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The communications, electronics & computers magazine

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Radio & Electronics World
The communications, electronics & computers magazine

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REGULAR FEATURES

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CHANGE IN PUBLICATION DATE

We are changing from Friday to a Thursday publication date with effect from the July, 1984, issue of *R&EW*. This means that the July issue will be on sale from 14th June

We regret to inform readers that due to continually rising production costs and to enable us to maintain the high standard of content in R&EW the price of the magazine will be 90p from this issue. This is your last chance to subscribe at the old rate. See page 80

See pages 59 and 60

COVER PICTURES
Top left: Low cost frequency standard
Top right: A Russian TV announcer
Centre left: Dual trace oscilloscope
Centre right: Digital multimeters
Bottom: Amateur TV picture

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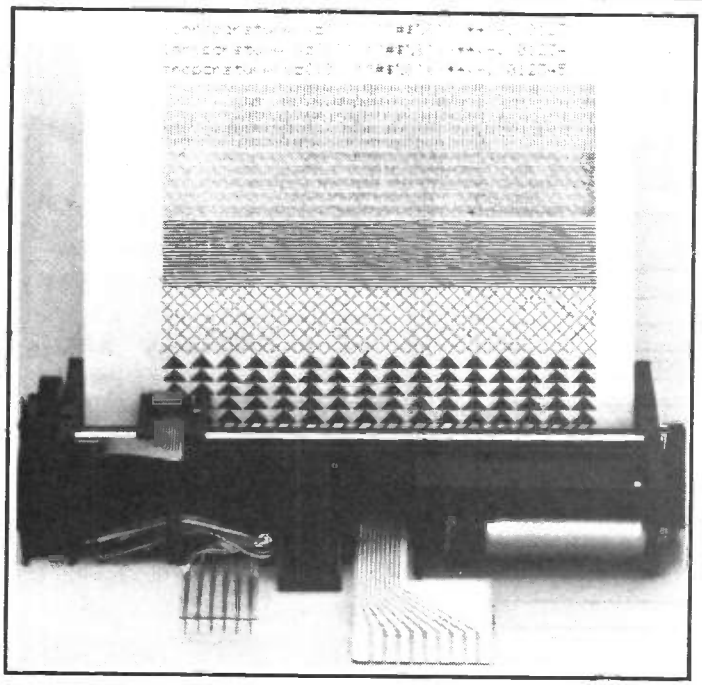
PRODUCT NEWS

Featured on these pages are details of the latest products in communications, electronics and computers. Manufacturers, distributors and dealers are invited to supply information on new products for inclusion in Product News
Readers, don't forget to mention ***Radio & Electronics World*** when making enquiries



TWO NEW PRINTER MECHANISMS

Two new printer mechanisms have been launched by Epson (UK) Ltd – the M-170 (see photo), a 40-column capacity dot matrix printer and the M-1200 thermal printer.

The M-1200 represents a major breakthrough for Epson by bringing the installed cost for thermal printer mechanisms down to a level which will appeal to the home computer marketplace. The M-1200 has a 40-column printing capacity, uses 112mm width thermal paper and offers both text and graphic mode with print speeds of 45cps and 0.41ps respectively. The unit is compact, measuring 139mm wide x 45mm deep x 23.5mm high and a wide range of applications includes intelligent instrumentation, home computers and mini and portable terminal printers. The unit will cost £23 (based on quantities of 1,000).

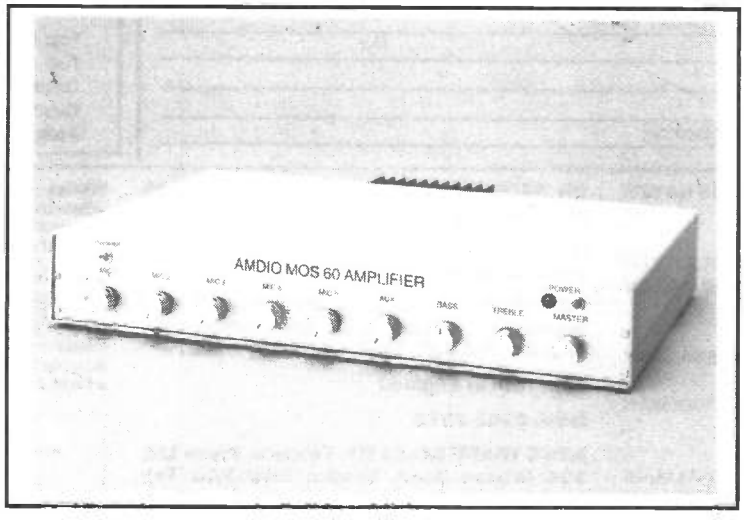
The new M-170 is a true 40-column capacity plain paper printer with full dot graphics capability. It is an extension of Epson's successful M-160 series offering all the same benefits of clear dot printing, low price, and compact size with the additional advantage of accepting normal paper of up to 69.5mm in width.

The M-170 prints at 0.4 lines per second and will be available for £21 (based on quantities of 1,000).

NEW AMDIO 60-WATT AMPLIFIER

Amdio have just released a 60 watt MOSFET amplifier and will have a 120 watt version available in the late summer. Amdio have found that there is a market for an amplifier with 5 microphone inputs and 1 auxiliary input at an inexpensive price. The microphone inputs are balanced line with XLR sockets with transformers. There is automatic override for microphone 1.

The output is 60 watts RMS into 8 ohms or 100 volt line and MOSFET's are used in the output stages. MOSFET offer excellent performance, low temperature operation and a fast slew rate. They are inherently free of crossover distortion and thermal runaway which results in this range of amplifiers being of very high quality and reliability.



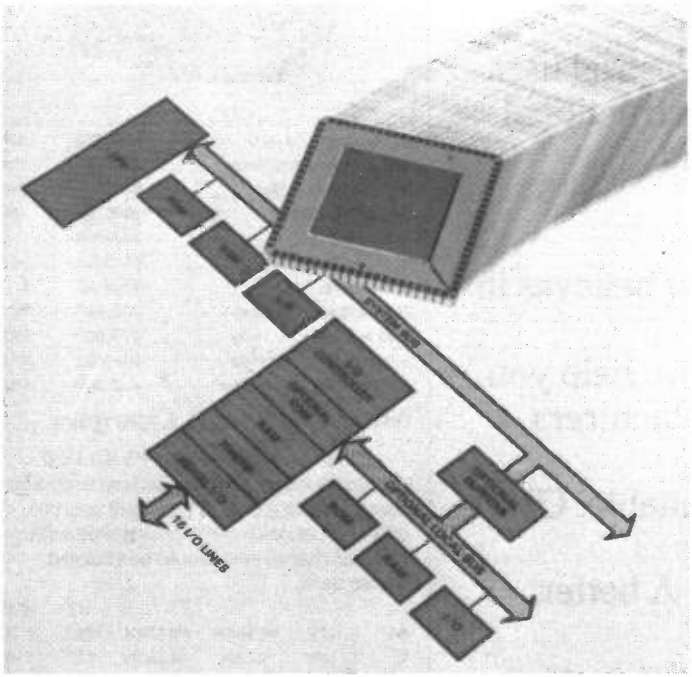
The 60 watt amp was designed for installations such as churches and conference use where up to 5 microphones are required. The amplifier retails at £360 plus VAT, and is available from stock. *Details from: AMDIO LTD, 26-28 Reading Road South, Fleet, Aldershot, Hants. Tel: (02514) 20567.*

PRODUCT NEWS

MOSTEK 16-BIT SINGLE CHIP MICROCOMPUTER

Mostek Corporation announces a new high-performance 16-bit single-chip microcomputer that can be configured either as an embedded stand-alone controller in a single-chip mode or as an intelligent peripheral controller in an expanded bus mode.

Designated the MK68200, the new component implements an architecture with an advanced 16-bit instruction set which offers high-speed execution and code space efficiency along with extensive on-chip I/O capabilities. Included in the instruction set are powerful bit-manipulation, extensive BCD arithmetic and high-speed multiply/divide operations. As an embedded stand-alone controller, this advanced NMOS device is designed for high-performance applications such as industrial controls, robotics and instrumentation.



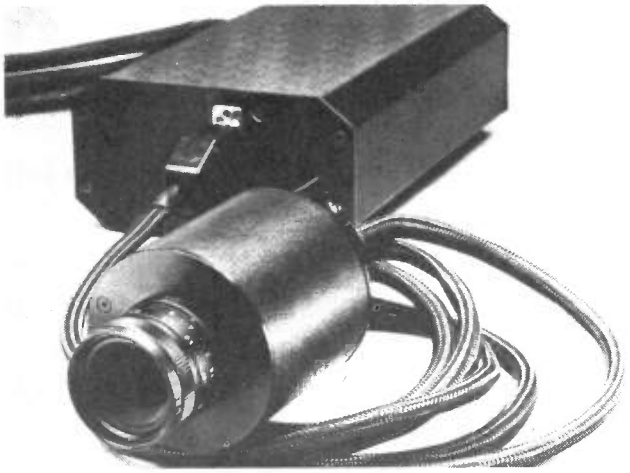
ELECTROSTATIC FIELDMETER

A new high sensitivity, auto-ranging electrostatic fieldmeter, the JCI 101, has been developed by John Chubb Instrumentation – UK Specialists in electrostatics and electrostatic instrumentation. This fieldmeter gives stable and accurate measurement of electric fields in the vicinity of 'static' charges on insulating or conducting surfaces.

The fieldmeter is designed to investigate and monitor static. Static can cause problems of material handling, attraction of dirt and shock risk to personnel in the plastics, textile, paper and packaging industries. In the microelectronics industry even low levels of static can damage sensitive semiconductor devices in manufacture and during printed circuit board assembly and handling. The high sensitivity of the instrument enables low levels of charge and low voltages to be measured remotely and without contact to the surface. Voltages as low as 100 volts can easily be observed on a person at a distance of 1 metre.

The JCI 101 fieldmeter is compact, light and easy to use for handheld investigatory studies around industrial plant and the definite, stable response with the auto-ranging liquid crystal display ensures reliable and unambiguous readings.

The front of the instrument is provided with a simple bayonet pin arrangement around the sensing aperture for easy mounting of additional units to expand the range of application of the instrument. One such unit is a guard plate to assist interpretation of measurements of charge densities on plastic webs – another is a Faraday Pail for the measurement of charge on small items.



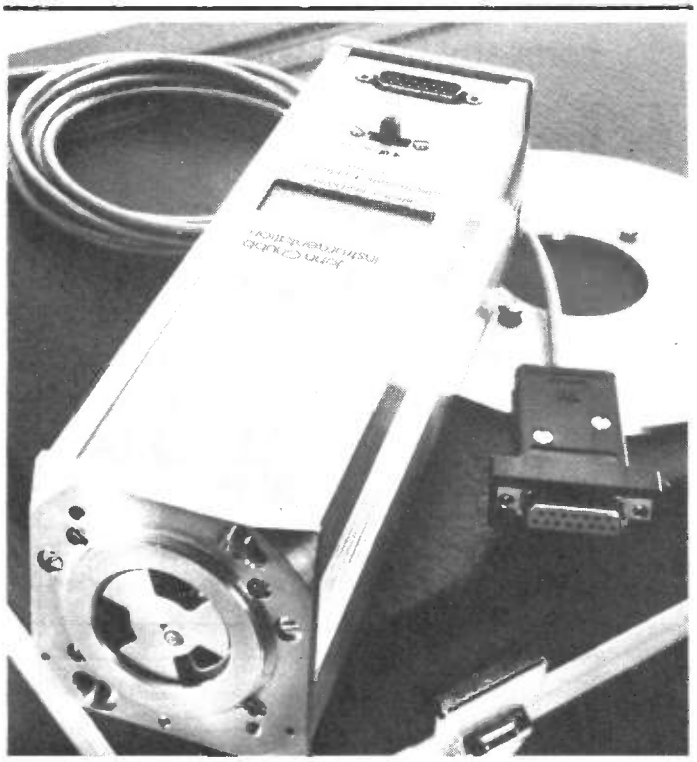
SOLID-STATE TV CAMERAS

Industrial Monitoring Equipment Ltd have recently introduced a comprehensive range of solid-state cameras developed from charge-coupled devices. The development of practical cost-effective vision systems is a recent phenomenon and they are now able to offer relatively low cost video cameras for robotic vision.

The new silicium solid-state sensor technology provides many advantages including high reliability, control of lighting variation by the use of an anti-blooming device, fast image capture speeds and no image blurring when the camera is moved quickly.

The NUMEVISION concept provides the user with an entire range of modular image acquisition and processing systems. Each system is built upon a basemodel depending on the CCD used. It is completed with electronic modules which are specific to precise applicational requirements.

For further information contact: *Industrial Monitoring Equipment Limited, Penn House, Penn Place, Rickmansworth, Herts, WD3 1SN.*



The JCI 101 Electrostatic Fieldmeter is part of the broad range of electrostatic instruments available from John Chubb instrumentation. For further information on this and other instruments available from JCI contact: *Dr J N Chubb, Unit 30, Lansdown Industrial Estate, Gloucester Road, Cheltenham. Tel: 0242-573347*

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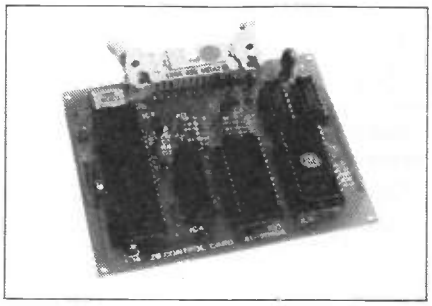


C12 Computer Cassette	21-00012	0.55
BBC to Centronics Printer	03-10019	7.25
BBC to 25 way D Male	03-10021	4.50
25 way D Socket	10-25200	1.90
25 way D Plug	10-25100	1.30
Cover for 25 way D	10-25322	0.93
20 up Eprom Eraser	40-82100	31.25
Z80 A Industrial Controller	40-82000	49.95
6802 Industrial Controller	40-68020	49.95
6502 Industrial Controller	40-65020	49.95
Z8 Basic/Debug Controller	41-00904	50.00

Nicad Batteries & Chargers

Minimum life 600 (300 PP3 size) full charge/discharge cycles. Batteries must be charged from a constant current source only. All batteries are supplied only with a residual charge and should be charged before used.

				1-9	10-49
AA	1.2V	500mAH	01-12004	0.80	0.74
'C'	1.2V	2.2AH	01-12024	2.35	1.99
'D'	1.2V	4.0AH	01-12044	3.05	2.85
PP3	8.4V	110mAH	01-84054	3.70	3.50
CH1/22 PP3 Charger 11mA for 16 hours			01-00159		4.30
CH8/RX Multi-purpose Charger			01-02204		9.40

Will recharge AA, C, D and PP3 size cells with automatic voltage selection. Will recharge following combination: 6×D, 6×AA, 6×C, 2×PP3, 2×D+2×C, 2×D+2×AA, 2×D+1×PP3, 2×C+2×AA, 2×C+1×PP3, 2×AA+1×PP3.

Battery Adaptor	01-12001	0.96

Sold in pairs: one to convert AA size to C size and one to convert C to D size. Both may be used together to convert an AA to D size.

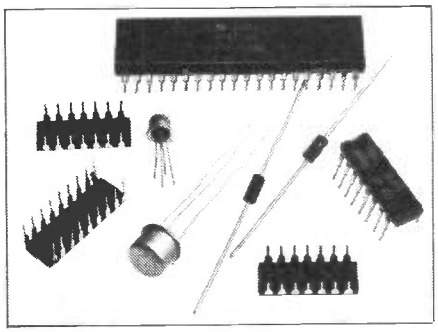
Semiconductors

Linear IC's

LM301AN	DIL version	61-03011	0.44
LM308CN	DIL version	61-03081	0.65
LM311CN	Popular comparator	61-00311	0.46
LM324	Low power quad op amp	61-03240	0.67
LM339N	Low power quad comparator	61-03390	0.68
LM346	Programmable quad op amp	61-00346	3.72
LF347	Quad Bi-FET op amp	61-00347	1.82
LM348	Quad 741 type op amp	61-03480	1.26
LF351	Bi-FET op amp	61-03510	0.49
LF353	Dual version of LF351	61-03530	0.76
LM380N	1W AF power amp	61-00380	1.00
NE555N	Multi-purpose low cost timer	61-05550	0.45

for a better service.

NE556N	Dual version of the 555	61-05560	0.50
uA741CN	DIL low cost op amp	61-07411	0.22
uA747CN	Dual 741 op amp	61-07470	0.70
uA748CN	741 with external frequency comp	61-04780	0.40
HA1388	18W PA from 14V	61-01388	2.75
TDA2002	8W into 2 ohms power amp	61-02002	1.25
ULN2283	1W max. 3-12V power amp	61-02283	1.00
MC3357	Low power NBFM IF system and detector	61-03357	2.85
ULN3859	Low current dual conversion NBFM IF and detector	61-03859	2.95
LM3900	Quad norton amp	61-39000	0.60
LM3909N	8-pin DIL LED flasher	61-39090	0.68
KB4445	Radio control 4 channel encoder and RF	61-04445	1.29
KB4446	Radio control 4 channel receiver and decoder	61-04446	2.75
ICM7555	Low power CMOS version of timer	61-75550	0.98
ICL8038CC	Versatile AF signal generator with sine/square/triangle OPs	61-08038	4.50
TK10170	5 channel version of KB4445	61-10170	1.87
HA12002	Protection monitor system for amps, PSUx, TXs etc	61-12002	1.22
HA12017	83dB S/N phono preamp 0.001% THD	61-12017	0.80
MC14412	300 baud MODEM controller (Eduro/US specs)	61-14412	6.85



Microprocessor & Memories

Z80A	Popular and powerful 8-bit CPU	26-18400	3.40
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6116-3	16K (2kx8) CMOS RAM 200nS	26-36116	6.68
Z6132-6	32K (4kx8) quasi RAM 350nS	26-06132	15.00
4116-2	16K (16kx1) 150nS	26-24116	1.59
2764	64K (8kx8) 450nS	26-02764	9.50
2732	32K (4kx8) 450nS	26-02732	5.70

Voltage Regulators

7805	5V 1A positive	27-78052	0.40
7812	12V 1A positive	27-78122	0.40
7815	15V 1A positive	27-78152	0.40
7905	5V 1A negative	27-79052	0.49
7912	12V 1A negative	27-79122	0.49
7915	15V 1A negative	27-79152	0.49

Transitors

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BC212	General purpose	58-00212	0.10
BC237	Plastic BC107	58-00237	0.08
BC238	Plastic BC108	58-00238	0.08
BC239	Plastic BC109	58-00239	0.08
BC307	Complement to BC237	58-00307	0.08
BC308	Complement to BC238	58-00308	0.08
BC309	Complement to BC239	58-00309	0.08
BC327	Driver/power stage	58-00327	0.13
BC337	Driver/power stage	58-00337	0.13
MPSA13	NPN Darlington	58-04013	0.30
MPSA63	PNP Complement to MPSA13	58-04063	0.30
J310	JFET for HF-VHF	59-02310	0.69
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3SK51	Dual gate MOSFET-VHF amp	60-04051	0.60
3SK88	Dual gate MOSFET-Ultra lo noise	60-04088	0.99
TIP31A	Output stage	58-15031	0.35
TIP32A	Complement to TIP31A	58-15032	0.35
VN66AF	VMOS Power FET	60-02066	0.95
ZTX3866	E-line version 2N3866	58-03866	0.45
IN4001	Rectifier diode	12-40016	0.06
IN4002	Rectifier diode	12-40026	0.07
IN4148	General purpose silicon	12-41486	0.05

Silicon Controlled Rectifiers

BRY55-100	100V .8A	52-55100	0.50
C106DI	400V 4.0A	52-00106	0.70
C122DI	400V 8.0A	52-00122	1.45

3mm Diameter LEDs

V178P	Red	15-01780	0.15
V179P	Green	15-01790	0.16
V180P	Yellow	15-01800	0.18

5mm Diameter LEDs

CQY40L	Red	15-10400	0.12
CQY72L	Green	15-10720	0.15
CQY74L	Yellow	15-10740	0.15

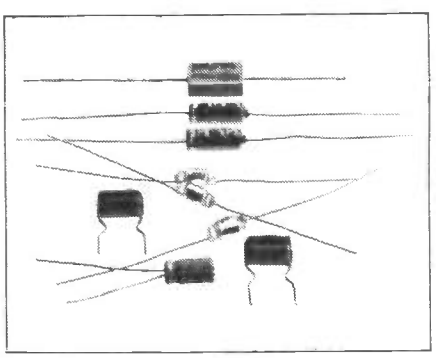
Infra-Red LEDs

CQY99	Emitter	15-10990	0.56
BPW41	Detector	15-30410	1.51

Tri Colour LED

V518	Orange-Green-Yellow	15-05180	0.60

Capacitors



Aluminium Electrolytics Radial PCB Mounting

			Pack of 4
10u	16V	05-10606	0.24
47u	16V	05-47606	0.28
47u	25V	05-47607	0.28
470u	6.3V	05-47705	0.36
470u	16V	05-47706	0.48

Tantalum Beads

			Each
1uf	35V	05-10501	0.18
10uf	16V	05-10601	0.28
47uf	6.3V	05-47601	0.45
47uf	16V	05-47602	0.92

Monolithic Capacitors

		Pack of 3
1n	04-10204	0.39
10n	04-10304	0.42
100n	04-10404	0.45

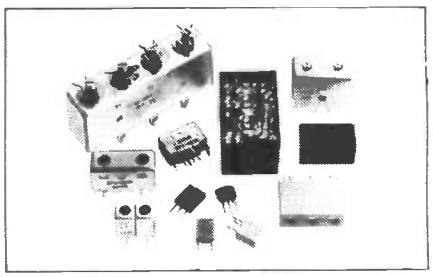
Low Voltage Disc Cermaic

		Pack of 5
1n	04-10203	0.20
10n	04-10303	0.20

Polyester (C280)

		Pack of 3
10n	04-10305	0.18
47n	04-47305	0.24
100n	04-10405	0.24
470n	04-47405	0.51
1uF	04-10505	0.66

R F Components



Filters

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Miniature 455kHz filters. I/P and O/P impedance 2K.

