

2 MTR HANDHELD

CT1600 A superbly sensitive new handheld covering 142-149MHz
- Repeater shift
- High/low power 1.5/0.5 Watt
- Thumbwheel selector

£179

Each set supplied C/W re-chargeable battery pack and free mains charger unit.

VHF MOBILE AMP

B110 144MHz 110 Watt W/Pre Amp.	£169
B42 144MHz 40 Watt	£64.66
LA05435 144MHz 45 Watt	£69.75

Full range of 144 MHz mobile amplifiers in stock see our Ham Catalogue.

RF AMPLIFIERS

All amplifiers except broadband models are tuned for 29.6MHz centre freq. Should you require a lower freq. i.e. 28.5MHz please state when ordering. Export models available for 26-30MHz.

MOBILE AMPLIFIERS

C.T.E. MOD 767
76 Watts FM
INPUT:- 0.5-10 Watts
SWITCHABLE:- Class AB, Class C
SUPPLY:- 13.8 Volt
REMOTE CONTROL FACILITY
£49.90

C.T.E. MOD 737 50W FM AM/SSB/CW	£44.76
C.T.E. MOD 767 80W FM AM/SSB/CW	£49.90
C.T.E. MOD 757 150W FM Broadband	£116.87
ZETAGI B35 25W FM 26-30MHz	£22.23
ZETAGI B150 70W FM 26-30MHz	£49.96
ZETAGI B300 150W FM (2-30MHz)	£136.00
NEVADA TC35 30W FM 26-30MHz	£23.75

MAINS OPERATED AMPLIFIERS

C.T.E. DC9 Solid State 150W FM (Broadband)	£199.31
ZETAGI B132 150W FM Solid State (Broadband)	£119.00

SCANNING RECEIVERS

C.T.E. DISCONE WIDEBAND ANTENNA £26

RECEIVE	70-700 MHz
TRANSMIT	70-500MHz
MAX POWER	500W
GAIN	3.5dB

WIDEBAND DISCONE RECEIVING ANTENNA
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Receives 8 bands plus aircraft band. 16 Channels, priority keyboard lock and lighted display.
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Base receiver covers:-
66-88MHz
118-174MHz
406-512MHz
with 16 channel memory/scan

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Direct access communications 10KHz-30MHz with 10 channel micro-processor controlled memory.

TEST EQUIPMENT

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RF DUMMY LOAD AND POWER METER
A very accurate unit for the service dept. or discerning enthusiast.
FREQ:- 0.5MHz-500MHz
POWER:- 150 Watt Max in 3 ranges 0-3, 0-15, 0-150W.
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SWR AND POWER METER
For the enthusiast who wants the very best. A twin meter unit with push button control for either 75 OHM or 50 OHM cable.
FREQ:- 3-200MHz
POWER:- Up to 2kW
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FD 1350 1.3GHz FREQUENCY COUNTER
FREQ:- 10Hz-1.35GHz
SENSITIVITY:- 43mV at 1GHz
DISPLAY:- 8 Digit
SUPPLY:- 9-12 Volt DC.
£139.53

NEVADA

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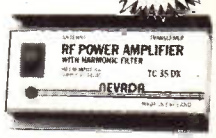
INPUT:- 1-4 Watts
OUTPUT:- 25-30 Watts
SUPPLY:- 13.8V DC
FREQ.- 26-30 MHz



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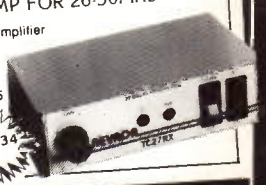

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