	-6dBW	-40dBW		
LFB6/CFU455H	6kHz	18kHz	16-45512	1.95
LFB12/CFU455F	12kHz	26kHz	16-45515	1.95
LFH6S/ CFW455HT	6kHz	14kHz	16-45525	2.45
LFG12S/ CFW455FT	12kHz	22kHz	16-45528	2.45
CFM2455A Mechanical IF Filters for 455kHz			19-45530	0.77

Crystal Filters 2 Pole Types

10M15A	10.7 Centre Freq.	20-10152	2.10
10MO8AA	10.695 Centre Freq.	20-11152	3.49

Inductors

We offer the complete Toko range of fixed and variable inductors. Over 500 coils from audio to V.H.F. See catalogue for details.

Soldering Irons (Antex)

CS240	Iron 240VAC 17 Watts	54-22300	5.20
XS-240	Iron 25W 240V High heat capacity	54-22500	5.40
SK6	Presentation pack of one XS-240 with ST4 stand	54-22510	7.20
MLXS	Handy 12V 15W soldering iron complete with crocodile clips and solder	54-20004	5.60

Please add 15% VAT to all advertised prices and 60p post and packing. Minimum order value £2 please. We reserve the right to vary prices in accordance with market fluctuation.

PRODUCT NEWS

TOOLHOLDERS

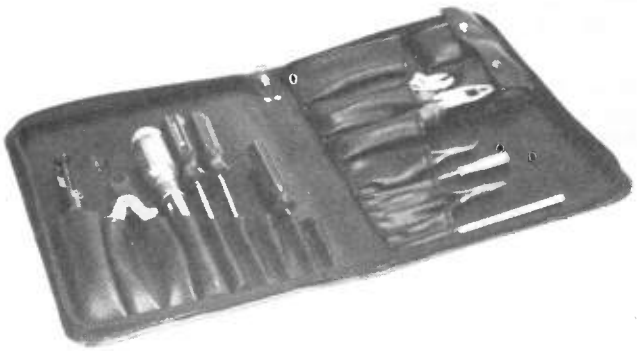
Having the right tools for the job is one thing – equally important is the need to carry them in a way that is most convenient, comfortable and accessible for the user.

Jarvis Manufacturing of Eastbourne have a great many years' experience in supplying toolholsters, cases, wallets, wire wrapping gun holsters, rolls and belts.

Whilst some of their products are based on a standard format, the great majority are produced – often in fairly small quantities – to meet specific requirements. The customer supplies a set of tools and consults with Jarvis on any special prerequisites, and Jarvis produce a prototype prior to manufacture.

Jarvis's capability in this field has seen their toolholders in use across a broad range of applications, including medicine, electronics, engineering, building construction office equipment servicing and electrical repairs.

For further information contact *Ken Wagstaff, Jarvis Manufacturing, 116 Seaside, Eastbourne. Tel: (0323) 638624.*



MULTIMETERS OFFER DIGITAL PERFORMANCE AT ANALOGUE COST

Now available from Semicomps are the Beckman T100 and T110 handheld digital multimeters at a price that competes with anolog equivalents (£49 and £59) but with the benefits of digital performance.

They feature an easy to read 3½ digit liquid crystal display with automatic polarity, decimal point and over-range indication and a maximum reading of 1999.

All functions and ranges are selected by a single rotary switch and are fully protected against overloads and transients and are shielded against external fields.

The T100 can be selected to read five ranges of dc and ac voltage, six ranges of dc and ac current, six ranges of high power resistance and five ranges of low power resistance. The T110 has all these range and function selections plus an instant continuity test facility in the form of a buzzer.

The multimeters are purpose-built for heavy duty using high quality components throughout including a CMOS integrated circuit.

LOW POWER DPM WITH DIGITAL HOLD

Lascar Electronics have announced the introduction of a low-cost, low-power LCD DPM with true digital hold of displayed reading. Consuming only 1mA from a 7-15V supply, the DPM10 features auto-polarity, auto-zero, 200mV FSD, low-battery indication, 12.5mm digit height and programmable decimal points. Connection to the 0.1in board pins can be by direct solder or with a connector (supplied). The meter can be easily rescaled by the user if required to indicate different voltages, currents or other engineering units. With its good accuracy and simple connections, this meter is particularly suited to high volume applications. Supplied with a bezel, mounting clips and connector, the DPM10 is the answer to many different measurement problems.

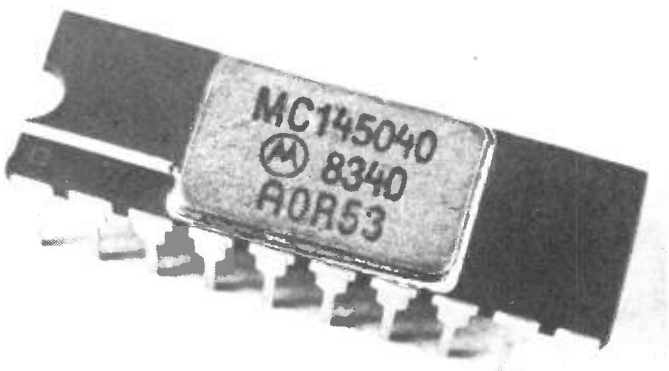
Details from: *Lascar Electronics Ltd, Module House, Whiteparish, Salisbury, Wiltshire Tel: (07948) 567.*

A/D CONVERTERS WITH SERIAL INTERFACE

Motorola Integrated Circuit Group announces availability of the MC145040/MC145041 analog-to-digital converters with serial interface. These devices are low cost, 8-bit A/D converters with serial interface ports that are compatible with SP1, Microwire and other similar interfaces.

The MC145040 offers the following features: wide operating supply voltage range of 4.0V to 6.0V for operation in NMOS as well as CMOS systems; wide operating temperature range of −55°C to +125°C; conversion rate of 16 microseconds for the standard part.

To further reduce the system cost, the MC145041 offers an on-chip oscillator that allows integration with low cost MCUs that do not output a clock signal. The inputs are TTL-compatible which can be driven with CMOS parts as well. The 20 pin DIP packages provide for 11 analog channels. These devices will also be offered in plastic quad packages. Contact your local Motorola sales office or distributor for further information.



NEW POWER MOSFET COLOUR BROCHURE

Ferranti Electronics Limited has issued a colour brochure highlighting its new generation of Power MOSFETS. Ferranti Power MOSFETS are especially suited to a wide range of switching and amplifying applications where high input impedance, high gain and fast switching speed is desired. The brochure gives fundamental MOSFET information with with aid of clear colour diagrams and compares the MOSFET with existing bipolar transistors. The MOSFET structure, its mode of operaion, its power handling capabilities and its advantages over bipolar transistors are noted.

Enquiries to: *John Fowler & Partners Limited, Ashbourne House, 334 Wellington Road North, Stockport SK4 5DA. Tel: 061-442 6060*

SOCKET TO ME MOULDED

Custom Cables International Limited, one of the first to mould 9, 15, 25, 37 'D' type connectors onto cables, now offer socket connectors moulded onto round cable.

The 'Moulded Sockets' are available on .100in x .100in grid spacing and a wide range of contact quantities, 10 – 64 ways, are available. The 'Moulded Socket' connector offers many advantages over the Standard Ribbon Cable Crimped Socket Connector. These include the very low price (up to 50% less in most cases), and the fact that they are very hard-wearing, (almost indestructable). Where frequent quick disconnect/reconnect capability is required, they will not come apart, can be used with screened cable, and are available in any length and any colour. Moulded Sockets are available from CCI along with moulded 'D' connectors and matching mating headers. Further information from: *Custom Cables International Ltd, Units 2, 3 and 4, Shire Hill Industrial Estate, Saffron Walden, Essex CB11 3AQ. Tel: (0799) 25014.*

QUICK REFERENCE PRODUCT GUIDE

Distributor Axiom Electronics Ltd has published its 1984 quick reference product guide and price list, with almost 200 pages of components, tools and instruments from Motorola, Sprague, Weller, Cooper Tools, Multicore and – for the first time – H & T Connectors. The guide contains more than 10,000 individual product lines, with the information organised using manufacturers' part numbers – which are also the Axiom order numbers – together with a product description, prices, and price break points. As well as the established range of products stocked in-depth by Axiom, the guide now contains full details of H & T components, including sockets and headers, which have recently been added to the Axiom portfolio.

Copies of the guide are available free from Axiom Electronics at *Turnpike Road, Cressex Industrial Estate, High Wycombe, Bucks HP12 3NR, Tel: (0494) 442181.*

LBO-308S OSCILLOSCOPE

The LBO-308S is a battery-/mains portable 20MHz dual trace oscilloscope. It has a high sensitivity of 2mV per division and full triggering facilities including a special circuit to ensure positive synchronisation with composite video signals. The LBO-308S can compare phase and levels plus addition or subtraction of two signals.

It is compact in size measuring only 120 x 235 x 320 and weighs 5Kg yet retains ruggedness to withstand the normal wear and tear of field service. A heavy duty carrying case is an available accessory. The LBO-308S is supplied complete with probes and internal rechargeable battery at a price of £569 + VAT.

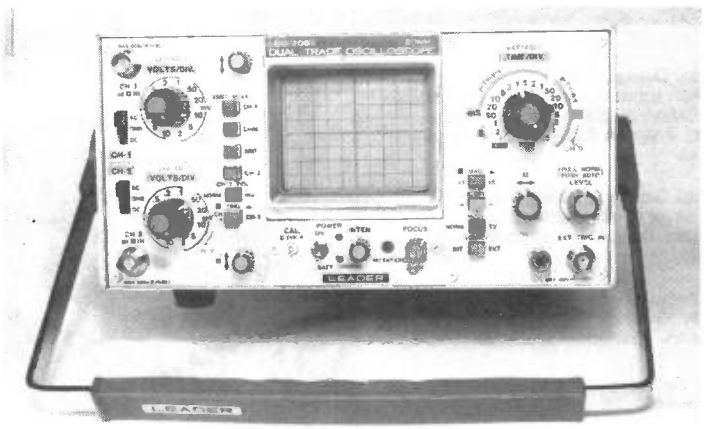
Further information: *Thandar Electronics Ltd, London Road, St Ives, Huntingdon, Cambs PE17 4HJ. Tel: (0480) 64646.*

POWER UNITS FOR LINEAR AND DIGITAL INTEGRATED CIRCUITS

A new triple output bench power supply unit from Grenson Electronics, designed for the home constructor, is available as a kit at £59 or fully assembled at £98, both prices inclusive of VAT and delivery.

Called the Grenson BPU-4, the unit has three variable outputs; 3-8V at 2.5 amps, +8 to +16V, 0.5 amps and -8 to -16V at 0.5 amps. The 8-16V supply lines are tracking outputs providing a true +ve/-ve supply across the range 8 to 16V. All the outputs are highly stabilised with an output change of less than 0.05% for a 10% input change, and less than 0.10% output change from zero to full load. Ripple is better than 0.05% P-P. In addition, all outputs are fully protected against long term overloads, short circuits and aginst the injection of external voltages. Output voltages are set by two front mounted controls with two switched moving coil meters indicating voltage and current on all lines.

Further information from: *Grenson Electronics Ltd, High March, Daventry, Northants NN11 4HQ. Tel: (0327) 705521.*



NEW EQUIPMENT FANS

Papst Motors Ltd have recently introduced two new equipment fans – the 812 and 814 in a new frame size of only 62mm and weighing less than 3 ounces. Amongst the Papst 'Superquiet' range are two new 24volt dc fans – the 4124GXL and 8124GL. The 8124GL in particular measures 79 x 79 x 38mm and is capable of producing 38 m/h airflow at a noise level of 24 dB(A) which is believed to be a record low for a framed fan of this performance.

Further information: *Papst Motors Ltd, East Portway, Andover, Hampshire SP10 3RT. Tel: (0264) 53655*

S-I-L DELAY LINES

Dau Components believe that their principals Bel Fuse are the first company to offer *active* single-in-line packaged delay lines. The pin outs are on 0.1in pitch and are typically on 14 pin packages. The height is a maximum of 0.35in and the width of the pack is 0.20in maximum. These 14 pin packages are 10 tap parts offering total delays of 50, 100, 150, 200 or 250 nS. The parts are also compatible with TTL and DTL circuits. The S-I-L arrangement fits neatly into the modern resistor and network packages that help to increase density and reduce overall board size.

Further information from: *Dau Components Ltd, 70-74 Barnham Road, Barnham, West Sussex PO22 0ES. Tel: (0243) 553031*

RADIOTELEPHONE TEST SET

A new portable, fully self-contained radiotelephone test set is available from Systron-Donner Limited, of Leamington Spa, Warwickshire. Complete testing and alignment of mobile radio equipment is now possible with the Model FMPM-30, which will be on show for the first time at Communications '84.

Manufactured by Neuwirth in Germany, the Model FMPM-30 covers all VHF/UHF mobile bands up to 1000MHz. The microprocessor controlled test set comprises a synthesised signal generator, frequency counter, independent and fully automatic modulation meter for FM, PM and AM, two AF generators and an

AA117	**0.09**	BC157	**0.06**	BD222	**0.31**	BU108	**1.00**	OC72	**0.50**	TIP29C	**0.25**	3N.143	**0.65**	2SA473	**0.37**	28 pin	**0.20**	PCL84	**0.50**	LM723	**0.32**	LED 5mm	
AA119	**0.09**	BC159	**0.06**	BD225	**0.31**	BU110	**1.10**	OC200	**1.80**	TIP30	**0.16**			2SB54	**0.25**	40 pin	**0.25**	PCL85	**0.55**	LM741 Dil	**0.15**	YELLOW	**0.10**
AAY32	**0.09**	BC182	**0.06**	BD232	**0.31**	BU111	**1.40**	OCP71	**1.00**	TIP31A	**0.24**	IN.914	**0.02**	2SB77	**0.32**			PCL86	**0.55**	LM741		LED 5mm	
AC107	**0.28**	BC182L	**0.06**	BD237	**0.21**	BU126	**0.70**	ORP12	**1.00**	TIP32	**0.24**	IN.4001	**0.04**	2SB337	**1.20**	**VALVES**		PCL805	**0.55**	Met	**0.45**	GREEN	**0.10**
AC126	**0.17**	BC183	**0.06**	BD238	**0.24**	BU204	**0.75**	ORP60	**1.00**	TIP32A	**0.24**	IN.4002	**0.04**	2SB405	**0.22**	DY87	**0.53**	PFL200	**0.85**	LM3900	**0.25**		
AC127	**0.15**	BC183L	**0.06**	BD443	**0.28**	BU205	**0.70**	ORP61	**1.00**	TIP33	**0.50**	IN.4003	**0.04**	2SC460	**0.21**	DY802	**0.45**	PL36	**0.80**	NE555	**0.15**		
AC128	**0.15**	BC184	**0.06**	BD437	**0.28**	BU208	**0.75**			TIP34	**0.50**	IN.4004	**0.04**	2SC495	**0.60**	ECC82	**0.40**	PL504	**0.95**	NE556	**0.40**	**BRIDGE**	
AC128K	**0.23**	BC184L	**0.06**	BD535	**0.38**	BU208A	**0.80**	R2008B	**0.80**	TIP41A	**0.22**	IN.4005	**0.04**	2SC733	**0.40**	ECC83	**0.43**	PL508	**1.90**	BYX55/		**RECTIFIERS**	
AC141K	**0.23**	BC212	**0.06**	BD536	**0.38**	BU208D	**1.20**	R2010B	**0.80**	TIP41C	**0.25**	IN.4006	**0.04**	2SC1161	**1.10**	ECC84	**0.40**	PY81	**0.70**	350	**0.30**	1A/50V	**0.16**
AC142K	**0.22**	BC212L	**0.06**	BD537	**0.40**	BU326	**0.85**			TIP42A	**0.22**	IN.4007	**0.06**	2SC1172Y	**1.50**	ECC85	**0.40**	PY88	**0.48**	BYX55/		1A/100V	**0.18**
AC153K	**0.23**	BC213	**0.06**	BD538	**0.40**	BU406	**0.85**	SAS560	**1.10**	TIP42C	**0.25**	IN.4148	**0.02**	2SC1279	**0.24**	ECH81	**0.49**	PY500A	**1.60**	600	**0.30**	1A/200V	**0.19**
AC176	**0.18**	BC213L	**0.06**	BDX32	**1.00**	BU407	**0.75**	SAS570	**1.10**	TIP47	**0.40**	IN.5400	**0.09**	2SC1306	**1.00**	ECH84	**0.52**	PL519	**4.50**	BYX55/		1A/400V	**0.21**
AC176K	**0.20**	BC214	**0.06**	BDX65	**0.80**	BU408	**1.00**	SN76003N	**1.40**	TIP48	**0.40**	IN.5401	**0.10**	2SC1307	**1.00**	ECL80	**0.57**			600	**0.30**	1A/600V	**0.23**
AC187	**0.15**	BC214L	**0.06**	BF180	**0.16**	BU500	**1.10**	SN76013N	**1.40**	TIP49	**0.40**	IN.5402	**0.10**	2SC1520	**0.25**	ECL82	**0.59**	**ZENERS**		BYX55/		tA/800V	**0.28**
AC187K	**0.20**	BC237	**0.07**	BF181	**0.18**	BU526	**0.80**	SN76023N	**1.40**	TIP110	**0.47**	IN.5403	**0.11**	2SC1969	**1.30**	ECL84	**0.57**	400MV		800	**0.32**	2A/100V	**0.35**
AC188	**0.17**	BC238	**0.07**	BF183	**0.20**	BY126	**0.06**	SN76033N	**1.50**	TIP112	**0.54**	IN.5404	**0.11**	2SC2029	**1.20**	ECL85	**0.57**	BZY88 Range		BYX70/		2A/200V	**0.36**
AC188K	**0.23**	BC300	**0.16**	BF184	**0.20**	BY127	**0.08**	SN76110N	**0.70**	TIP115	**0.45**	IN.5405	**0.12**	2SC2078	**1.20**	ECL86	**0.49**	2V7 to 39V	**0.06**	500	**0.29**	2A/400V	**0.42**
ACY18	**0.48**	BC301	**0.18**	BF185	**0.20**	BY133	**0.08**	SN76115	**0.70**	TIP117	**0.56**	IN.5406	**0.13**	2SC2122A	**2.00**	EF80	**0.31**	1.3W Zeners		BYX70/		2A/600V	**0.54**
ACY19	**0.48**	BC302	**0.18**	BF194	**0.50**	BY164	**0.22**	SN76226	**0.90**	TIP120	**0.43**	IN.5407	**0.13**	2SC2952	**0.27**	EF85	**0.34**	BZX61 Range		500	**0.31**	2A/800V	**0.58**
AD142	**0.60**	BC303	**0.18**	BF195	**0.50**	BY176	**0.85**	SN76227	**0.80**	TIP121	**0.46**	IN.5408	**0.13**	2SD234	**0.37**	EF89	**0.43**	2V7 to 39V	**0.12**	BYX70/800	**360**	3A/200V	**0.66**
AD149	**0.45**	BC327	**0.06**	BF196	**0.60**	BY179	**0.35**			TIP122	**0.47**			2SK135	**4.00**	EF183	**0.45**			BYX71/		3A/400V	**0.68**
AD161	**0.22**	BC328	**0.06**	BF199	**0.60**	BY182	**0.32**	T2800D	**0.52**	TIP125	**0.47**	**VOLTAGE**		MB3712	**1.50**	EF184	**0.53**			600	**0.80**	3A/600V	**0.78**
AD162	**0.22**	BC337	**0.06**	BF200	**0.16**	BY184	**0.32**	TAG06-60	**0.42**	TIP126	**0.56**	**REGULATORS**		TA7205	**1.50**	EL34	**1.90**					6A/200V	**1.00**
AF124	**0.25**	BC328	**0.06**	BF257	**0.18**	BY187	**0.32**	TAG521-200	**0.72**	TIP127	**0.56**	7805	**0.35**	UPC575	**1.00**	EY86	**0.31**					6A/400V	**0.80**
AF125	**0.25**	BC557	**0.06**	BF258	**0.18**	BY196	**0.20**			TIP2955	**0.34**	7812	**0.35**			EY87	**0.31**	**MEMORIES**				25A/100V	**1.60**
AF126	**0.25**	BCY32	**1.50**	BF259	**0.18**	BY206	**0.11**	TAG4443	**0.76**	TIP3054	**0.38**	7815	**0.35**			PC97	**1.00**	2114	**2.00**				
AF127	**0.25**	BCY33	**1.50**	BF336	**0.20**	BY207	**0.11**	TAG4444	**0.76**	TIP3055	**0.34**	7818	**0.35**	**ICS**		PCC85	**0.42**	2716	**3.00**				
AF139	**0.22**	BCY34	**1.50**	BF337	**0.20**	BY223	**0.72**	TAA550	**0.16**	TIS61	**0.15**	7824	**0.35**	**SOCKETS**		PCF80	**0.58**	2532	**4.00**	**LED**			
AF239	**0.22**	BCY42	**0.20**	BF338	**0.20**	BYX10	**0.15**	TBA120S	**0.45**	TIS90	**0.15**			8 pin	**0.06**	PCF200	**1.35**	2732	**4.00**	LED 3mm			
AL112	**0.70**	BCY56	**0.16**	BF362	**0.30**			TBA395	**0.60**	TIS91	**0.18**	7905	**0.35**	14 pin	**0.08**	PCF801	**1.10**	2764	**7.00**	RED	**0.05**		
AL113	**0.80**	BCY70	**0.16**	BF422	**0.21**	CA270	**0.40**	TBA396	**0.60**			7912	**0.40**	16 pin	**0.09**	PCF802	**0.57**	4116	**0.75**	LED 3mm			
ASZ15	**1.00**	BCY71	**0.16**	BF458	**0.19**	CA3086	**0.25**	TBA520	**0.75**	2N.2904	**0.20**	7915	**0.40**	18 pin	**0.12**	PCF806	**1.15**	6116	**6.00**	YELLOW	**0.10**		
ASZ17	**1.00**	BCY72	**0.16**	BF459	**0.19**	CA3089	**1.50**	TBA530	**0.75**	2N.2905	**0.20**	7918	**0.40**	20 pin	**0.14**	PCH200	**1.00**	LM324	**0.30**	LED 3mm			
AU110	**1.10**	BD115	**0.26**	BFX29	**0.20**	CA3240	**0.90**	TBA540	**0.75**	2N.2906	**0.18**	7924	**0.40**	22 pin	**0.16**	PCL81	**0.54**	LM380	**0.60**	GREEN	**0.10**		
AY102	**1.80**	BD124P	**0.50**	BFX84	**0.20**	C106D	**0.23**	TBA560	**0.70**	2N.2907	**0.18**			24 pin	**0.18**	PCL82	**0.63**	LM709 Dil	**0.30**	LED 5mm			
AY106	**1.80**	BD124	**1.10**	BFX85	**0.20**	MC1327	**0.70**	TBA800	**0.35**	2N.2926	**0.80**	78L05	**0.28**							RED	**0.05**		
		BD128	**0.35**	BFX87	**0.15**	MJ2500	**1.00**	TBA810S	**0.60**	2N.3019	**0.28**	78L12	**0.28**										
		BD131	**0.25**	BFX88	**0.15**	MJ2501	**1.10**	TBA820	**0.75**	2N.3053	**0.18**	78L15	**0.28**										
BA145	**0.06**	BD132	**0.25**	BFY50	**0.14**	MJ2955	**0.55**	TBA920	**0.80**	2N.3054	**0.35**	74L18	**0.28**										
BA148	**0.10**	BD135	**0.20**	BFY51	**0.14**	MJ3000	**1.15**	TBA950	**0.80**	2N.3055	**0.32**	74L24	**0.28**										
BA154	**0.06**	BD136	**0.20**	BFY52	**0.14**	MJ3001	**1.15**	TBA990	**0.80**	2N.3055H	**0.38**												
BA157	**0.12**	BD137	**0.20**	BFY56	**0.20**	MJE29A	**0.30**	TCA800	**0.80**	2N.3440	**0.58**	LM309K	**1.00**										
BB101	**0.13**	BD138	**0.20**	BFY57	**0.25**	MJE30A	**0.30**	TCA940	**0.85**	2N.3442	**0.85**	LM317K	**2.20**										
BB103	**0.16**	BD139	**0.20**	BFY64	**0.25**	MJE340	**0.25**	TDA1170	**0.90**	2N.3771	**0.85**	LM317T	**1.80**										
BB105B	**0.18**	BD140	**0.20**	BR100	**0.14**	MJE350	**0.80**	TDA1412	**0.60**	2N.3772	**0.90**	LM323K	**4.20**										
BB205B	**0.24**	BD144	**0.90**	BSX19	**0.15**	MJE520	**0.30**	TDA2002	**0.80**	2N.3773	**1.00**	LM723	**0.32**										
BC107	**0.07**	BD150	**0.30**	BSX20	**0.15**	MJE2955K	**0.90**	TDA2003	**1.50**	2N.4031	**0.25**	78HGKC	**5.70**										
BC108	**0.07**	BD157	**0.38**	BSX21	**0.16**			TDA2020	**1.40**	2N.4036	**0.25**	78HO5KC	**5.20**										
BC109	**0.07**	BD158	**0.38**	BSX26	**0.16**	OA47	**0.06**	TDA2030	**1.40**	2N.4037	**0.25**	78GU1C	**1.90**										
BC115	**0.10**	BD166	**0.30**	BSX29	**0.19**	OA90	**0.04**	TDA2522	**0.80**	2N.4443	**0.76**	79GU1C	**2.15**										
BC118	**0.11**	BD175	**0.30**	BZX76	**0.30**	OA91	**0.04**	TDA2530	**0.80**	2N.4444	**0.76**	79HGKC	**6.70**										
BC140	**0.19**	BD177	**0.30**	BT106	**0.90**	OA200	**0.07**	TDA2532	**0.75**	2N.5061	**0.20**												
BC141	**0.19**	BD179	**0.32**	BT109	**0.90**	OA202	**0.07**	TDA2560	**0.70**	2N.5294	**0.30**	**JAPANESE**											
BC142	**0.19**	BD181	**0.45**	BT116	**0.80**	OC28	**1.00**	TDA2593	**0.80**	2N.5296	**0.30**	**TRANSISTORS**											
BC143	**0.19**	BD201	**0.33**	BT119	**1.00**	OC29	**0.80**	TDA2540	**0.80**	2N.6106	**0.40**	2SA73	**0.30**										
BC147	**0.06**	BD202	**0.38**	BT120	**1.00**	OC35	**1.00**	TDA2690	**0.70**	2N.6107	**0.40**	2SA104	**0.32**										
BC148	**0.06**	BD203	**0.42**	BU104	**1.00**	OC45	**0.50**	TIP29	**0.15**	2N.6109	**0.40**	2SA198	**0.22**										
BC149	**0.06**	BD204	**0.42**	BU105	**0.80**	OC71	**0.30**	TIP29A	**0.22**	3N.128	**0.55**	2SA203	**0.30**										

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COUNTERS

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Venezuala

Radio Tachira, San Cristobal on **4830** at 0345, OM with station identification, YL with a promo then OM with announcements – all in Spanish. The schedule is from 0900 to 0400 and the power is 10KW.

EUROPE

Belgium

BRT (Belgische Radio en Televisie – the Flemish Authority) Brussels on **17610** at 1403, YL with a newscast in the English programme for North America and the Far East, timed from 1400 to 1445 (not on Saturday or Sunday).

RTBF (Radio-Television Belge – the French community authority) Brussels on **17680** at 1025, the interval signal which is the sound of an African xylophone, this signal originally being used by Brazzaville in the Belgian Congo prior to independence, then station identification in French at the start of that languaged transmission for Africa and Europe, scheduled from 1030 to 1100.

Czechoslovakia

Prague on **9605** at 1434, OM with the news during an English presentation to Africa, the Far East and South Asia, timed from 1530 to 1625.

East Germany

Radio Berlin International on **7185** at 1657, OM with announcements and the station identification at the end of the English programme for Europe, scheduled from 1615 to 1700.

France

Paris on **17795** at 1604, YL with a newscast in the English programmed World Service to Africa and Europe, listed from 1600 to 1700.

Greece

Athens on **17565** at 1520, YL's with a Greek folk song during the Foreign Service 'Voice of Greece' programme directed to North America from 1500 to 1550.

Netherlands

Hilversum on **17605** at 1518, OM with the station identification at the close of an English programme for Europe on this channel from 1330 to 1420.

Poland

Warsaw on **7270** at 0651, OM with a talk about the Polish theatre and recent productions during an English transmission for Europe, scheduled from 0630 to 0700.

Spain

Madrid on **17660** at 1410, YL with a newscast in the Spanish programmed World Service (Programa Mundial) which may be heard on this frequency and in parallel on **17890** from 1400 to 1730.

Vatican State

Vatican City on **7250** at 1155, YL with a news commentary in English then OM in Spanish during the multi-lingual Italian, French, English and Spanish news and comment only programme for Europe, scheduled from 1130 to 1200 (not on Sunday).

Vatican City on **11700** at 2013, interval signal, bells then YL with the station identification at the commencement of the Portuguese programme for Africa, timed from 2015 to 2030.

ASIA

Afghanistan

Kabul on a measured **6231** at 1555, YL announcer, OM with songs and local-style music in a programme of the Domestic Service (2nd Programme) in Pashto/Dari, timed here from 1430 to 1630.

China

Radio Beijing on **9290** at 1414, YL with songs and music in the Thai programme, scheduled on this channel from 1330 to 1430.

Radio Beijing on **9945** at 1420, OM with a long talk during the Vietnamese transmission, timed from 1400 to 1500.

Radio Beijing on **17605** at 0745, YL with a talk in Chinese during a Domestic Service 1 programme, on this frequency from 0100 to 1100.

India

AIR Delhi on **9950** at 1452, YL with the news in English until 1455 then the station identification and OM with a programme in vernacular.

Israel

Jerusalem on **9385** at 2100, 'pips' time-check then OM with station identification in a relay of the Domestic Service Network 'B' to Europe and North America from 0400 to 0615 and from 1745 to 2310 on this frequency, entirely in Hebrew.

Kuwait

Kuwait on **9840** at 1510, OM with recitations from the Holy Quran in a Domestic Service General Programme presentation which is on this channel from 1505 to 0015.

North Korea

Pyongyang on **6577** at 2047, OM with a talk in the 'Radio Magazine' series – all about internal events and all in the English programme for Europe, scheduled from 2000 to 2150.

Pakistan

Karachi on a measured **9864** at 1445, OM with announcements, OM with a song and some local orchestral backing, YL with station identification at 1447 during the Urdu transmission for the Middle East and the Persian Gulf, timed from 1330 to 1600. Karachi is listed on **9860!**

Karachi on **17640** at 1023, OM with a news commentary in the Indonesian programme, scheduled on this channel from 1000 to 1045.

Turkey

Ankara on **7154** (measured) at 2020, OM and YL alternate with a news commentary, mainly about local events and affairs, in the English programme for Europe, on this frequency from 2000 to 2100.

Yemen Arab Republic

San'a on **9780** at 2100, OM with recitations from the Holy Quran, OM with announcements and station identification in Arabic, the National Anthem and sign-off at 2106. This is a Home Service presentation entirely in Arabic and is scheduled from 0230 to 0700 and from 1000 to 2100 on this channel.

EE PX's

Translated from DXers shorthand into English, this heading becomes English Programmes – a list of which has been sent to the writer by W M Rigby of Morecambe, Lancs. All are correct at the time of writing and are listed here in GMT order.

0900 to 1030 **9535** Berne, Switzerland; 1015 to 1045 **17775, 21655, 21695** Dubai, United Arab Emirates; 1100 to 1200 **21535, 25790** Johannesburg, S Africa; 1300 to 1600 **9585, 15220, 25790** Johannesburg; 1630 **7065** Tirana, Albania; 1630 **5930, 7345** Prague, Czechoslovakia; 1800 **10040, 15010** Hanoi, Vietnam; 1830 **7065, 9480** Tirana; 1900 **10040, 15010** Hanoi; 2000 **7155** (but see above) Ankara, Turkey; 2030 **7065** Tirana; 2030 **10040, 15010** Hanoi; 2115 to 2245 **9805** Cairo, Egypt; 2200 to 2300 **9560** Ankara and 2200 **7065, 9480** Tirana. Where termination times are not shown, the transmissions are of 30 minutes duration.

Our thanks are due to WMR for his efforts on our behalf.

CLANDESTINE

The almost endless search for clandestine transmitters continues unabated and so does the interest displayed by many DXers. In one notable SWL publication a special section is devoted to them almost every month and also deals additionally with the pirate pop stations never mentioned in these articles. Clandestine stations are political and claim to represent an opposition to the governments with which they are at variance. I shall be dealing with the clandestine stations more fully at a later date but for the moment I bring to your attention one of the latest loggings.

Voice of the PLA

Voice of the PLA (People's Liberation Army) on **9627.6** (measured) at 1115, orchestral version of the Internationale followed by OM with station identification in Chinese ('Jiefangjun Zhi Sheng') and sign-off. The transmissions are irregular, the subsequent three days listening sessions drawing a blank. An alternative frequency is that of **7524.6** but no joy there either

NOW LOG THIS

Radio Nacional de Sao Tome on **4807** at 1957, OM's with a discussion in Portuguese. This one has been back on its original frequency on the short waves for some months now after a prolonged absence. The Home Service entirely in Portuguese operates from 0530 to 2300 (Saturday until 2400) with a power of 10KW. The full identification is 'Aqui Sao Tome transmite Radio Nacional de Republica Democratica de Sao Tome e Principe'.

NOW HEAR THIS

Radio Station 4VEH Cap Haitien, Haiti on **4930** at 2302, OM with announcements and a talk in French. This is another transmitter absent for some time from the short waves, seemingly abandoning its **9770** and **11835** channels. The schedule is reportedly from 1100 to 1500 and from 1900 to 0400. Listen then on **4930** around 2300.

REGULATORS
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LM317 Metal **£2.00**
7812 Metal **£1.00**
L036 TO3 Metal 12v L037 15v ..... ea **50p**
7805/12/15/24 plastic **40p**
7905/12/15/24 plastic **50p**
CA3085 TO99..... **50p**
LM723 14 dil or TO99 ..... **50p**

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MISCELLANEOUS

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sim RS 413-563
Vero pins fit 0.1" Vero..... 100/**50p**
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TO220 Micas + bushes 10/**50p**... 100/**£2.00**
TO3 Micas + bushes 10/**50p**
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2 pole changeover..... **£1.00**
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555 Timers..... 5/**£1.00**
40KHZ ULTRASONIC TRANSDUCERS EX-EQPT. NO DATA ..... PAIR/**£1.00**

RECTIFIERS
120v 35A stud **40p**
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1N5401 100v 3A..... 10/**£1.00**
BY254 800v 3A ..... 8/**£1.00**
BY255 1300v 3A ..... 6/**£1.00**
1A 800v bridge rectifier ..... 4/**£1.00**
6A 100v bridge **50p**
10A 100v bridge **£1.25**
15A 100v bridge **£1.25**
25A 200V bridge..... **£2.00 ea** 10/**£18**
25A 400v bridge **£2.50**

SCRs
2N6399A 10A 600v..... **£1.00**
BTX95 800v 15A..... **£1.20**
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10 FOR **£1.00**
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W23 or sim 9 watt ..... 6 for **£1.00**
R22 1R0 3R0 6R8 56R 62R 100R 270R 1K8 10K
W24 or sim 12 watt ..... 4 for **£1.00**
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PHOTO DEVICES
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TIL38 Infra red LED 2/**50p**
OPI2252 Opto isolator **50p**
Photo diode **50p**..... 6/**£2.00**
MEL12 (Photo darlington base o/c) **50p**
RPY58 LDR..... **50p**
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POINT OF CONTACT

The general interests of some of our readers are shown below. If you have similar interests why not establish a point of contact at the time and on the band indicated

If you wish to be included in this scheme, would you please complete and return the form below and send to: ***Radio & Electronics World***, Sovereign House, Brentwood, Essex CM14 4SE.

MOST IMPORTANT — include a **telephone number** — if you have a particularly interesting contact so that we can contact you for details for publication.

G4LNA:
Usually available Mondays to Fridays between 06.30 and 07.15 and before 12.00 during weekends on 1.8, 3.5, 7, 10 and 14MHz. Uses CW mainly but sometimes phone on RNARS nets nr 2069. Equipment includes Redifon marine TCVR with H/B synthesiser and his special interest is Homebrew. Most interesting contact was QSO and CARU from the Magnus oil platform.

5B4NA:
Usually available daily except Mondays and Tuesdays between 13.30 and 16.30 GMT on 10, 15 and 20 metres. Uses phone and CW. Equipment includes FT-902 DM and his special interests are DX stations and contacts with USA stations. Most interesting contact to date was QSO-A3J with 5W1DZ in Apia (Western Samoa) on 21.243.

G4VFG:
Usually available between 22.00 and 24.00 Monday to Friday on 80m and at various times during the weekends on 10 metres and 2 metres SSB. Uses mostly phone but occasionally CW. Equipment includes Yaesu FT77, Eddystone EC10 RCVR, Trio 2300 FM 2m, Belcom liner 2SSB. His special interests are QRP portable work on VHF, construction and simple antennae. Most interesting contact was VP8ALD on S Orkney on 28MHz.

G4NNJ:
Usually available daily on 20, 40 and 80 metres. Uses CW only.
Equipment includes Homebrew QRP on 80m and Heath HW7 40/20/15. His special interests include ragchew around the UK on 80m.

GU6NAE:
Usually available daily after 18.00 on 144MHz. Phone only at present. Equipment includes IC290H, IC2E, Belcom Liner 2, R1000, Vic 20 with MPTU-1 terminal unit (RTTY). His special interests are /P operation, RTTY, amateur satellites and FSTV (receive only).

G3VMR:
Usually available Sundays on 2m, CH14 (145/·35) and 10m (28.4). Nets 11.00 (social), 19.30 (data). Uses phone, FM preferred. Equipment includes Multi 2000 & Atlas 210. Special interests are high speed data and news bulletins using CCITT tones at 300 and 1200 baud, text and programs.

G3IFM:
Usually available daily between 08.00 and 20.00 on 160 through 10 metres (local chats on 2m). Uses RTTY and AMTOR. Equipment includes FT1012D, VIC-20, AMTOR AMT-1, 5 band vertical ant. His special interests are RTTY and AMTOR mainly 20m. Auto-mode available on 14075 MHz daily. Most interesting contact was FP8 in 1950s, 10Watts CW on 7MHz.

G1ESG:
Usually available on Wednesdays, Fridays and Sundays between 08.30 and 21.00 on 144 MHz. Uses phone, F3E and sometimes J3E. Equipment includes Icom IC2E and FT290R. His special interest is DX. Most interesting contact was Lebanon during lift, RST (5-0-3).

G3ZNZ:
Usually available most days on 144 and 432MHz. Uses J3E and FM mainly horizontal. Equipment includes FT221R Mutex Board, FT780R and 19ELE 'Cushcraft' Boomer. Special interests are radio computing with Dragon 32, diplomas especially DLD1000 on VHF and PA1000 2 metres VHF. Most interesting contact made to date was QSO with King Hussein (JY1) and his then wife Princess Muna (JY2). Both confirmed. Last QSO to complete 'WAB' gold (13) and 'Mary Rose'.

G3NRW:
Usually available on Sundays between 0900 and 1300 on 2, 4 and 20 metres. Equipment includes FT200, MM transverters, Nascom for RTTY and AMTOR. He is editor of 'Datacom' and of the BARTG quarterly magazine. His special interests are RTTY, AMTOR, Packet radio, computers, QRPp (50mW on 20m) and transmitting RTTY news on 2m on Sundays at 10.30.

G3YLR:
Usually available most days on 3.5MHz through 30MHz and 144-146MHz. Uses mainly phone. Equipment includes HF bands, Ten Tec Argosy II, 144-Trio 2300 and 40w amp. Special interests are RNARS, AMSAT, G-QRP, mobile, Technical interest: antennae transmission lines, methods of matching. Has upwards of 1000 QSL cards and has had one interesting QSO with Jan Mayen Island and another with St Kilda.

G1DCD:
Usually available daily between 1800 and 0100 on 2 metres. Uses phone and RTTY. Equipment includes KDK FM 2030, Belcom LS102 and MM transverter. Special interests are AMTOR, satellite work and European DX. Most interesting contact was made with F6BY (France).

G8YOX:
Usually available early evenings on most days on 2m, 23cm and above.
Uses phone, RTTY with computer, SSB, ATV. Equipment includes, Trio TR1010 SSB Txcvr, H/brew linear, H/brew FM Synth Rig, 9ELE Tonna, 24 ELE Quad (23cms) and his special interests include VHF/UHF DX, Meteor scatter microwave propogation, homebrew equipment and computer-aided communication. Most interesting contact to date was made with Karl OK1KH/P. Czech 2m SSB.

G3FCK:
Usually available most days during the afternoons of the winter months and in the mornings and early evenings during the summer. He uses CW only and the bands preferred are 80, 40, 20, 15 and 10 metres. Equipment includes homebrew QRP, med pwr, QRO and his special interests are homebrew gear, U/W awards, DARC (DIG) awards and experimental 'small garden' antennae. His most interesting contact made to date was with a Japanese Maritime Mobile.

G6YQD:
Usually available late evenings on Thursdays and at weekends on 2m. Uses phone. Equipment includes FT290R + Mickey Mouse 10W linear and FT1012 (listening only). He is club secretary of the 308 Amateur Radio Club and his special interest is computer link-up to Ham radio. Most intersting contact to date was Vic Elliot (VE1QH) Nova Scotia lighthouse keeper.

POINTS OF CONTACT

G2VF:
Usually available most afternoons and evenings on 40, 15, 20 and 10m (CW only). Equipment includes Heathkit HX1681 and DX100 transmitters, HF loop antenna. Special interests include loop antennae for HF bands. RSGB QSL awards. Bureau Sub Manager. Had an interesting contact with OR4VN during the Antarctic expedition of 1964/65.

G3AKG:
Usually available Monday to Friday: 08.00-09.00, 09.30-10.30, 15.00-17.00 on 10, 15 and 80 metres. Uses CW and SSB. Equipment includes FT101E (modified), Standard C8500 and Datong downconverter. Special interests are various nets, 80m, KSG, BTI, RNARS and RAOTA.

G4ASR:
Usually available daily from 16.00 on 70, 144, 432, 1296 and 5760 MHz. Uses SSB, CW, FSTV, RTTY. Has various equipment and his special interests include EME on 144/432 MHz, MS on 144 (432), Auroral, Sporadic-E and DX Tropo. Most interesting contacts made to date: 584AZ on 70 MHz, LA6HL/TF Iceland, three QSO's on 144 MHz.

POINT OF CONTACT

Name..... Address .....

..... Postcode.....

Telephone No ..... Call Sign..... Date licensed.....

Type of Licence A.....☐ B.....☐

Bands usually preferred .....

Operating days M T W T F S S Times .....

Equipment .....

Phone/CW.....

Special interests eg DX,AMSAT etc.....

.....

Most interesting contact made to date .....

..... RE0684

We are pleased to accept Points of Contact not on our order form

CORRECTIONS AND MODS

Whilst every effort is made to minimise errors in diagrams we will correct these as they come to our knowledge and we also appreciate the co-operation of our readers in notifying these.

We occasionally receive suggested modifications from readers who have constructed projects form ***Radio & Electronics World*** and we will publish those that would interest other readers.

For example, it may be possible to extend the use of a particular item by minor circuit changes or re-arrangement only. If this can be done for minimal cost and the idea has been proved in practice, others may benefit from the information.

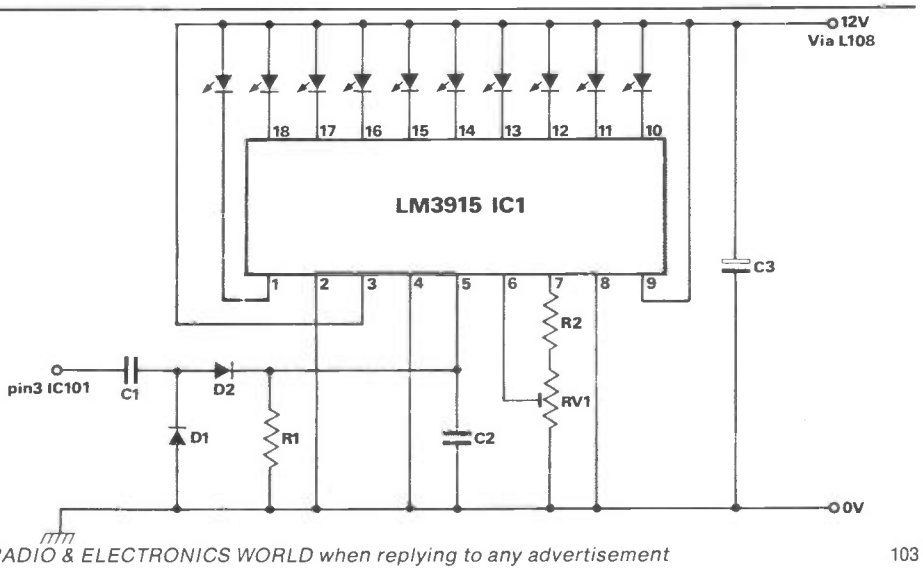
Write to Corrections and Mods, ***Radio & Electronics World,*** *Sovereign House, Brentwood, Essex, CM14 4SE*

HF LINEAR AMPLIFIER (APRIL 1984 ISSUE):
We are advised that Mr. G R Jessup, G6JP, originated this article and regret that Mr. Jessup was not included in the acknowledgements.

SX-200N RELATIVE S-METER (MAY 1984 ISSUE):
We regret that we omitted the Parts List for this project. It is as follows:-

Parts list

IC1 - LM 3915
R1 - 220K,⅛W
R2 - 1K,⅛W
VR1 - 1K pre-set
C1 - 270pF ceramic
C2- 0.01uF ceramic
C3 - 10uF 25Vwkg
D1, D2 - IN 4148 or similar
LED1-10 - 3mm green
Connecting wire, PCBs, adhesive pads



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FOR SALE

■ Yaesu FT101E MK3, CW Filter, 12 volt converter, RF Processor, Fan plus spare valves & holdings FM Rx/Tx conversion (not fitted) £275. Hirschman RO250 rotator £25. Two 11ft 1½in square aluminium boom sections plus approx 40ft½in tube, £10 the lot. G4RSY Tel:01-651-0633 (Croydon).

■ FRG7 Yaesu comms. receiver, excellent condition. Also 2 metre converter £135.00 for both. Tel: Yateley 0252 875810.

■ Yaesu FRG7700, as new, mint condition, 9 months old £240.00. FRV770A converter. 118MHz-150MHz. FRT7700 ATU £70.00 or £290.00 complete.Tel:Hastings East Sussex (0424) 51795.

■ J-Beam D15/1296 assembled but unused, £25. J-Beam professional end-fed 105 MHz dipole, unused, £10. Reftec 934 MHz short colinear for 2in. pole, unused £5. High quality power splitter (not phasing harness) for 23 cm. Heliax N conectors. £10. Masthead antenna changeover switch, with remote control. Ideal VHF/UHF, £20. Two 19in. racks, approx. 20in. and 25in. tall. Need repaint, free to good home. 12V, 8 amp computer PSU. With fault and diagram, £1. Buyers collect or pay carriage please. Andy Emmerson, G8PTH: 71 Falcutt Way, Northampton, NN2 8PH Tel: 0604 - 844130.

■ ATV Program for the 48K spectrum as reviewed in Nov 83 R&EW now with 36 features including testcards, maps, large printing, QRA calculator and much much more. The price which includes a 16K version and full instructions is only £5.50 inc.P&P from R. Stephens, Toftwood, Mill Lane, High Salvington, Worthing, Sussex. For list of other programs send SAE.

■ AOR AR240A handheld, 140-150 MHz, with accessories £99; Yaesu FT290R, mint, unmodified £185; cordless telephone £35; 26-30 MHz 12V linear amplifier, AM/FM/SSB 100W PEP, switchable preamp, brand new £45. D. Hawkins, G8KNF, 20 Putteridge Road, Stopsley, Luton, Beds.

■ Philips 54 dictation machine complete with microphone headphone and footpedal, £25. Canon NP200 plain paper copier, in good working condition, £425 Tel: 01-647 5434.

■ Sharp MZ80B, 64K RAM personal computer, built in moniter and tape deck. Excellent condition. Extras include basic conversion from MZ80K, plus many programs, basic tape & manuals, only £600 ono. Will deliver 50 miles from Newcastle. Please write to: SM Mahmud, 4A, Richardson Road, Newcastle-U-Tyne, Tyne & Wear.

■ Trio TR 2500 hand-held 2m FM Rig, excellent reports, as new, must sell to go to 70cms, just £200 ono. Stuart Law 16c Tapton House Road, Sheffield, S10 SBY. Tel: 0742 662989. 5.30 - 6.30 pm.

■ Two Uniace 200 CB sets £75.00 the pair. Also Durst M601 enlarger all sizes up to 6x6 compl. with two lenses, glassless neg carrier and 10x8 enlarging frame. Make me sensible offer around £200. Adcock, Arlington Terrace, Aldershot, GU11 3JF. Tel: 0252 25165 (evenings).

■ Yaesu FT902DM HF transceiver, mint condition, complete with Y0148 desk microphone, hi-mound electronic key, PTT foot control, pair spare valves, (brand new). Brand new G5RV antenna never used, instruction manual. £625 the lot, all letters answered, sorry no phone. Consider computer plus cash. John McCurdie, 80 Thornyflat Road, Ayr, Scotland, KA8 OLT.

■ Marconi Sig Gen 801B/3/S/D, looks like new. RF 12 to 490MHz in 5 bands very good working order with three manuals; its own Caibi handbook, parts manual, service manual. Also with new set of valves. The valves alone cost £100. It all must be collected. The lot will be sold for £65. First buyer pays by post collects at his own time arranged. Peter Tel: Ipswich 0473 85526 anytime.

■ Bearcat 220 scanner receiver mains/12V synthesised, 32-50, 118-136, 144-174, 421-512 MHz, £135. G8RHU Tel: Newhaven (0273) 516801.

■ Old mags, PW, SWM, Radcom etc. ideal for study for RAE. Kenwood TS130 very little use so offers, swap, haggle, WHY? 10m FM rig never used £35. Portable VHF multiband RX £5. Log books £2 each, only a few left. Split charge relay new £15. Martyn Bo£t, 112 Leeds Road, Mirfield, Yorks, WH40JE.

■ Printer LX180-L high speed matrix 180 characters second ASC11 code with parallel interface and continuous paper feed. Good working order complete with cables connectors but uncased £50. Floppy disks 8in twin measures 8.5x12x13in, uncased but complete with 19in rack mount cards, cables etc. Removed from a working system £50. Modems 2400/1200 BPS working order £10. Tel: G4PEY, Horsham (0403) 69835.

■ Yaesu FT290 with 10W Linear Mobile Mount bracket, set of NiCads, mobile charger, aerial lead and mobile oscar, complete £250. Tel: Brighton 309335 (evenings or weekends).

■ Test equipment. Telequipment D83 dual-beam scope, dual-timebase, 50 MHz £250 ONO. (cost new circa £2,500). HP.141B dual-beam, 20MHz scope with storage facility £125 ONO. Fluke 895A DC differential voltmeter range 1mV to 1000V. Very accurate £75 ONO. Fluke 8000A digital multimeter 3½ digit 0.1% AC DC and resistance £50 ONO. All the above have been looked after and are in working order. (Manuals/circuits available) Tel: Stoneyburn, Scotland (05016) 231.

■ Clearing out packs of resistors/capacitors/transistors, all new, mixed with some other devices, very best quality 100+ items £2.50. Every one delighted so not much left so write soon. Also 22K lin pots, 10 for £1. Power pack 13A plug type, output 100mA at 8V DC, just £2. Only 5 left. D. Martin, 29 St. Johns Close, Leatherhead, Surrey.

■ York Home Base CB.complete with loft aerial, Power Mic., SWR Meter, instruction manual etc. In excellent condition, only used twice. Will sell or swap for an equally good scanner or WHY? Vicki. Tel: Potters Bar 53596.(weekdays after 6pm, anytime at weekends).

■ CD1400 CRO circuits for main frame, CX1442 and CX1571 £2 each. Mains Trans. 36V 7A sec £5. Philips N1700 long play VCR, new head drum fitted, good working order £70. Anita 1000 comptometer 10 gas NY discharge readout tubes, solid state mains operated £30. Tel: Hythe (Kent) 68854.

■ Magazines from 1956 to 1983 some full and some part years. Practical television/wireless/electronics. Please ring with offers or enquiries.Mr. Halsall, 47, Smalley Street, Castleton, Rochdale, Lancs. OL11 3EB. Tel: 0706 33511.

■ Regonda 3 speed stereo record player. Brand new £50. ONO. For details tel: Godalming (Surrey) 04868 7088.

■ Lowe SRX30D receiver L/M/HF-PLL tuning digital readout. Brand new, boxed, never connected £150. Costs new £215. For details tel: Godalming (Surrey) 04868 7088.

■ DX100L LW 150-400KHz, MW 520-1620KHz, SW1 1.55-4.5MHz. SW2 4.5-13MHz, SW3 13-30MHz. BFO pitch range±5KHz (at 7MHz). Power required: 220/240 50HZ plus 12V neg ground. £65 carriage paid. Tel: Abergele 825765.

■ Stag 357 120ch CB radio £40. Formak 88 80ch CB £15 or swap exchange for short wave aerial and SWL's books and require 2m converter for FRG7000. Also require active aerial Datong or Yaesu or similar. Any short wave items will be considered. Mr. P. O'Brien, 12 Church Street, Caernarvon, Gwynedd, Wales, LL55 1SW. Tel: Caernarvon 5468.

■ Eddystone 730/4 receiver full spec excellent condition with spare valves. 500KHz to 30MHz £90. Mr. Day, 17 Beche Road, Colchester.

■ Alda 103 super 250 watt mobile rig 20 40 80 metres, £220. Datong ASP processor with Shure 201 mic, £60. G - whip multimobile 10 - 80m slightly damaged base £30. KP202 hand held S20, S21, R3 NiCads, no charger. Offers. M R Davies, Laburnum House, Guilsfield, Welshpool, Powys, SY21 9PX. Tel: 0938 75441.

■ Synthesized scanner. Gem Scan 70. Covers LO band, airband, 2 metres, high band, LO UHF, 70 CMS, high UHF AM or FM thoughout coverage. Sensitivity 0.8 UV. Channel spacing 12. 5/25 KHz BNC aerial connector. Built-in 240 volt AC power supply or external 12 volts DC memory back up. 70 channel memory scan with lock outs. 2 scan rates. Cost new £279, sell £195 complete with original packing and accessories. G6BEX Tel: Dunstable (0582) 604767.

■ Vorta 92 Element UHF aerial array high gain wideband UHF TV coverage ideal for TV DX work complete with fitting bracket and original packaging, £20. Also 2 metre vertical colinear 6 dB gain with brackets good condition, £15. Some UR67 available if required. G6BEX. Tel: Dunstable (0582) 604767.

■ Sell or swap WS19, R1155, BC-3Y8, BC-1000, 028RO. Ragnar Otterstad, Veidammen 5, DK28YO Holte. Tel: 02-801875 (evenings).

■ Rolls Royce Morse Tutor Program for CBM64. Too many features to list, tape £10.00, disk £12.00. Contact E14BVB.

■ WKS 1001 120 Channel AM USB/LSB PLL No MC 145106p, full digital frequency read out, instruction book. circuit diagram, boxed. In excellent condition £75, owner going licensed, sent recorded delvery. Tel: 0795 89565 (evenings).

■ Collaro Conquest 4 speed autochange. Collaro 3 speed 3 motor tape deck. mains XFR, CRT for Solartron CD1014 oscilloscope. Various Cossor 4 inch CRT. Marconi 600 ohm atten. quantity WW text rom 1970 offers. CA cooper, 11, Radical Ride, Wokingham, Berks. Tel: 0734 734312.

■ Trio 2200 6 channel 2 meter FM transceiver inc NiCads carrying case, £40. 2 meter beam 8 ele £9. FRG7 digital readout £140. Rotator £35 with control cable. Katsumi electronic keyer £25. HF5 30 radial kit £20. G3ZH1 QTHR. Tel: 0709 814911 between 1700 and 1900.

■ Reftec, perfect working order, £200. Tel: Brighton 774381 after 6 pm or weekends.

■ Yaesu FT720R 10W 70 cm tranceiver. Fully synthesised memories and scan. Can be made dual band by purchasing 2m rear end. Excellent condition £170 ONO. John Hodson. Tel: 0270 256458 weekdays 9-5.

■ SX27 27-143 MHz + discone £55. Sansui stereo amp AU101 2x40W £25. SP600JX 500KHz - 56MHz, immaculate condx. Collectors Rx £160. Very rare collectors Rx, Howard 450 c1937 USA £100. BRT 400 150KHz-32MHz good condx £80. ex BBC all working. Exchanges for RA63 and outboard frequency counter. Tel: 0908 314095 before 2pm.

■ Sony ICF 6800W FM/AM Multi Band receiver 1983. Model excellent condition £230. Walker. Tel: Ilkley (0943) 607872.

■ FDK T1200 Hand held Tx/Rx, covers 143.000 to 149.995 in 5KHz steps. Keypad operation. Scan and search facilities, 10 memories, 1 watt or 4 watts output, good condition, only 18 months old with NiCads and charger £140 ono. Plastic case and Ext spkr/mic £10. FV101B ext VFO Good condition £75. 7C601 digital display £45. G6LKF QTHR or Tel: Derek on Southend 553841.

■ YP 1502 dummy load £75. YD 148 desk mic (wired for 902) £15. Multimeter £5. DNT M40 for 10M £?. 10/11m mobile ant mount on screen £10. Kenwood TS 130 £400 or offers. Px's swaps considered why? Datong ASP/A £70 ono. Martyn Bolt. 112 Leeds Road, Mirfield, Yorks. Tel: 0924 495916 (evenings).

■ Maxline ML212 HF linear amplifier, built in

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FOR SALE

preamp, 4 output settings up to 100W AM, £50. ZetaGi B.70 linear amp AM/FM SSB 70W AM 28MHz-30MHz £18. Peter Tel: 01 859 1688 (evenings/weekends)

■ Storno 2m Tx/Rx 50watt base unit, 4 channel but provision for more, £60, buyer collects, for details please phone or SAE. Cisira Bede; G8ZIT, 72 Primrose Hill, Haverhill, Suffolk, CB9 9LS. Tel: 0440 61113.

■ Trio R1000 receiver, hardly used, mint condition, £200. 3, Burwash Road, Plumsead, LonPdon,SE18 7QY. Tel: 01-855-2998 after 6pm.

■ Pye Radio Telephones in working order, easily converted to Amateur bands. Hand-held Bantams 1.5W output £15, Cambridge Mobile 5W £10, Vanguard 20W £18, also Avometers Model 7 £15, Model 40 £12, York 863 CB new with guarantee, Fidelity 2000 also new £29 each. Many other spares and bits including valves. Carriage extra. Walker 23 Forest Hill, Yeovil Somerset.

■ HRO 5T receiver with mains PSU and complete set of nine general coverage coils 50 KL-30 ML clean working condition with handbook £60. Buyer collects. K G Pullen, 210 Hollett Rd, Penfilia Est, Treboeth, Swansea, SA5 9ER.

■ Yaesu FT901DM £440. FV901DM £100, FC901 ATU £80. SP901P exten speaker with patch £30. KW trap dipole Balun 40m cable £30. Rotator, control 8 + Y antenna £50. Office desk with custom built square tube shelves to suit. Yaesu equipment £50. R N Kendrick, 41 Kingsway Avenue, Paignton, Devon. TQ4 7AA. Tel: (0803) 843350.

■ TRIO 2300 with case charger Helical Nicads £130. J Beam C5/2M Colinear plus feeder £50.⅝ W Magmount whip £15. STE AT222 CW/AM/FM 2 meter transmitter £60. Murphy B40 receiver £60. Taylor Scope £25. Spares/repair Eddystone 358X £10. G3RKK receiver £20. Valves, PCBs, spares, wanted Trio 1000 offers to G80YY, QTHR or PM. Tel: 0342 832972.

■ BBC B Microcomputer. Boxed, unused. Offers? Tel: 01-348 6805 (after 6pm)

■ Radio valves, new and still boxed. ECL82 70p, EZ80 60p, UCH81 75p, UABC80 65p, UCC85 70p, UL84 £1, UY85 60p. Plus 12½p stamp. I wish to buy CB sets, TV tank battle game (not computer type) and ER900 dials. Write: D Martin, 29 St John's Close, Leatherhead, Surrey.

■ Trio TR9130 2m Multimode, as new, complete with mobile mount and SWR meter, plus swan neck car mike and remote. Cash needed for HF move. £385 ovno. Tel: 01-328 3238

■ Over 150 chips. Some SS1, MS1, LS1, VL51, few analogue. Over 90 per cent unused £99. 8Kx8, 350nS static RAM board £29. Tel: 01-580 6622 extension 533 (before 12.30)

■ Yaesu FRG7700 SW receiver, 1-30MHz AM/FM. Very good condition. £230 ono. G Walker, 77 Deerleap, Bretton, Peterborough PE3 6YB. Tel: 269342

■ Sony ICF2001. Excellent working condition. Complete with Sony ag power adaptor, instruction, wave handbook, earphone, strap and aerial wire £65. Tel: Keith Leeds (0532) 564525.

■ 2 volt 4A/Hr lead/acid battery (unfilled) complete with 2 pin charger (new) £5. Six batteries £12.50. XF9A SSB Filter with carrier Xtals £8. QQV03-20 £4. QQVO3-10 £1. Dual beam scope tube (new) £3. Roger. Tel: Brentwood (0277) 214406.

■ Heathkit Bench VVM £24; 4 of VDU terminals (14ins) with separate KBD £35; 3 of mains DVM £15-£20; 7 needle dot Matrix heads £12; Creed teletype £16; Electric Duplicator £110; Dyeline Duplicator £75; new Goldring CK2 turntable £22: music centre housing £8; various cassette mechanisms, KBD's, housings, valves etc; BBC digitisers with info less software £40; Will part exchange for various computers. Peter Silver, 18 Acacia Road, Hampton, Middlesex, TW12 3DS. Phone after 4pm (01) 979 6129.

■ Tono 09000E CW/RTTY/ASCII terminal unit VGC £400. Would consider swapping for a 70cm multimode, FT790 + PA or IC451 etc with cash adjustment. Sony ICF7600A Rx 76 to 108 MHz, MW and SW (49m, 41m, 31m, 25m, 19m, 16m, 13m) £55. Ideal for the traveller. See review in WRTH 1983). Khee Chan G5MUR, 20 Agnes Court, Wilmslow Road, Fallowfield, Manchester, M14 6AJ. Tel: 061-225-5202.

■ Xtals assorted freq's £1.50 each or 10 for £10.00. Large QTY resistors, new unused 400 £3.00. Workshop manuals: Jonson Messenger 123 AM CB £5. Jonson Messenger 320 AM CB £5. Trinidad III AM; CB £5. Sommerkamp. Tx/Rx FT277B £5. Westminster W30AM £8. Radio TV servicing 1973/74 new £12. Sinclair PDM35 including case no leads £38. Seldom used. Mr Cooper Tel: 0705 386254.

■ PSU for linear amplifier. Nearly finished but not tested. Also two brand new boxed 4C x 250B valves plus one VHF base and one chimney. Any reasonable offer accepted. Will split if required. Tel: Havant 451746.

■ Frequency counter. Soar 10HZ-50MHz. Good condition, batteries, instructions £25. Hallicrafters receivers. S20 and S20R models, circuit, handbook, valved, need re-alignment, tidying, offers. Two 80Y valves with ceramic bases for chassis, £3. .0005 broadcast tuning condensers, suit Pi-section RF output £2 each. some 3-gang, 4 gang, manuals, Trio KA2000A stereo, amplifier, KW Viceroy transmitter, BCC 69 Tx/Rx, Codar AT5, Eddystone 750, Trio TR-2200G, FT200/250, No 19 set, type 76. 150B2 Valve, £3. Alan 244 Ballards Lane, N12 0EP. Tel: 01-445 4321.

■ Racal RA17L receiver, serviced and realigned March 1984 at cost of £135, very good condition. New colour front panel. 0.5KHz to 30MHz, case supplied.

Marconi selector protector, A must with the RA17, leads supplied with plugs, very good condition, all leads supplied with plugs, £375 the pair or exchange FRG 7700. Buyer collects. I Sear, 35 The Oval, Didcot, Oxon.

■ RGB video monitor, CVB3136R/D television studio type by Rank Cintel. Working when stored via rear inputs, but studio switching unit on front faulty. This unit is very impressive looking and solidly made but rather large. It uses both valves and transistors. £70 as is, carr at buyer's risk. (£50 if collected.) Please write in first instance. JDR, Westowan, Porthtowan, Truro TR4 8AX, Cornwall.

■ 'Superscope' stereo amplifier, 15W RMS, inputs for tuner, tapes (with monitor), ceramic cartridge, magnetic cartridge, aux input. Exchange for stereo cassette radio for car with cash adjustment if necessary. BGC gas fire in teak, hammered metal and chrome with astonishing real open fire effect. Retails at £140, only £50. Gordon Jackson. G4FPK, 109. Culver Grove, Stanmore, Middlesex, HA7 2NG. Tel: 01-907 2253.

■ Practical Wireless, 115 copies 1960 to 1984. 57 other radio mags. Mini Morse Key made for A510 set £2. Japanese ditto, £2. Camera flash bracket £3. Electronic ignition (ETI), new £12.50 Exakta Camera in sorry state, needs craftsman photog. Buff, Schneider lens £12. Ramirez classical guitar as used by Segonia £295. Maidstoe violin and two bows £95.

Process lens, Wray 16in F10 £46. Frank Glynn, 41 Crossways Avenue, East Grinstead, Sussex. Tel:(0342) 22967.

■ BTH Tungar charger, 230 volts, 0-75 volts 8 amps, metered £10. Isolating transformer 230/240 volts 60 VA £5. Various switchboard metres £1 each. PCB component cards, 50 pence each. Radio constructor and Tee mags, 20 pence each. Blackburn, 57 Friern Watch Avenue, Finchley, N12 9NY. Tel: 445-6997.

■ Icom IC740 with FM marker PSU20 £550, Swan ST2A 2KW QRO ATU covers all bands, fitted Balun and metres £100.

American Vomax split band speech processor-,cost almost 200 dollars, sell £60, Western DX31 3 band alloy trap dipole with instructions £25, Bill Moscrop G4EMG. Tel: 01 534 3460 (evenings) 01-553 7161 (daytime).

■ Transverter MMT 432/144R 2m input 70cms output repeater shift SSB/FM 15dB altenator included IOW out, vgc £125 ono. G4ABF QTHR Tel: Malvern (06845) 66202.

■ Yaesu FRG7 receiver plus MGC 7 Led freq. Read out unit plus perspex dust cover and hand book. Boxed, as brand new £145.000.

Sony CRF 5090 Earth Orbiter, 9 bands cover 5 short waves MW, LW, FM and Air Handbook, mint unmarked condition. Tel: Sheffield (0246) 410545 evenings.

WANTED

Ex-RAF forage cap with badge. Also letters from ex-RAF WWII WOPS, If trained at Blackpool and Compton Bassett and operated in Western desert. Also interested in inexpensive WWII Rx, eg 1155 (mains), SX28A, R1475 with type 360 power unit, or similar, F Glynn, 41 Crossways Avenue, East Grinstead, sussex. Tel: (0342) 22967.

■ Geiger counter or Geiger Muller tube. Also surplus components, kits PCB etc for novice constructor. Also test equipment, books, mags. etc Barrie MacDonald, 32 Peverel Road, Leicester, Tel: Leicester (0533) 823436.

■ Pye pocket phones. Gordon Jackson G4FPK, 109 Culver Grove, Stanmore, Middlesex, HA7 2NG. Tel: 01 907 2253.

■ KW107 Supermatch, cash waiting, can collect or pay carriage. also wanted speaker plug for KW202 Rx, two pins of different sizes – can anyone help? Barrie, Tel: Herne Bay 02273 3511 (evenings or weekends).

■ Swap Coasar 107E 66 Channel VHF Marine band Rx/Tx (as new) for any system capable of Tx/Rx on MF and HF bands. Petty Officer M Brownlee, 7 Croft Terrace, Botcherby, Carlisle, CA1 2SN. Tel: 45552.

■ Circuit diagram. Service manual for Koyo KTR-1770, eleven band portable receiver. I can photocopy. D Smith, 20 Corsock Drive, Wigan, WN1 3YY. Tel: Wigan (0942) 39576.

■ Sem Z-Match (ATU) 3.5 to 30 MHz or any model required, good price paid. Chris Clarke, 9 Poplar Drive, Fareham, Hants. PO14 1PZ. Tel: 0329 284105

■ Information about Ex WD reception set DST 100 catalogue No 11322. Your price paid for service manual or facility to copy same. would selcome contact with anyone who knows the equipment. K G Whitehead, Bryncroft, Reynoldston, Swansea, SA3 1AE. Tel: Gower 390070

■ Stockists and manufacturers of Aerial HF and oscillator coils, IF transformers, for use in value radios. SW MW LW. R Rawling, 48 Westburn Avenue, keighley, Yorks. BD22 6AW. Tel: 0535 605421.

■ 5in open reel tape spools, ancient ships' receivers or DF gear, chart echo sounder, sonar equipment, transdulers, hydrophones, undersea recordings, 5000 ohm Hi-Fi mono headphones, Woodhouse,'Trenoweth' Porthpean, St Austell, Cornwall, PL26 6AV.

■ SSM Europa 4m transverter G6LKF QTHR or Tel Derek, Southend 553841.

■ Exchange FDK 750EX Multi TR/Rx 1 Watt to 25 watt FM. Good condition no mode. + 4 ele tonner. Also SWR bridge and wave meter for good AM/FM Scanner. Rx G8BJS QTHR. Tel: 07356 71278.

■ Early crystal set and headphones. also double beam scope. Cisira Bede, G8ZIT, 72 Primrose Hill, Haverhill, Suffolk, CB9 9LS. Tel: 0440 61113

■ CB rig, working order, condition not important. Must be very cheap. Circuit diagram would be very useful. Andy Cunningham. Tel: Jersey (0534) 31308.

■ Information required on a British Physical Laboratory meter TVM 1063. Any postage, printing etc will be paid for. Tel: Wisbech 780489

■ Science of Cambridge MK-14 computers, any condition considered. M J Gundy, PO Box 89 Belize City, Belize, Central America.

■ Small Short Wave Marine Amateur Receiver such as Codar T28 or similar. Have Eddystone model 670 not working, with complete set of new valves in fair condition. Also have Synclite projector and Linear L45A amplifier. Would exchange for small SW receiver such as Codar T28 or similar type. A W Hyde, 54 The Causeway, Pagham, Sussex, PO21 4PG. Tel: Pagham 3256

■ Old type of TV games wanted. Stunt Cycle, Tank Battle, Road Race, etc. Please send details and price. D Martin, 29 St Johns Close, Leatherhead, Surrey.

■ Have Stalker ST9 FDX multimode CB transceiver, as new, still in box. Five modes, plus 40 channel, UK. also base antenna K40 with magmount. Will swap for TR2300 2M FM portable transceiver. C Roberts, 20 Bridge Street, Shotton, Deeside, Clwyd, Tel: Deeside 811687

■ Old'Radio constructor' magazines with diagrams.'Practical Wireless' magazines 1930s-60s and RSGB books. Good price paid. J Savage, 7 Weyhill Close, PK North, Swindon, Wiltshire.

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WANTED

■ Racal RA63 SSB adaptor. Add-on frequency counter up to 200 MHz and Xtal calibrator. Tel: Milton Keynes 0908 314095 before 2pm.

■ FRG7 or similar. Must be good condition, preferably Herts Bucks area. Please phone with details to G41XY St Albans. Tel: 39908.

■ Circuit diagram and/or workshop manual for GEC communications receiver type BRT 400D. Good price paid or will pay for loan of same. Martin, 4 Church Lane, Timberland, Lincoln, LN4 3SB or Tel: 222.

■ German WW2 radio and radar equipment by collector. Parts, technical bulletins etc also wanted. Will collect or pay freight. Ragnar Otterstad, Vehdammen 5, DK28YO, Holte Denmark. Tel: 02-801875 (evenings)

■ Realistic Pro 2002 so channel scanner or Gemscan 70 or similar G8RHU Tel: 0273-516801 (Newhaven).

■ Rigonda 6in television sets – working or not. Viewfinder/monitor and service manual for Sony CVC2100 monochrome television camera. Andie Wilkes, G4NTV, 34 Tideswell Road, Great Barr, Birmingham, B42 2DT Tel: 021 525 5445 (office hours only)

■ Exchange Realistic Professional 2001 Scanner, Brand new, Program with memories, covers a II VHF, UHF. Bands for HF Rig. Tel: St Albans 39333

■ Free standing Tilt over telescopic triangular tower, any height considered. Must be hot dip galvanised and preferably with electric winch. G3XSN QTHR. Tel: 051 722 3644

■ WS68 and Radioset No 8, No 1, for defence museum in Scandinavia. Will pick up. Also incomplete set of interesting Canadian WS53 also wanted. Can offer equipment from the same era or cash in return. Will collect in UK. R Otterstad, Vejdammen S, DK2870 Holte, Denmark. DK 2840 Holte.

■ Wireless equipment radio valves, wireless books, mags, trade literature 1920 to 1930. also early valve Hi-Fi (Leak, Williamson, Quad 1, Lowther etc) and Clandestine 'Spy Set' radios/military communications equipment. Anything interesting with valves in it considered. Tel: 794-0823

■ Circuit and calibration data for BPL component comparator CZ457/3 to loan or purchase. Also manual and or circuit for cossor FM alignment generator, model 1324. Also circuit for advance millivoltmeter 77B. H. L. Earnshaw, 58 Prices Lane. Reigate, Surrey. RH2 8AY. Tel: Reigate 21480.

■ Heathkit HW7 or HW8 or Mizuho HF QRP transceiver, working or not. Full details and price. Tel: Newbury 40750.

■ Cheap good condition ZX81 for under £45 with books and games and instructions. Master Toby Wood, 37 Pilgrims Way, Harleston, Norfolk. Tel: 853456.

■ CW, RTTY decoder, also 10m to 2m transvrtr. Tel: 054 27 372.

■ Yaesu YC221 digital freq. display for FT221. G8YQT, QTHR. Tel: 0227 60675.

■ R408M Redifon Marine Comms RX. Sailed with these. Any on S/H market? Prices ? I have CCTs. Morris Tel: 0654 710 741.

■ Circuit diagrams of Westminster FM low band, Motorola Maxar low band Europa FM, Realistic PRO2001 scanner plus mods. Details of single crystal CB's to 10 metres. Am interested in 934 MHz equipment and would appreciate any info on the subject. Des Walsh (EI5CD) 17 Owenabue Rise. Carrigaline, Co Cork, Eire.

■ Empty 5-inch tape reels. H G Woodhouse, Trenoweth, Porthpean, St Austell, Cornwall, PL26 6AN.

■ I would like to get in touch with people in UK to trade VIC 20 books, tapes, discs, etc. Write to: Mike Neville, 182 Eagle Road, Lethbridge, Alberta, Canada, T1H 456.

■ Drake desk mic, type 7095, 7077 etc. Price QTH. Pete Bennett, (G3VDU). Tel: Nuneaton 349461.

■ FT 77 or similar. Cash oi PX FT 290R + accessories. G1ELN. Tel: 06632 2545.

■ Oscilloscope tube, new or secondhand, type 'Etel' 3AZP31, good price paid. T. Watkins, 68 Ashwood Road, Nuneaton, Warwickshire CV10 9AY.

■ CCT diagram or any information on ARDE scope type 58 and type 63/3, can photocopy. £10.00 offered, also handbook, Solartron scope 5701D with units CX 1441 and CX 1443. L.R.K. Gregory, The Well House, The Downs, Herne Bay, CT6 6JP. Tel: 02273 4774.

■ 'Senior Citizen' enthusiast wants Linsley Hood cassette recorder (Series 2) by Hart Electronics. Complete working or unbuilt kit, with VFL910 deck. Even part kit considered, but must have deck with it. Not too expensive please. Could exchange with camera. Ken Evans, Shelford Cottage, Melbury Abbas, Shaftesbury, Dorset. Tel: Shaftesbury 3515.

■ Racal RA63 SSB adaptor, HRO and coils + P/P. Milton Keynes, 0908-314095 (after 3pm).

■ Trio R2000 and Trio VHF converter in first class condition. Tel: Wroxham (06053) 3292.

■ Help! Has anybody any idea who may have hidden in his shack a VFO 30G or any VFO that will adapt to fit the Kenwood Trio TR-7200G. If you do and it's for sale please contact Terry, G1FFH at 25 Duke Street, Fitzwilliam, Pontefract, WF9 5AF.

■ Manuals or circuit for Heathkit oscilloscope 0-12U and electronic switch S3U. Also Philips Scope PM 3201. Buy or borrow. Write C G Tennant, 7 The Maltings, Cranleigh Gardens, South Norwood, London, SE25 6UJ.

■ Benkson portable radio model 999. This radio has fourteen transistors and covers five wave bands and is powered by batteries only. Frank T Plan, 215 Dickson Avenue, Dundee, Scotland. DD2 4DD. Tel: Dundee 645325.

■ AM CB and plans for all band AM TX. Thomas Williams, 51 Alamein Drive, Winsford, Cheshire. CW7 1DG.

■ FT 290B and 13.8V, 25 amp protected PSU. Mike Jackson G3TSL, 27 Greenacres, Freckleton, Preston, Lancs, PR4 1PS. Tel: 0772 635560.

■ Manual for Lafayette receiver HE80 or photostat. Will pay. Ray White, 38 Boxted Avenue, Clacton on Sea, Essex.

■ Owners Manual/Service manual or telequipment D31R, Taylor valve tester, Windsor 45B/photocopy, buy, borrow. Tony Palmer, 409B Chiswick high Road, London, W4. Tel: 01 994 8001.

■ Yaesu FRG 7700 or Trio R2000. Have to swap Ham International Jumbo Homebase CB including Protel stand mike with graphic equaliser, compressor, etc. as new. A Campbell, 24 Elizabeth Rd, Seaton, Devon. EX12 2DS. Tel: Seaton 22115.

■ Urgently required, circuit diagram or any information for Metero model U127S AC/12VDC. B/W 12in portable TV, make unknown. Denning, 46 Court Road, Kingswood, Bristol. BS15 2QG. Tel: Bristol 675006.

■ RTTY and SSTV programs for the CBM64 wanted on cassette. exchange possible with other programs. D C Cabasson, 25 Rve Epoigny, 94120 Fontenay-Sous-Bois, France.

■ Circuit information on how to convert Harvard 410T. Forty Channel 27MHz handheld NBFM transceiver to work on 29.6MHz amateur band. Anthony Stokes G3ZRH, Shenfield Crescent, Brentwood. Essex, CM15 8BW. Tel: 0277 221465.

■ Exchange FT708R 70cm Portable TX/RX, NC-9C charger plus Datong D70 Morse Tutor. All as new in original packaging, for FRG7700, FT101, R1000, R600 or WHY? Brian Aspinal G6CJL, 5 Park Fields, Moor End Road, Halifax. Tel: (0422) 54635.

■ Manual or circuit diagram for RCA Victor AR77E. Will purchase or photo copy. E Robins, 69 Hart Road, Byfleet, Surrey. KT14 7HL. Tel: Byfleet 40753.

■ Data books, ESP Motorola RF manual WHY? G4AIR Tel: 0606 882949. QTHR.

■ Trio TS820 Add ons, digital freq. unit, external VFO. C S Fawkes, 130 Chatterly Drive, Kidsgrove, Stoke on Trent, Staffs. Tel: Kidsgrove 72100.

■ One FV-101 for Yaesu FT101. Plus SP-101P for same. Good price paid. Tel: Bangor (0248) 354022 or write David Oates, 41 Fford Tegai, Maesgeirchen, Bangor, Gwynedd.

■ Ireland Bearcat or similar air band etc. Scanner. Must be working well. Mods accepted. Service manual for Philips PM5508 Pattern Gen. expenses paid, can photocopy. Ray Lyons, 27 High Meadows, Gouldavoher, Limerick, Ireland, Tel: 061/29287.

■ BC348 receiver. No mods, complete with motor gen. Parts for R1475 including output transformer. Scrap set considered. Meter for 19 set. R107, R1224, BRT400. Info on receiver type R3582 and ind unit type 62A. Interested in any WWII radio gear, including plugs, sockets etc. Steadman, 4 Vineyard Way, Buckden, Cambs. Tel: 0480 810382 (evenings)

■ Instruction manual for GEC sound deck, model No A 5022H. Will buy or photocopy. Tel: Bexhill 215619

■ LF converter, type RA337 and SSB adaptor RA298. Also rack mount case for Racal 1217 receiver or any parts to do with 1217 receiver. B Pollard, 3 Deepdene Mansions, Rostrevor Road, London SW6. Tel: 01-736 6581 (evenings)

■ Icom IC 251E VHF XCVR or Sommer Kamp TS 788DX XCVR. Will exchange TEAC X3R stereo reel to reel tape recorder. Auto reverse, cost £400, used half hour only. R M Dotchin, 2 The Crescent, Shorts Town. Bedford MK42 OUJ. Tel: Hitchin 815016, Ext. 2453 Working hours.

■ 12MHz Xtals for Seavoice Marine FM. RX, TX for 144 conversions. A E Jeffrey, 42 Dennis Road, Padstow, Cornwall PL28 8DF. Tel: Padstow 532723 (after 6.30pm).

■ Swap Super 8 Camera, projector, editor and splicer for good 2m rig or linear-amp in good condition. IW input. Toni. Tel: 021 236 1974 ext 268 (leave message, anytime.)

● Yaesu FT 720 RV 2m 10W FM Mobile purchased 1.3.84. Used on RX 5 mins only. £169. G1FUO.Not QTHR. Tel: South Elmsall 43101.

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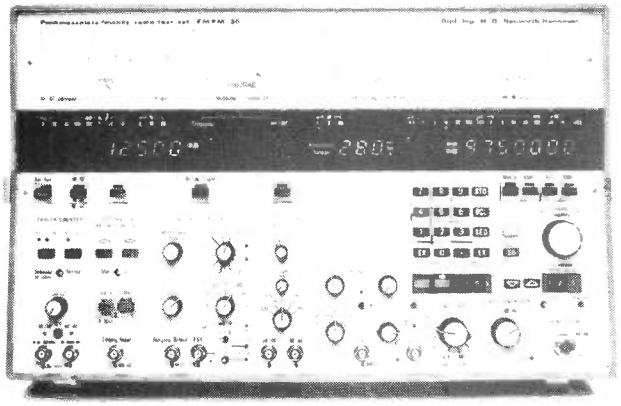

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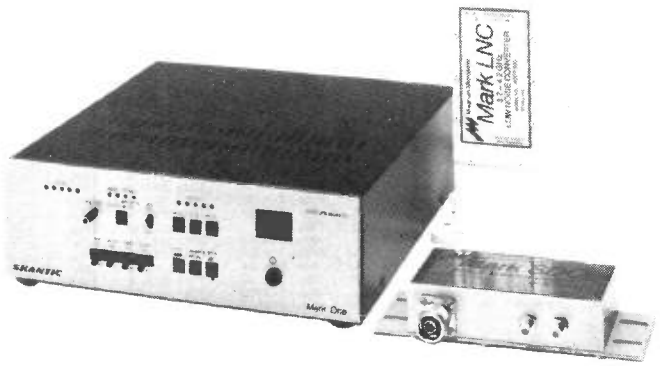
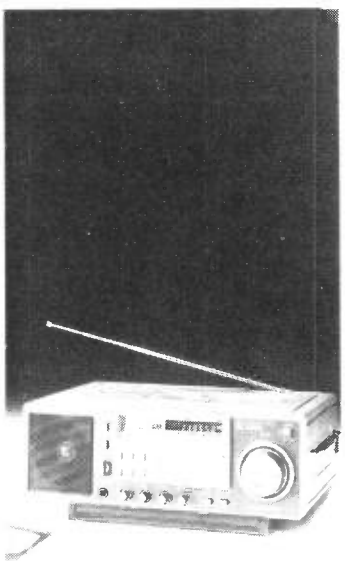
Further details on the Model FMPM-30 can be obtained from: *The Sales Department, Systron-Donner Limited, St Marys Road, Sydenham Industrial Estate, Leamington Spa, Warwickshire, Tel: (0926) 35411.*

SATELLITE RECEIVER SYSTEMS

Magnum Microwave Corp of California, Luxor AB of Sweden and Luxor (NA) Corp of Washington, announce the presentation of the TVRO Satellite Receiver Systems in North America and Europe. The Luxor/Magnum joint enterprise will focus on 4GHz and 12GHz Satellite Receiver systems, combining a range of advanced design Luxor Satellite Receivers with Magnum-designed Downconverters and Low Noise Converters. Further information: *Magnum Microwave Corporation, Mountain View, California. Tel: (415) 968-9281.*



THE PANASONIC RE-B600LBE PORTABLE COMMUNICATIONS RECEIVER



Panasonic have introduced the RF-B600LBE, a PLL synthesized FM/LW/MW/SW portable communications receiver with a micro-computer multi-tuning system. This model is designed to give accurate, stable reception. This new mains or battery operated portable radio has a highly developed technological construction, although operating procedures are straightforward.

The RF-B600LBE incorporates 5 advanced tuning systems, and a fluorescent digital display will show the frequencies that are being tuned – in 1KHz steps for SW/LW and MW bands and in 0.005MHz for the FM band. Additional features include: a product demodulator for clearer SSB and CW; an automatic noise limiting system to reduce unwanted interference; an AM/RC gain control to permit adjustment of signals that are too strong and cause distortion; and a widthband selector switch designed to prevent cross interference and provide cleaner sounds in AM broadcasts.

Elegantly styled in a silver and grey finish, the RF-B600LBE has a recommended retail price of £444.50 and is available complete with instruction manual through Panasonic's authorised dealer network.

WOULD YOU BELIEVE IT?

Sansui Electronics (UK) are launching a whole new range of in-car hi-fi products that aim to offer the same levels of sound reproduction in your car as you have become accustomed to in your home.

Sansui have achieved this goal by concentrating on the technical specifications of the product range, eg their RX 700/710 models have a THD (Total Harmonic Distortion) of .05% which is even less than their own highly acclaimed AU-D22 domestic amplifier, and something you'll really appreciate when you turn the volume up.

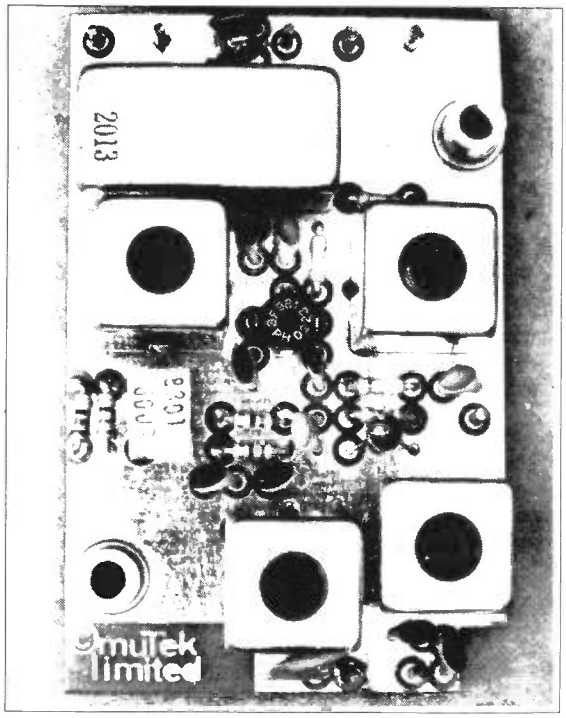
This concern with sound quality, has not, however, caused Sansui to ignore those convenient features that allow you to keep your eyes on the road, whilst operating your system. The RX 700/710 has auto reverse and there is automatic music program search, to help you easily locate tracks on a cassette. There are also 30 pre-sets on the tuner section, which again is highly specified with a frequency response of 30-15 kHz – as good as the majority of domestic tuners.

The range starts at just over £200, with the flag-ship model, the CX 910L costing around £340, for whch you get Dolby B & C, bass, treble, loud, quartz PLL synthesized tuning, automatic station seek and a choice of green or orange panel illumination as well as a host of other features.

The power output of the models ranges from 12 watts per channel to 20 watts, with the additional option of two power amplifiers for those who want up to 55 watts per channel.

Also available will be a wide selection of 2-way and 3-way speakers.

ADVERTISERS INDEX



SLNA 145sb preamplifier for Yaesu's FT290 transceiver. £27.40 + £1.20 p&p inc VAT

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The answer isn't really obvious. Good engineering often isn't. But that IS the answer: good engineering. But why is it that muTek products work so well? You see there's an awful lot more to good engineering than merely finding the 'right' transistor for example. There's a lot more to it even than the extensive use of computer-aided systems analysis and design techniques, or the use of quality components and printed circuit boards. There's experience, and that's one item that's always in stock at muTek. Experience in the design of everything from synthesised uhf signal generators, to downconverters for microwave pay-tv systems, to antenna test equipment. Lessons learnt in such projects benefit our amateur radio customers today. There's another thing too — backup. How many people do you know who've paid for factory service or repair of their muTek products, in or out of guarantee? We care! What about reliability? That's simple — we couldn't afford to offer such deep support if we had reliability problems!! Delivery? We've had problems in the past, and we've admitted it! However, these problems are now receeding into history, and we are now usually able to supply most of our range if not from stock, then within a few days.

We enjoy making amateur radio equipment: it's an extraordinary challenge to do it well. We may make equipment for radio amateurs, but we're anything but amateur in our attitudes to our work!

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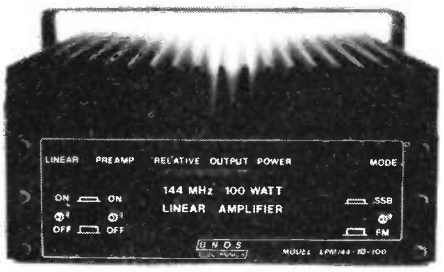
The L144 Range

To complement the LPM range, we have introduced the L series linear-only versions for the amateur who may already be equipped with a good pre-amplifier and power meter. The excellent linear performance is maintained and both RF Vox and hard-wired changeover are standard.



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- *Mobile mount on all 100 Watt models*

LPM144-1-100	**£172.50**
LPM144-3-100	**£172.50**
LPM144-10-100	**£149.50**
LPM144-25-160	**£207.00**
LPM144-3-180	**£235.75**
LPM144-10-180	**£235.75**

LINEAR PART NUMBERING SYSTEM

LINEAR — LPM144-3-100 — OUTPUT POWER

PREAMP

RF METER

FREQUENCY (BAND)

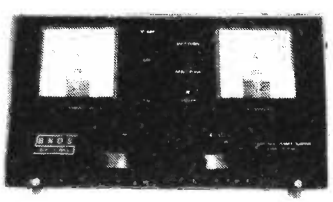
INPUT POWER

L144-1-100	**£143.75**
L144-3-100	**£143.75**
L144-10-100	**£120.75**
L144-25-160	**£178.25**
L144-3-180	**£207.00**
L144-10-180	**£207.00**

BNOS 'A' Series Power Supplies

12/6A £52.90
- 13·8V, 6A continuous output
- 7A maximum output current
- 10A current meter
- 10A output terminals
- LED shut down indicator
- Fully protected

12/25A £138.00
- 13·8V, 25A continuous output
- 30A maximum output current
- Large 30A current meter
- 30A output terminals
- LED shut down indicator
- Fully protected



12/12A £95.45
- 13·8V, 12A continuous output
- 15A maximum output current
- Large 20A current meter
- 15A output terminals
- LED shut down indicator
- Fully protected

12/40A £276.00
- 13·8V, 40A continuous output
- 50A maximum output current
- Large 50A current meter
- Large output meter
- LED shut down indicator
- LED out of regulation indicator
- Output sensing terminals
- Fully protected

Our Guarantee *Our aim is to provide you with high quality products at realistic prices, to give you the best value for your money.*

All products that carry our logo are designed and built by our engineers in the UK and carry a full 12-month guarantee, which includes all parts and labour.

We are so confident that our linears are simply the best that we offer to repair your unit at component cost for up to 5 years from date of purchase. That means we will repair, calibrate and return to you free of charge.

All other products sold by us carry our standard 12-month guarantee.

Available direct or from one of our many UK agents — or come and see us at most rallies and exhibitions

BARCLAYCARD VISA

BNOS Electronics (Dept RE) Bigods Hall, Great Dunmow, Essex, CM6 3BE
Telephone (0371) 4677 SAE for further details

PLEASE NOTE NEW ADDRESS AND PHONE NUMBER

All prices include VAT. Postage free on all Mainland UK orders, goods normally despatched by return.

ENFIELD ELECTRONICS

208 Baker Street, Enfield, Middlesex. EN1 3JY. Tel: 01-366 1873

TRANSISTORS

AC125	30p	BC183C	12p	BF198	14p	TIP29C	45p
AC126	30p	BC183L	12p	BF199	14p	TIP30A	40p
AC127	30p	BC183LB	12p	BF200	35p	TIP30B	50p
AC128	30p	BC184	12p	BF224B	20p	TIP30C	45p
AC132	90p	BC184B	12p	BF244B	35p	TIP31	38p
AC141	30p	BC184L	12p	BF256	35p	TIP31A	40p
AC142	30p	BC186	30p	BF257	35p	TIP31B	40p
AC176	30p	BC187	30p	BF258	35p	TIP31C	45p
AC187	30p	BC212A	14p	BF259	35p	TIP32A	40p
AC188	30p	BC212L	12p	BF594	40p	TIP32C	40p
AD149	80p	BC213	12p	BF595	30p	TIP36C	140p
AD161	45p	BC213B	12p	BFR39	20p	TIP41A	50p
AD162	45p	BC213L	12p	BFR79	30p	TIP41B	50p
BC107	12p	BC214	12p	BFR80	30p	TIP42A	60p
BC107A	14p	BC214B	14p	BFX29	30p	TIP42B	65p
BC107B	14p	BC214L	12p	BFX84	30p	TIP120	80p
BC108	12p	BC237	18p	BFX85	30p	TIP121	80p
BC108A	14p	BC238B	18p	BFX87	30p	TIP122	100p
BC108B	14p	BC307	18p	BFX88	30p	TIP2955	70p
BC108C	14p	BC308	14p	BFY50	28p	TIS43	36p
BC109	12p	BC327	16p	BFY51	25p	TIS44	40p
BC109B	14p	BC328	16p	BFY52	25p	TIS90	30p
BC109C	14p	BC337	16p	BFY90	80p	TIS91	30p
BC140	35p	BC338	16p	BRY39	40p	VN10KMA	75p
BC141	35p	BC441	36p	BSX20	30p	VN66AF	95p
BC142	35p	BC461	36p	BSX29	35p	VN88AF	110p
BC143	35p	BC477	40p	BU105	170p	ZTX107	12p
BC147	12p	BC478	40p	BU205	200p	ZTX108	12p
BC148	12p	BC517	45p	BU208A	220p	ZTX109	12p
BC157	12p	BC547	15p	MJ2955	90p	ZTX300	15p
BC158	12p	BC548	15p	MJE3055T	80p	ZTX301	18p
BC159	12p	BC549	16p	MJE340	50p	ZTX302	20p
BC160	50p	BC556	20p	MJE371	90p	ZTX303	20p
BC161	45p	BC557	16p	MJE2955	110p	ZTX304	20p
BC167	15p	BC558	16p	MPSA06	25p	ZTX330	35p
BC168	12p	BC559	16p	MPSA56	30p	ZTX500	18p
BC169	12p	BCY70	20p	MPSU05	65p	ZTX501	18p
BC170	20p	BCY71	20p	MPSU56	60p	ZTX502	18p
BC171	13p	BCY72	23p	OC22	150p	ZTX503	18p
BC172A	12p	BD131	50p	OC23	150p	ZTX504	30p
BC173	13p	BD132	50p	OC26	100p	ZTX531	30p
BC177	20p	BD133	60p	OC28	200p	ZTX550	30p
BC178	20p	BD135	50p	OC36	220p	2N696	35p
BC179	25p	BD136	40p	OC41	75p	2N698	45p
BC181	23p	BD137	40p	OC42	75p	2N699	40p
BC182	12p	BD138	40p	OC70	60p	2N706A	26p
BC182B	14p	BD139	45p	OC76	60p	2N708	30p
BC182L	12p	BD140	45p	OC81	60p	2N914	36p
BC183	12p	BF194	14p	OC82	60p	2N918	30p
BC183B	12p	BF195	14p	OC84	50p	2N930	30p
				TIP29	30p	2N1131	30p
				TIP29A	35p	2N1132	30p
				TIP29B	50p	2N1303	80p

2N1304	80p	2N3055E	60p
2N1305	80p	2N3442	150p
2N1307	70p	2N3615	200p
2N1308	80p	2N3702	12p
2N1613	36p	2N3703	12p
2N2222A	30p	2N3704	12p
2N2369A	28p	2N3705	12p
2N2646	68p	2N3706	12p
2N2904A/5A	30p	2N3707	12p
2N2906A	60p	2N3708	12p
2N2907A	30p	2N3710	12p
2N2926G	12p	2N3711	12p
2N2926R	12p	2N3771	200p
2N2926Y	12p	2N3772	200p
2N3053	30p	2N3773	200p
2N3054	75p	2N3819	25p

TTL

7400	18p	7417	28p	7447	75p	7486	35p	74119	70p	74160	65p	74190	58p
7401	18p	7420	20p	7448	55p	7489	140p	74121	35p	74161	55p	74191	55p
7402	18p	7422	28p	7450	21p	7490	37p	74122	41p	74162	46p	74192	55p
7403	18p	7425	28p	7451	20p	7491	45p	74123	41p	74163	46p	74193	55p
7404	18p	7426	28p	7453	21p	7492	40p	74126	70p	74164	46p	74194	52p
7405	18p	7427	30p	7454	21p	7493	41p	74132	65p	74165	60p	74195	52p
7406	32p	7430	26p	7460	21p	7494	41p	74135	50p	74166	60p	74196	55p
7407	32p	7432	26p	7470	25p	7495	41p	74141	51p	74167	185p	74197	55p
7408	25p	7433	35p	7472	25p	7496	41p	74144	250p	74170	195p	74198	95p
7409	25p	7437	30p	7473	30p	7497	60p	74145	575p	74173	120p	74199	95p
7410	18p	7438	30p	7474	35p	74100	95p	74147	125p	74174	85p	74221	60p
7411	25p	7440	23p	7475	40p	74104	58p	74148	65p	74175	65p	74279	60p
7412	26p	7441	51p	7476	35p	74105	58p	74150	70p	74176	46p	74284	95p
7413	26p	7442	40p	7480	30p	74107	30p	74151	46p	74177	55p	74285	95p
7414	37p	7443	71p	7481	110p	74109	30p	74153	46p	74180	50p	74366	64p
7416	28p	7444	95p	7482	70p	74110	41p	74154	81p	74181	121p	74390	325p
		7445	71p	7483	58p	74111	70p	74155	46p	74182	70p	74393	100p
		7446	71p	7484	81p	74116	70p	74156	46p	74184	105p		
				7485	75p	74118	65p	74157	35p	74185	105p		

LS TTL

74LS00	17p	74LS27	21p	74LS83	51p	74LS138	40p	74LS169	98p	74LS243	81p	74LS293	46p
74LS01	17p	74LS28	21p	74LS85	52p	74LS139	39p	74LS170	86p	74LS244	65p	74LS353	71p
74LS02	17p	74LS30	21p	74LS86	23p	74LS147	121p	74LS173	63p	74LS245	86p	74LS362	110p
74LS04	17p	74LS32	21p	74LS90	39p	74LS148	86p	74LS174	58p	74LS247	85p	74LS365	35p
74LS05	17p	74LS33	21p	74LS93	35p	74LS151	46p	74LS175	52p	74LS248	66p	74LS366	35p
74LS08	18p	74LS37	21p	74LS95	46p	74LS153	52p	74LS181	115p	74LS249	66p	74LS367	35p
74LS09	20p	74LS38	21p	74LS96	109p	74LS154	120p	74LS183	201p	74LS251	40p	74LS368	35p
74LS10	20p	74LS40	21p	74LS107	46p	74LS155	46p	74LS190	58p	74LS253	46p	74LS373	70p
74LS11	20p	74LS42	37p	74LS109	35p	74LS156	46p	74LS191	55p	74LS257	40p	74LS374	70p
74LS12	23p	74LS47	63p	74LS112	32p	74LS157	40p	74LS192	55p	74LS258	43p	74LS375	52p
74LS13	28p	74LS51	21p	74LS113		74LS158	40p	74LS193	55p	74LS259	67p	74LS386	130p
74LS14	32p	74LS54	21p	74LS114	32p	74LS160	40p	74LS194	52p	74LS260	30p	74LS390	55p
74LS15	21p	74LS55	21p	74LS122	46p	74LS161	40p	74LS195	52p	74LS266	32p	74LS393	55p
74LS20	21p	74LS63	138p	74LS123	75p	74LS162	40p	74LS196	52p	74LS273	63p	74LS395	98p
74LS21	21p	74LS73	25p	74LS124	166p	74LS163	43p	74LS197	52p	74LS275	146p	74LS398	310p
74LS22	21p	74LS74	25p	74LS125	37p	74LS164	48p	74LS221	63p	74LS279	40p	74LS541	130p
74LS26	21p	74LS75	28p	74LS126	35p	74LS165	60p	74LS240	81p	74LS280	110p	74LS629	200p
		74LS76	25p	74LS132	41p	74LS166	81p	74LS241	75p	74LS283	46p	74LS668	160p
		74LS78	25p	74LS136	28p	74LS168	97p	74LS242	80p	74LS290	60p	74LS670	120p

CMOS

CD4000	15p	CD4015	46p	CD4035	55p	CD4054	100p	CD4093	40p	CD4503	46p	CD4568	80p
CD4001	15p	CD4016	30p	CD4038	125p	CD4060	80p	CD4099	140p	CD4511	52p	CD4572	80p
CD4002	15p	CD4017	40p	CD4040	50p	CD4066	30p	CD4160	75p	CD4512	60p	CD4581	80p
CD4006	60p	CD4018	52p	CD4041	50p	CD4068	20p	CD4161	75p	CD4514	140p	CD4582	80p
CD4007	16p	CD4019	30p	CD4042	45p	CD4069	20p	CD4162	75p	CD4515	200p	CD4583	60p
CD4008	45p	CD4020	52p	CD4043	46p	CD4070	16p	CD4163	75p	CD4516	65p	CD4584	60p
CD4009	30p	CD4021	46p	CD4044	46p	CD4071	18p	CD4175	75p	CD4518	52p	CD4585	110p
CD4010	35p	CD4022	46p	CD4045	120p	CD4072	18p	CD4402	75p	CD4520	60p	CD40100	200p
CD4011	15p	CD4023	20p	CD4046	55p	CD4075	25p	CD4412	75p	CD4528	81p	CD40106	80p
CD4012	20p	CD4024	40p	CD4047	46p	CD4076	60p	CD4419	75p	CD4538	100p	CD40109	100p
CD4013	25p	CD4025	18p	CD4048	45p	CD4077	30p	CD4445	75p	CD4539	78p	CD40114	200p
CD4014	55p	CD4026	100p	CD4049	30p	CD4078	25p	CD4446	75p	CD4541	100p	CD40174	80p
		CD4027	25p	CD4050	30p	CD4081	25p	CD4449	75p	CD4555	60p		
		CD4028	45p	CD4052	70p	CD4082	25p	CD4501	35p	CD4561	110p		
		CD4029	55p	CD4053	60p	CD4085	72p	CD4502	70p	CD4568	80p		

LINEAR

CA1310E	185p	CA3090	415p	LM339	80p	LM3911	140p	SAA5020		TDA1008	347p	TL074	117p
CA1350E	90p	CA3130	105p	LM348	90p	LM3914	285p	SN76013N	295p	TDA1022	570p	TL081	40p
CA3020	230p	CA3140	52p	LM358	62p	LM3915	285p	TAA621A	290p	TDA1024	120p	TL082	65p
CA3028	110p	CA3240	125p	LM380	85p	LM3916	285p	TAA661B	175p	TDA2002	150p	TL083	92p
CA3035	270p	ICM7555	105p	LM381	170p	MC1458	70p	TBA120B	70p	TDA2003	345p	TL084	85p
CA3043	305p	ICM7556	200p	LM382	130p	MC1488	80p	TBA120S	68p	TDA2020	350p	UA748	40p
CA3055	85p	LF347	200p	LM384	160p	MC1489	90p	TBA120U	98p	TDA2030	340p	ZN414	95p
CA3043	305p	LF351N	55p	LM386	100p	NE555	20p	TBA540Q	161p	TDA2102		ZN424	150p
CA3055	85p	LF353N	100p	LM387	140p	NE556	55p	TBA651		TDA2522		ZN425	400p
CA3065	150p	LM224	150p	LM389	110p	NE564	405p	TBA800	95p	TDA9400		ZN426	345p
CA3080	80p	LM301	30p	ILM732	55p	NE566	173p	TBA810S	110p	TL061	50p	ZN427	715p
CA3081	225p	LM308	100p	ILM747	75p	NE567	161p	TBA820	81p	TL062	75p	ZN1034	230p
CA3085	145p	LM311N	81p	ILM1458	45p	NE570	391p	TBA920Q	175p	TL064	150p	ZN1040	750p
CA3086	65p	LM318N		ILM3900	70p	NE571	387p	TCA270S	171p	TL071	50p		
CA3089	230p	LM324	50p	ILM3909	92p	SAA5010		TDA1004	345p	TL072	60p		

DIODES

AA119	15p	OA200	9p	1N5060	18p
AA215	16p	OA202	9p	1N5062	20p
BAX13	10p	1N823	5p	1N5400	11p
BY100	30p	1N914	5p	1N5401	12p
BY127	18p	1N916	6p	1N5402	14p
BY133	20p	1N4000	5p	1N5403	15p
BY206	30p	1N4001	5p	1N5404	16p
BY207	30p	1N4002	5p	1N5405	17p
BY299	40p	1N4003	6p	1N5406	18p
BYX10	18p	1N4004	6p	1N5407	22p
OA47	10p	1N4005	7p	1N5408	25p
OA90	8p	1N4006	7p	1S44	5p
OA91	8p	1N4007	8p	1S921	7p
OA95	8p	1N4148	5p	1S922	7p
		1N4448	6p	1S923	7p

LEDs

5mm: Red	10p	113: Red			
Green	13p	Red	20p		
Yellow	13p	Green	25p		
3mm: Red	10p	Yellow	25p		
Green	13p	323: Tri.			
Yellow	13p	Red	20p		
COX21: Red		Green	25p		
flashing	65p	Yellow	25p		
251: Rect/stack.		503: Square			
Red	20p	Red	20p		
Green	25p	Green	25p		
Yellow	25p	Yellow	25p		

REGULATORS

LM304H	180p	UA723C	77p	78H12 (3A/5V)	
LM309H	80p	7805A	50p		460p
LM309K	130p	7812A	50p	78L05	35p
LM317K	350p	7812Kc	121p	78L12	35p
LM317T	130p	7815A	50p	78L15	35p
LM320/5	65p	7818A	50p	78L18	35p
LM320/12	65p	7824A	50p	78L24	35p
LM320/15	65p	7905A	55p	78L62	35p
LM320/24	65p	7912A	55p	79L05	45p
LM337T	180p	7915A	55p	79L12	45p
LM1469	324p	7918A	55p	79L15	45p
UA78P (8A/5V)		7924A	55p	79L18	45p
	450p			79L24	45p

RIBBON CABLE

(Priced per ft)

COLOUR	
WAYS	
10	26p
20	53p
26	76p
34	100p

D CONNECTORS

MALE		FEMALE
9 way	75p	100p
15 way	100p	1140
25 way	140p	195p

D-CONNECTOR COVERS

9 way	110
15 way	110
25 way	125

RECHARGEABLE BATTERIES

HP2, 1.2v, 4.0AH	£3.95
HP2, 1.2v, 1.2AH	£2.60
HP11, 1.2v, 1.2AH	£2.40
HP7, 1.25v, 500mAH	£1.00
AAA, 1.2v, 180mAH	30p
PP3, 8.4v, 110mAH	£4.50

I.C. SOCKETS

LOW PROFILE		TURNED PIN	
D.I.L Type	Price	D.I.L. Type	Price
8 pin	10p	8 pin	35p
14 pin	12p	14 pin	50p
16 pin	14p	16 pin	60p
18 pin	18p	18 pin	65p
20 pin	24p	22 pin	75p
22 pin	25p	24 pin	80p
24 pin	30p	28 pin	100p
28 pin	32p	40 pin	150p
40 pin	35p		

ZENER DIODES

BZX61C/1.4 watt: 3V3, 3V6, 3V9, 4V7, 5V6, 6V2, 7V5, 8V2, 10V, 11V, 12V, 13V, 15V, 18V, 20V, 22V, 24V, 27V, 30V, 33V, 36V, 39V, 43V, 47V, 56V, 68V, 75V, 82V, 100V, 180V, 200V
16p each

BZY88C/0.4 watt: 1V3, 2V7, 3V, 3V3, 3V6, 3V9, 4V3, 4V7, 5V1, 5V6, 6V2, 7V5, 8V2, 9V1, 10V, 11V, 12V, 13V, 15V, 16V, 18V, 22V, 24V, 27V, 30V, 33V, 36V
10p each

ALUMINIUM BOXES

3¼" × 1¾" × 2¼"	
80 × 50 × 25	80p
100 × 65 × 50	1.20
100 × 70 × 40	1.20
100 × 100 × 40	1.20
135 × 70 × 40	1.20
135 × 105 × 40	1.40
180 × 125 × 65	1.95
205 × 155 × 75	2.50

VERO PLASTIC BOXES

White 71 × 49 × 25	60p
Blk 71 × 49 × 25	60p
Blk 120 × 80 × 35	1.10
Blk 180 × 110 × 55	1.75

VERO BOARDS

127 × 63	1.10
95 × 63	95p
431 × 63	3.17
127 × 95	1.20
95 × 95	1.15
431 × 95	4.20
454 × 119	5.50
63 × 25	pk of 5 1.30

SOLDER

20 swg, 3 core

500g 495p

THYRISTORS

BT101	104p	T05 1A/400V	104p	600mA/200V	45p
BT102	104p	2N1599	40p	1A/50V	40p
BT106	104p	2N4441	170p	1A/100V	45p
BT107	132p	2N4444	150p	1A/200V	50p
BT108	143p	2N5060	36p	1A/400V	60p
TIC44	20p	2N5061	33p	1A/600V	75p
TIC106D	40p	2N5062	42p	3A/50V	46p
TIC106M	77p	2N5063	47p	3A/100V	53p
TIC126D	99p	2N5064	47p	3A/200V	58p
TIC206D	80p	600mA/20V	21p	3A/400V	71p
TIC226D	90p	600mA/30V	24p	3A/600V	79p
TIC246D	130p	600mA/100V	30p	3A/800V	99p
				5A/50V	43p

5A/400V	60p
5A/600V	70p
5A/800V	80p
7A/100V	55p
7A/200V	60p
7A/400V	70p
7A/800V	80p
10A/50V	55p
10A/100V	60p
10A/200V	65p
10A/400V	70p
10A/600V	88p
10A/800V	115p

TRIACS

2A/200V	50p
2A/400V	60p
2A/600V	60p
4A/400V	60p
6A/100V	80p
6A/200V	80p
6A/400V	90p
8A/400V	80p
10A/100V	80p
10A/200V	100p
10A/400V	110p
10A/400P	100p

BRIDGE RECTIFIERS

1A/50V	30p	6A/50V	75p
1A/100V	30p	6A/100V	75p
1A/200V	35p	6A/200V	80p
1A/400V	40p	6A/400V	100p
2A/50V	35p	10A/200V	200p
2A/100V	45p	10A/400V	200p
2A/200V	50p	25A/200V	250p
2A/400V	55p	25A/400V	300p

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Range	Price
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Range	Price
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Range	Price (1-99)	(100+)
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POLYSTYRENE 22pF, 47pF, 68pF, 82pF, 100pF, 120pF, 150pF, 220pF, 270pF, 330pF, 390pF, 470pF, 680pF, 820pF, 1000pF, 1200pF, 1500pF, 1800pF, 2000pF, 2200pF, 3300pF, 4700pF, 5600pF, 10nF
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each. 33uF **33p**. 47uF **40p**. 68uF **63p**. 220uF **110p**.
16V: 2u2, 3u3 **20p each**. 4u7, 6u8 **25p each**. 10uF **32p**. 22uF **35p**. **16V:** 33uF **40p**, 47uF **60p**. 100uF **95p**. 220uF **105p**. **25V:** 15uF, 22uF **40p each**. 47uF, 68uF **60p**. **35V:** 0.1uF, 0.22uF, 0.47uF **16p each**. 1uF, 1u5 **18p each**. 2u2 **25p**. 3u3, 4u7 **20p each**. 6u8 **30p**. 10uF **40p**, 47uF **80p**.
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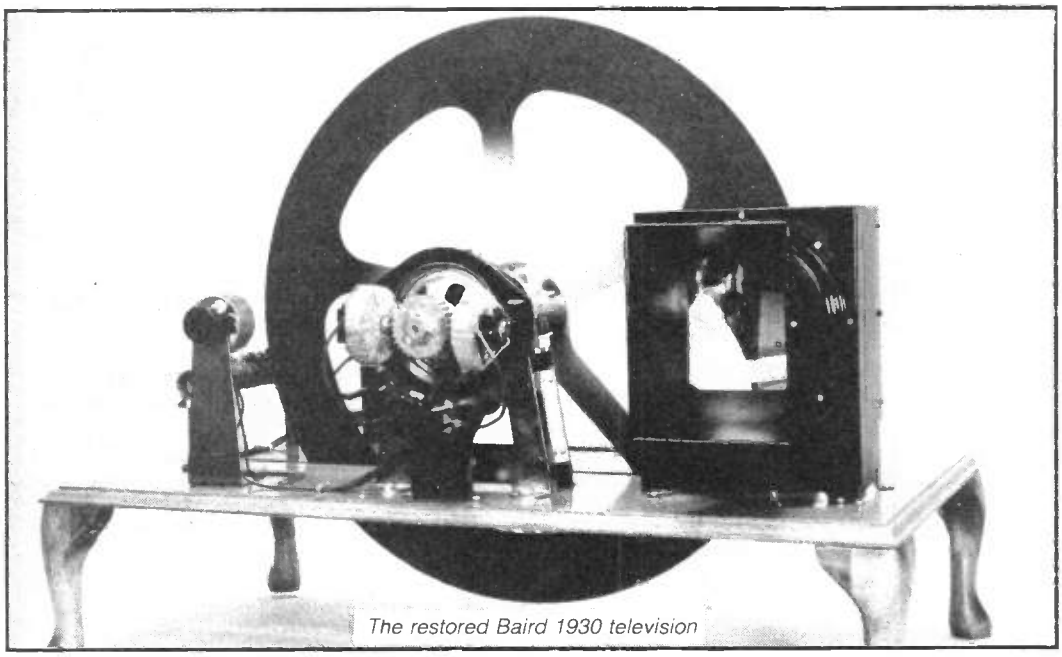

The restored Baird 1930 television

Plessey Radar restore original televisor

The first flickering, eye-straining pictures which heralded the birth of the television era and a social and entertainment revolution have been made to live again by engineers and apprentices with Plessey Radar at Cowes, IOW. They have combined their talents, and their patience, to restore an early 1930's televisor – an antique, mechanical 'goggle box' which fascinated affluent grandparents.

The original Baird set, costing £18 in the days when steam radio ruled, has been loaned to the National Wireless Museum at Arreton Manor, IOW, after being discovered under a pile of rotting firewood in an Essex outhouse where it had lain forgotten for half a century. Only six televisors have survived and all are believed to be priceless.

To operate the televisor a household had also to own two radio sets to watch pictures described as 'barely discernible' which were broadcast for two hours each evening on the medium wave. One wireless provided the picture, the other the accompanying sound.

The televisor operated on 30 lines but, with the aid of a scan converter, it is hoped that it may eventually be adapted to show today's 625 line pictures.

Two technician apprentices Mark Holloway and Nick Warry helped to restore the televisor. Nick said: 'I had seen photographs of one before in magazines which I read, but I didn't think I would ever work on the real thing. We had to decide how best to reproduce a new disc and we worked from photographs of a drawing made at Cowes. Fortunately, the televisor was complete and no bits were missing but it was extremely tarnished and needed a great deal of cleaning up. The scan converter involved a great deal of design work but we thought that it would be possible'.

Mr Ian Moth, a principal electro-optics engineer with Plessey Radar and also a radio amateur, advised the apprentices on the rebuild. He said: 'Our principal problem was the large aluminium disc which had been buckled and torn. We couldn't restore it, so we had to copy it. It was through the whirling disc that the televisor scanned the picture. Behind it was a light and a family of three or four, huddled together, viewed by looking through a magnifying glass incorporating two lenses which gave good distortion properties. The effect could be compared to looking at a slide viewer'.

US may adopt European TV system

A new colour TV system that may be selected to improve the technical quality of American television is based on the European PAL colour television system. The proposed system is one of a number being studied following an American decision to look at ways of improving the technical quality of their TV system. If adopted, new sets for the system would be needed, though manufacturers would be able to use many of the existing components and sub-assemblies.

The new system, called AmPAL, is not identical to PAL but improves on it by removing its 'eight-field sequence' – jargon for PAL's major drawback. American viewers are at a disadvantage as a result of being first with colour television back in the 1950s. The NTSC system, named after National TV Standards Committee, (or alternatively, 'Never The Same Colour!'), has long been criticised for its sensitivity to what engineers call 'phase errors' in the transmission path and which frequently results in poor colour rendition.

If the Americans change their TV system to AmPAL it could have benefits for the British consumer. Japan would be under pressure to change from NTSC and production of single-system sets would be expected to reduce the price of imported sets.

New repeater group

A recent meeting was held to form a new repeater group for GB3NN (RB2), located 3Km south of Wells Next The Sea in Norfolk. Site approval and a franchise have been received and licensing procedures are in progress with the DTI.

It is hoped to have the repeater operational at its new site by June/July '84. The repeater is a Pye 460 UHF unit converted to 70cm repeater use, the aerials are 4 stacked J-poles for Rx and 4 stacked dipoles for Tx, the site is 77m ASL, with aerials at 25m high, giving an ERP of 12 watts.

Donations from any prospective users of GB3NN would be gratefully accepted by the keeper: *Bill Tuck G8KZP, 'Whalebone Cottage', Wells Next The Sea, Norfolk NR23 1EN,* or the treasurer: *Malcolm Amis G4VDC, 'Arcantell', 5 Waveney Close, Wells Next The Sea, Norfolk NR23 1HU.*

Digital storage oscilloscopes

A new in-depth application note written by Chris Crook of Gould Design & Test Systems Division gives an authoritative review of digital storage oscilloscopes and their applications. The application note compares digital storage oscilloscopes with other classes of waveform-storage instruments, and also discusses the effects of resolution and sampling on waveform capture.

Specific applications discussed in the new publication include the simultaneous display of reference trace and updated trace for easy testing of electronic circuits; automatic plotting of spikes on power-supply lines to analyse the causes of data corruption in computer circuits; automatic recording of alarm conditions using the variable set-point facilities on a DSO; automatic recording of bursts

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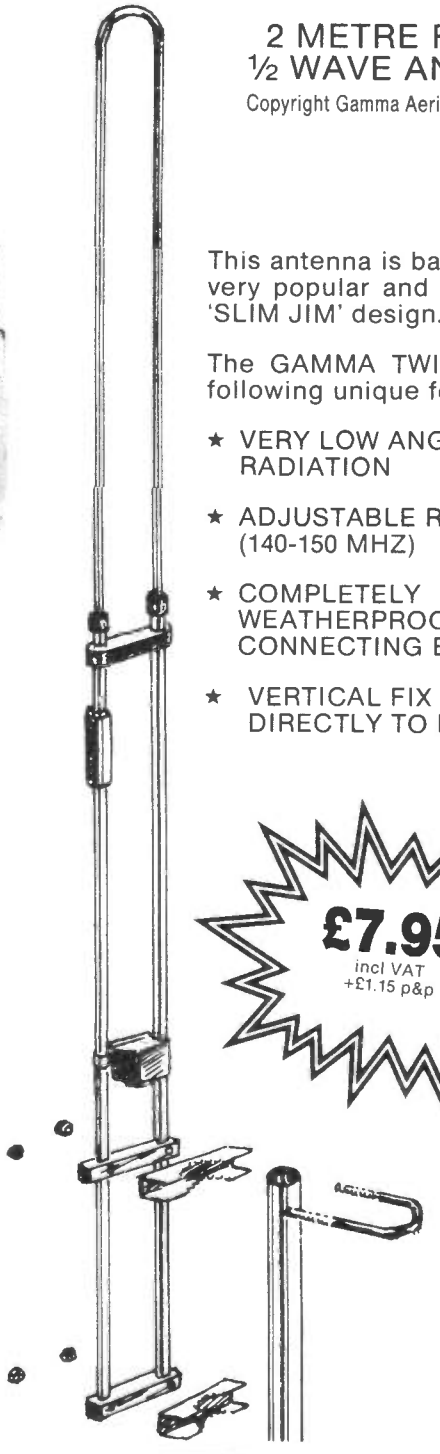

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of pulses or transients into separate stores to overcome store output delays; automatic copying of the displayed waveform into a computer for analysis by average, Fourier analysis, or integration to find, for example, the energy content of the waveform; and automatic copying of the displayed waveform onto a pen recorder.

Application Note and further information from:- Gould Design & Test Systems Division, Roebuck Road, Hainault, Ilford, Essex IG6 3UE.

New computer school in London

A new London Computer and Electronics School is due to open in Hammersmith. Apart from management and financial support from The BOC Group, it will receive backing from The Manpower Services Commission and grants from The Department of Trade and Industry and the London Borough of Hammersmith and Fulham. Of the £1 million cost, over half will come from The BOC Group.

Prospective students for the six month and one year courses must be at least 19 years of age, unemployed, and will need to show evidence of having been out of full time education for the past two years. They will also need to succeed at an aptitude test and an interview. The courses begin in June/July and initially, the number of students will be limited to 120. During the course, students will receive a wage in the region of £40 per week, according to personal circumstances.

The School aims to meet two urgent needs. First, people can be provided with access to a new career with good long-term prospects and second, employers can be provided with people who are productive from day one. The demand for such people has been demonstrated by a survey which revealed that a shortage of several thousand suitably trained people in the computer and electronics field exists in the London area.

The success of the School will be measured by how many of its students are placed in jobs at the end of the course. As the programme has been designed to meet the criteria for producing qualified graduates for industry, it is hoped to achieve a high job placement rate. Indeed, there is a built-in incentive in the arrangements with the MSC to achieve a high placement performance whereby its financial contribution will be reduced for each graduate not placed in a job related to the skills for which he or she has been trained.

Overseeing the establishment of the London School, is Mr Marty Hanfling, President of BOC's Educational Services Division. He says: 'We see this first couple of years as very much a pilot scheme. It's the first time a school of this type has been set up in the UK and, in conjunction with our partners in the venture, we shall be monitoring its progress closely'.

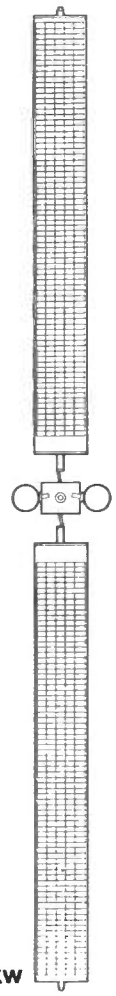
The address of the London Computer and Electronics School is Glenthorne House, Hammersmith Grove, London W6, and the office will be open to receive applications from Saturday 7th April.

Satellite study to keep solar panels in their place

Marconi Space & Defence Systems Ltd has been commissioned by the 11-nation European Space Agency (ESA) to study ways of improving the pointing accuracy of large spacecraft. The study will focus on the particular problems presented by large, flexible solar panel structures with a view to the eventual application of this research to very large telecommunications spacecraft.

Large satellites with high output powers (up to several kilowatts) need to be manoeuvered with a high degree of accuracy to ensure that their communications antennae are correctly orientated with respect to the Earth; even a tenth of a degree error in a satellite communications beam at a distance of 20,000 miles could mean a serious loss of data at the ground station. Pointing accuracy is, of course, even more vital for satellites with very narrow beams.

The Space Division of MSDS, located at Portsmouth, has already embarked on an ambitious programme aimed at improving the control thruster jets (and their propellants) which react to, and correct the natural drift of satellites in



orbit. Earlier improvements in thruster jet control have already led to a phenomenal increase in pointing accuracy for small, power-limited craft where the solar-collecting panels are fixed to the body of the satellite. However, large, power-hungry craft with their extended solar panel structures present a particular problem: such structures tend to bend under the impulse generated by the control thrusters. This unwanted flexing introduces further movement of the spacecraft, probably necessitating additional correction by the thrusters and ultimately leading to further disorientation of the satellite. This could negate any improvements in thruster control and result in depletion of propellant reserve. The operational life of the craft would, therefore, be seriously affected.

The new study takes a mathematical approach to the problem by applying Sturm's algebraic theorem, first proposed in 1836, to calculate a correctly timed sequence of thruster commands. These commands, delivered by a Marconi attitude control microcomputer, could correct the pointing of the satellite *and* bring the solar collectors and other flexible parts of the satellite to a state of zero vibration at the same instant. This process can be repeated automatically, to correct natural drift or the effects of deliberate commands from the ground to alter the position of a spacecraft in the sky.

The study also addresses methods of determining the vibration pattern of flexible satellite structures from a single sensor, typically a gyroscope, attached to the spacecraft. By adopting these Sturm-based techniques, satellite pointing accuracies should soon improve from the 0.15° currently achieved, to better than 0.05°.

COMPANY NEWS

Walmore Electronics

Walmore Electronics Ltd, the Covent Garden based communications specialists, have been appointed sole UK agent by E-H International Inc. This Oakland, California based manufacturer of automatic test equipment claims to produce 'the cleanest pulses in the world'. To substantiate their claim, E-H International produce a range of programmable and benchtop pulse generators with frequencies from 0.5Hz to 250MHz and pulsewidths from less than 1ns to 1s.

To complement the pulse generators, a full range of waveform analysers is available and to facilitate the switching of pulses, a line of programmable coaxial switches is available. Additionally, PCB mounted reed switches are available.

Leisure Zone Ltd

Leisure Zone Ltd, home consumer electronics and electronic games importers, are now in liquidation. The company began trading in March 1982 and had lost some £50,000 by June 1983. It has now gone into voluntary liquidation with a total estimated deficiency as regards unsecured creditors of £32,361.

For further information please contact Clive Hicks on 01-499 1649.

NEWS DESK

Videoconference Service

A digital videoconference service between London and New York will start shortly. The new service will be set up jointly by British Telecom International (BTI) and AT&T Communications. Initially, it will operate between British Telecom's studios in London and other cities in Britain, and AT&T's studios in New York and 13 other American cities.

The digital videoconferencing service to the USA follows the inauguration of a similar service earlier this year to Toronto, Canada ***(R&EW** News, April)*.

The service will use a high-speed digital link between international exchanges in London and New York, providing full motion video and audio communications. A British Telecom-developed video coder/decoder (Codec) codes and compresses the signals that make up the television picture, transmitting only changes in picture content from one frame to the next. This reduces the bandwidth required to 2Mbit/s or possibly less.

British Telecom is planning to provide terminals and codecs for private use on purchase or rental terms through its VideoStream domestic videoconferencing service scheduled for launch after Easter. These video terminals will incorporate television cameras, monitors, microphones and loudspeakers, enabling users to set up conferences from rooms in their own premises.

The announcement was made at the International Teleconference Symposium which is being run under the auspices of Intelsat by BTI in conjunction with Comsat (USA), KDD (Japan), OTC (Australia) and Teleglobe (Canada).

Intelsat, which has 106 member countries, owns and operates a global satellite network supplying two-thirds of the world's international telecommunications services. Britain is Intelsat's second largest shareholder.

R&EW Zilog competition

Following a series of articles describing Zilog's Z8000 microprocessor, ***Radio and Electronics World*** and Zilog UK ran a competition whose prize was donated by Arcom Control Systems Ltd. Entrants had to answer some fifty questions and describe a suitable application for their prize.

Mike Quee, Zilog UK's European Marketing Manager, had the great pleasure of presenting the Z8000 CPU VME board to lucky winner Dave Wells.

Mr. Wells is attending the Cranfield Institute of Technology in Cranfield, Bedfordshire where he is taking a PhD in Ecological Physics studying bird migration using an X-Band Radar System. He is planning to use the board in his experiments.

Learn from Maplin

Maplin Electronics are set to become a major supplier of training products and services. As the sole UK distributor of the now expanded Heathkit Educational Systems, Maplin can supply a fully comprehensive range of training and educational products, support services and courses.

Having appeared on TV, radio and the press, Maplin's highly user-friendly robot 'Hero' has become the best known and best selling training robot. Also receiving considerable interest are the Heathkit microprocessor courses, which range from basic instruction to 'build yourself a micro' level with kits supplied by Maplin.

Maplin, the major UK suppliers of electronic components and a leading distributor of hobby computer products, are similarly expanding their range of 'Practical Projects'. These provide users with a kit covering such projects as special interfaces for many of the popular range of home micros, home security devices, car and radio enhancements. The company have decided to produce and publish on a monthly basis 'Maplin's Top Twenty Kits'. At the top of the first best seller listings are the 75W Mosfet Amp Module; Modems; The ZH81 I/O Port and a car burglar alarm.

LOW COST COMPUTER CAD FOR ELECTRONICS

Number One Systems, the Cambridgeshire based electronics design consultants, announce the launch of a Sinclair Spectrum version of their ac linear circuit analysis program for micro-computers.

The program was written originally for the BBC-B and Newbrain computers and has proved to be extremely popular with universities and industrial R & D establishments both at home and abroad.

The version for the Spectrum is in response to many requests, particularly from undergraduate students and school science teachers, and brings professional electronics CAD facilities within the reach of all. Circuits of up to 16 nodes and 60 components can be analysed for input impedance, output impedance and gain.

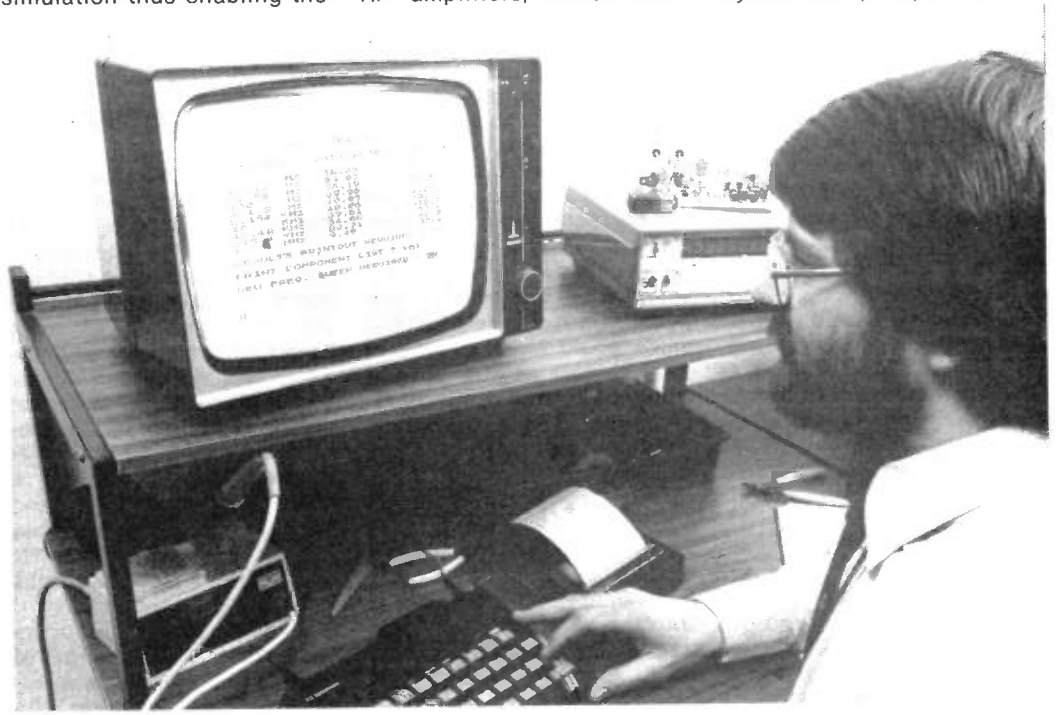
Resistors, capacitors, inductors, transformers, op-amps and FETs can be simulated by the program, and the ac performance of circuits containing any combination of these components fully evaluated over a wide frequency range without the need for laborious breadboarding and bench testing. Once a circuit has been entered into the computer it can be stored on tape for further analysis at a later date.

Modifications can be made to the component values and circuit configuration during a simulation thus enabling the designer to assess quickly the circuit's sensitivity to component tolerances, stray capacitances, temperature effects etc.

The program is ideally suited for frequency response analysis of filter circuits, audio amplifiers, wideband amplifiers, tuned RF amplifiers, linear integrated circuits etc, and has now been in use for over two years.

The version for the Sinclair Spectrum is supplied on cassette and is fully documented.

For further information contact *Adrian Espin or Martin Morris at Number One Systems on (0480) 61778*



MICROPROCESSOR-CONTROLLED DOT MATRIX PRINTER WITH RS232 INTERFACE

An inexpensive way to extend the home computer facility by adding a hard copy printer.Graham Moore, G4DML,explains how he did just that.

Many people with home computers do not own a printer of any sort. Certainly they do seem rather costly for what they are, mainly because electromechanics are much more expensive to produce than the pure electronics found in micros.

The following article explains a simple method of constructing an RS232 ASCII printer utilising one of the many cheap dot matrix plain paper printer mechanisms that are available today. The mechanism used in the printer described is a Roxburgh DP822 7-needle 21-column unit that was picked up from the scrap heap with a burnt-out needle solenoid. After rewinding the solenoid no other problems were experienced and the design was embarked upon.

Print mechanism

The DP822 unit, as in most others of similar type, is a unidirectional printer. The needle head is driven by a spiral grooved shaft, the return spiral being 50% shorter than the print spiral. When the motor is turned-on the head begins to move and a 'start print' signal is generated by a reed switch closing. This switch remains closed for the complete print cycle and is used to define the start of printing and to keep the motor running.

A pulse generator incorporated in the printer gives a timing signal which defines the positions for print-head needle firing. This provides a pulse approximately every 1.7 milliseconds and it is imperative that the needles are accurately synchronised to these pulses in order to ensure exact registering of the printed characters (see *Figure 1*).

Paper feeding is performed by energising the paper feed solenoid while the motor is running. The solenoid must be energised for approximately 30 milliseconds to ensure correct operation of the mechanism chosen; this will, however, vary if other mechanisms are used.

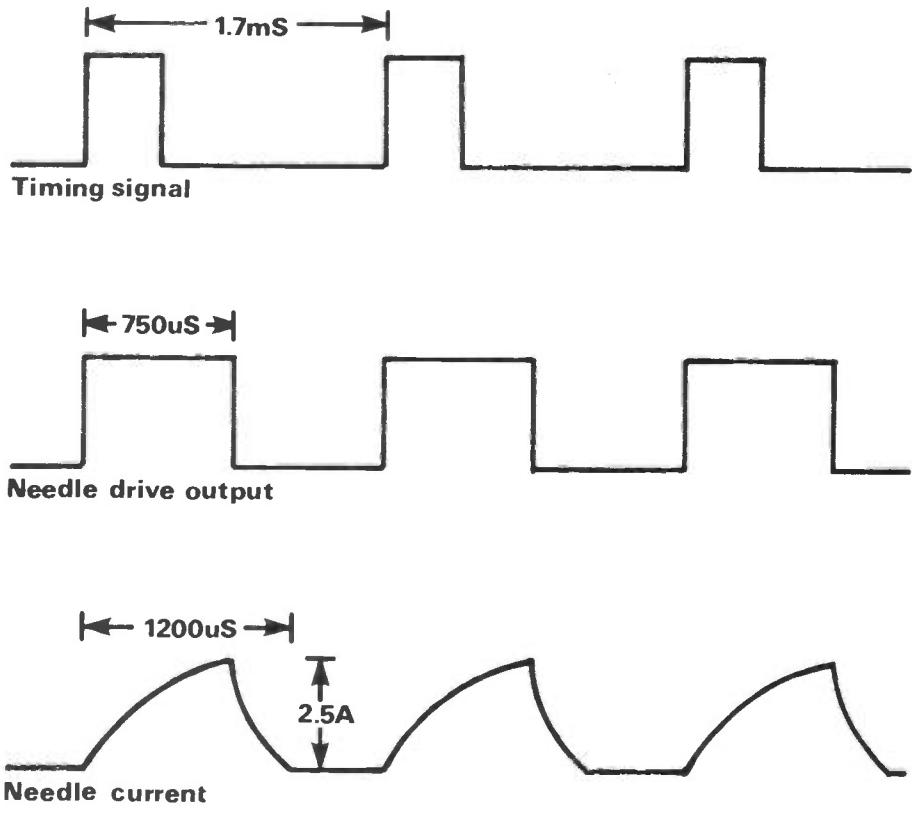


Fig 1 *Needle solenoid timing and control waveforms*

Printing a character is performed by seven solenoids which drive needles that impact the ribbon against the paper. The operation is carried out five times in succession with a varying pattern until the character matrix is built up. Being energised for only 750 microseconds, the solenoids are therefore of very low impedance; a peak current of 2.5A is drawn by each needle and it is essential that the 12v PSU can supply adequate current for these periods.

Design

Because of the complexity of the control functions required it seemed obvious to use a processor of some kind, the Z8681 being the one chosen *(Figure 2)*. This processor, IC1, is one of the latest additions to the Zilog Z8 range and is ideally suited to control applications, with its three I/O ports, 256 bytes of internal RAM and an internal UART. The Z8681 has no internal ROM, allowing an external 2716 EPROM to be used for program storage. A 74LS373 latch is used to demultiplex the address/data bus, and the processor design is completed with the 4049 inverter, IC4a. In order to interface the Z8 UART with the 'outside world' an RS232 to 5V logic converter, TR1, is included so that the printer can be driven by most micros.

To enable the Z8 to interface with the motor and solenoids on the printer mechanism, the circuits incorporating IC7 and IC6a respectively were constructed. As can be seen from *Figure 2* they consist mainly of Darlington current drivers to power the low impedance electromechanics on the printer.

So that the Z8 can interpret the 'start print' signal and the timing pulses, both of these must be amplified and converted to ITL. This is done by IC4c in the case of the start signal, and by TR2-IC4d for the timing pulse. Both circuits generate 5V square pulses that can readily be input to the processor.

The power supply, as previously mentioned, must be capable of supplying quite large currents for relatively short periods of time. This can be accomplished by constructing a supply with a high-value output smoothing capacitor, large enough to supply the 750μS pulse to the print solenoids without overloading the rest of the circuits.

The power supply circuit *Figure 3* shows a PSU capable of supplying about

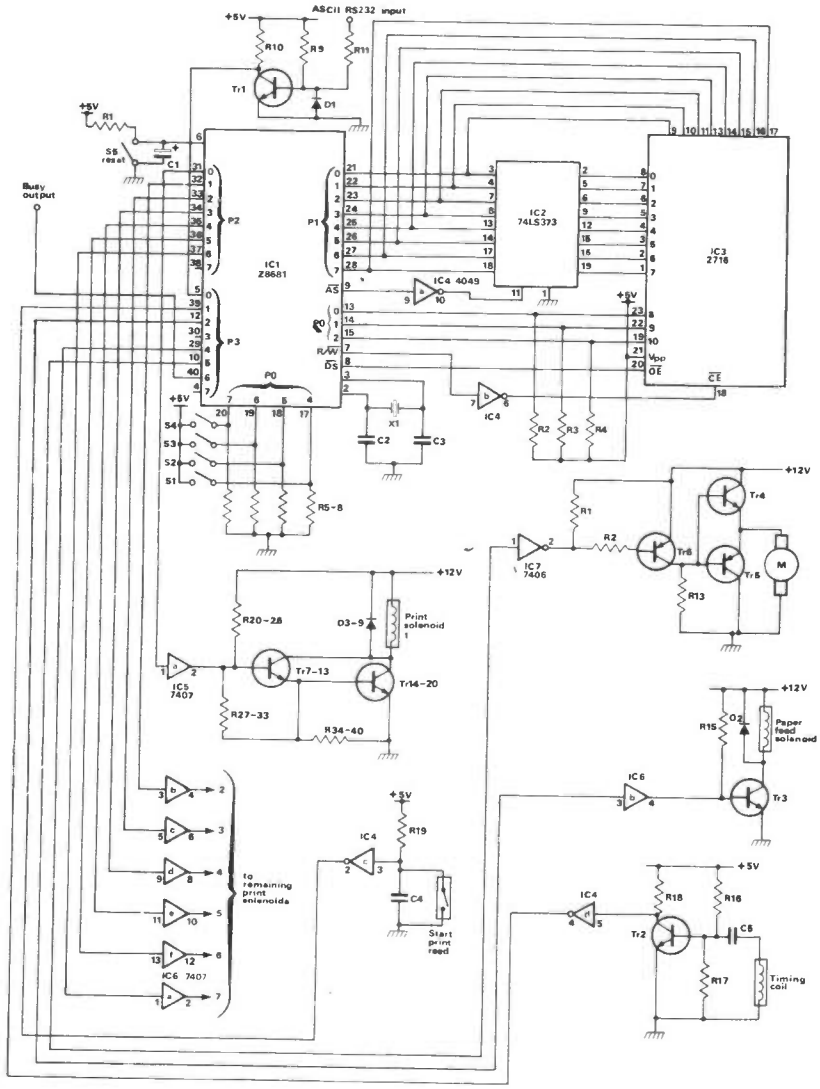


Fig 2 *DOT matrix printer control circuit*

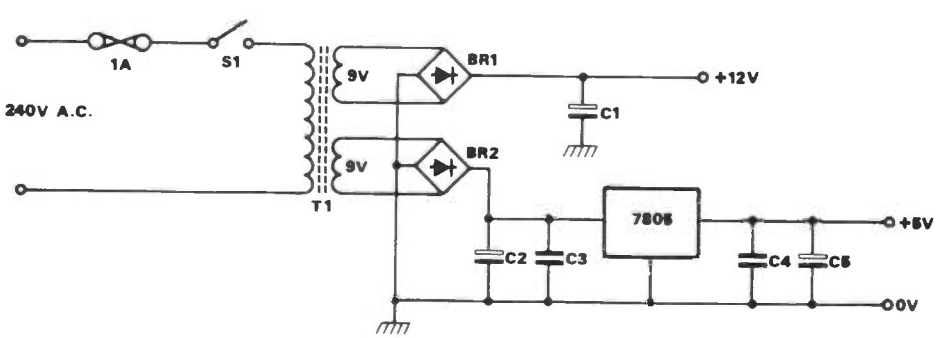


Fig 3 *The power supply circuit*

1A continuously, but the 15000μF capacitor stores enough charge to power the solenoids during a print cycle.

Due to the fact that the print solenoids are activated on switch-on by the processor, it was found necessary to run the 5V supply for the Z8 PCB from a separate winding on the transformer. This is because the 12V supply line cannot supply enough current from switch-on to power both the Z8 and the print mechanism, thus preventing Z8 from completing its reset cycle properly.

Software

The software for the printer application was developed on the Ambit Z8 TBDS Computer PCB using the Zilog assembler. A full listing of the software is included with this article and a brief description of the routines is given below.

The incoming ASCII data is stored in a line buffer which is output to the printer mechanism whenever either the buffer is full or a 'CR' (Carriage Return) is received.

In order to print a character a matrix must be made up of 5 binary words that are output consecutively to the print needle solenoids. As can be seen from the table of ASCII characters the codes start at 20 Hex and end at 7F Hex, those below 20 being reserved for control codes. Therefore, if we subtract 20 Hex from the ASCII code we obtain values between 0 and 5F Hex. The resulting value is multiplied by five and the result used to address a look-up table which contains the 5 bytes to output.

As can be seen from the table, a carry will be generated by the higher of the codes and this must be taken into account before addressing the ROM look-up table.

The resulting pattern is thus (for the figure 8): 8 = 38 H (ASCII code)

38 H - 20 H = 18 H, 18 H5 = 78 Hex

Thus the look-up table pointer for 8 is located at 78 bytes from the start.

TABLE 1

Address	Word
78 Hex	00110110
79	01001001
7A	01001001
7B	01001001
7C	00110110

The resulting bit pattern is that of a figure 8 lying on its side. Note that the high order bit of the word is always 0 as we only need to drive seven needles, these being connected to the low order data lines.

Construction

The complete printer interface was constructed on Veroboard to allow for the numerous modifications that one usually has to make on a project of this kind. It was also felt to be impracticable to publish a PCB layout as most of the dot matrix mechanisms have differing drive requirements; however, a good idea of the circuitry required should be obtained by studying the circuit diagram.

Most of the devices used are non-critical and any device with similar specification can be used, remembering that the EPROM must be at most a 450ns device if the processor is to be used at 7.4MHz on normal timing. Ensure that the 12V and 5V rails are as isolated as possible, i.e. by taking all the 0V lines back to a very low impedance point; otherwise some problems may be experienced with transients when the print needles are energised.

Testing

Switch on and confirm that the solenoids are not operated. The motor may run during the processor reset cycle: this

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SAS 570	1.80	TBA 540	1.70	UPC 1032H	0.98
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BY127	0.11
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BY184	0.40
BY187	0.69
BY190	0.60
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BY223	0.95
BY226	0.27
BY227	0.31
BY295	0.25
BY296	0.25
BY298	0.25
BY299	0.25
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BYX36-600	0.50
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BYX71-600	0.99
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OA47	0.10
OA90	0.08
OA91	0.08
SKE5F	1.40
IN60	0.08
IN4001	0.05
IN4002	0.05
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IN4004	0.06
IN4005	0.07
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		BD140	0.60	TIP42C	0.68
		BD150A	0.70	TIP30A	0.34
		BD207	0.90	TIP31A	0.34
		BD221	0.40	TIP31C	0.48
		BD228	0.35	TIP32A	0.34
		BD233	0.53	TIP32C	0.48
		BD234	0.38	TIP33B	0.75
		BD238	0.38	TIP41A	0.46
		BD239	0.42	TIP41C	0.58
		BD253B	0.65	TIP42A	0.45
		BD416	0.42	TIP42C	0.68
		BD534	0.33	TIP100	0.70
		BD595	0.55	TIP130	0.70
		BD596	0.55	TIP2955	0.74
		BD681	0.58	TIP3055	0.55
		BD807	0.50	TIS90	0.90
		BDX32	1.70	TIS91	0.24
		BF127	0.30	2N3055	0.73
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		BF180	0.29		
		BF181	0.27		
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		BF185	0.32		
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		BF197	0.13		
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5 Pin 240°	0.22
6 Pin	0.23
7 Pin	0.23

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2 Pin Switched	0.10
2 Pin Unswitched	0.12
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5 Pin 180°	0.22
5 Pin 240°	0.23
6 Pin	0.23
7 Pin	0.25

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.22MF 35V	0.16
.33MF 35V	0.16
.47MF 35V	0.16
.68MF 35V	0.16
1MF 35V	0.16
1.5MF 35V	0.16
2.2MF 35V	0.17
3.3MF 35V	0.18
4.7MF 35V	0.18
6.8MF 35V	0.20
10MF 35V	0.20
22MF 16V	0.24

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.01 1500V	0.25
.022 1000V	0.28
.033 1000V	0.28
.1 1000V	0.30
.1 1250V	0.46
.1 2000V	0.75
.22 1000V	0.48
.22 1250V	0.60
.47 1000V	0.79

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.033MF	0.06	.047MF	0.06
.068MF	0.06	.1MF	0.07
.22MF	0.08	.33MF	0.08
.47MF	0.13	.68MF	0.13
1MF	0.16		

MYLAR FILM 100V

.001MF	0.06	.0022MF	0.06
.0047MF	0.07	.01MF	0.07
.022MF	0.07	.033MF	0.08
.047MF	0.08	.068MF	0.09
.1MF	0.09	.22MF	0.13
.47MF	0.22		

DISC CERAMIC 50V

.01MF, 022MF, 047MF, .1MF	0.04

S CORRECTION

.91MF G11	0.55

ELECTROLYTIC 25V

10MF	0.08	22MF	0.08
47MF	0.09	100MF	0.09
220MF	0.15	470MF	0.22
1000MF	0.33	2200MF	0.50

ELECTROLYTIC 40V

470MF	0.30	2200MF	0.70

ELECTROLYTIC 63V

1MF	0.08	2.2MF	0.08
4.7MF	0.08	10MF	0.08
22MF	0.11	47MF	0.12
100MF	0.19	220MF	0.30
470MF	0.42	1000MF	0.65

ELECTROLYTIC 100V

0.47MF	0.10	1MF	0.10
2.2MF	0.10	4.7MF	0.10
10MF	0.12	22MF	0.16
47MF	0.17	100MF	0.26
220MF	0.45	330MF	0.55

ELECTROLYTIC 250V

0.47MF	0.11	1MF	0.14
10MF	0.28	22MF	0.31

ELECTROLYTIC 450V

10MF	0.50

SMOOTHING CAPACITORS

Decca 200/200/400 350V	2.70
Decca 400/400 350V	2.90
Decca 400/800 350V, 250V	2.90
Philips 600 300V	2.50
Philips 2200 63V	1.55
Philips 470 250V	2.00
Philips (G9) 600 300V	2.80
PYE 200/200/100/32	2.85
PYE 600 300V	2.80
RRI 2500/2500 30V	1.20
RRI 220 400V	2.90
Thorn 150/160/100 300V	1.90
Thorn 4700 25V	0.85
Thorn 1000 70V	0.70
Thorn 200/100/100 350V	2.85
Thorn 175/100/100 400V	2.40
Thorn 400 400V	2.50

PUSH BUTTON UNITS

Decca 30 4 way	6.80
Decca 30 6 way	7.80
GEC 2110	11.00
GEC 2112	12.95
GEC 2136/7	8.90
GEC 2112 Conversion	13.00
Hitachi 190 4 way	8.95
ITT CVC5 7 way	10.00
ITT CVC8/9	12.85
ITT CVC20/30 6 way	8.00
ITT CVC 25 6 way	8.50
Philips 520	11.00
Philips 550	13.55
Philips G11	22.50
PYE 713 4 way	8.70
PYE 715 6 way	13.50
PYE 725 (UHF-VHF)	13.50
RRI 823 4 way	8.75
RRI 823 6 way	9.50
RRI T20 6 way	10.50
RRI Z718 6 way	9.50
Thorn 3500 6 way	2.75
Thorn 8500 6 way	2.75
Thorn 9000 6 way	2.75
Thorn 1615 4 way	8.70
Telpro 4 way	8.50

FUSES

20mm A/S (10 Pack)	
100mA, 160mA, 250mA	1.50
315mA	1.20
500mA, 630mA, 800mA	0.95
1A, 1.25A, 1.6A, 2A	0.95
2.5A, 3.15A, 4A, 6.3A	0.95
20mm Q/B (10 Pack)	
160mA, 250mA, 316mA, 500mA, 630mA, 800mA, 1A, 1.6A, 2A, 3.15A	0.45
1¼" A/S (10 Pack)	
250mA, 500mA, 630mA	1.50
800mA, 1A, 1.25A, 2A	1.50
2.5A, 3A, 5A	2.30
1¼" Q/B (10 Pack)	
250mA, 1A, 1.5A	0.60
2A, 3A, 5A	0.60
Mains Fuse (10 Pack)	
2A, 3A, 5A, 13A	0.90

LOUDSPEAKERS

8 x 5 16 ohm	2.98
6 x 4 16 ohm	2.60
6 x 4 25 ohm	4.30
8 x 3 70 ohm	3.40
5 x 3 50 ohm	3.00
7 x 3½ 16 ohm	3.00
5¼ x 3 80 ohm	2.90
Thorn 1590 large	4.00

TUNERS

1043/05	7.95
1043/06	7.95
U321	7.25
U322	7.25
G8	11.75

RESISTORS (CARBON)

½ Watt IRO to 10M (10 Pack)	0.18
1 Watt 2R2 to 10M (10 Pack)	0.39
2 Watt 4R7 to 10M (10 Pack)	0.60

RESISTORS (WIREWOUND)

2½W OR22 to 10R	0.15
5W OR47 to 6K8	0.15
7W OR47 to 12K	0.15
11W OR1 to 18K	0.18
17W IRO to 6K8	0.24

PRESETS

Horizontal and Vertical Standard and sub mid sizes 100R to 4M7	0.12

MAINS DROPPERS

Decca 20 mono	1.35
Decca 30 3R9	0.60
Philips G8 2R2 - 68R	0.84
Philips G8 47R	0.50
Philips 210 (no link)	1.10
Philips 210 (with link)	0.95
PYE 725 3R3	1.79
UMc B69 6BL - 56R	1.40
PYE 725 - 56R - 3R	1.55
RRI 823 56R - 68R	0.85
Thorn 1500	1.55
Thorn 1600	1.45
Thorn 3500	0.97
Thorn 800	1.20
Thorn 8500	0.97
Thorn 8800	0.97
Thorn 9800	0.90
GEC 2110	0.85

CONVERGENCE CONTROLS

5R, 7R, 10R, 12R, 15R, 20R, 100R, 200R, 500R	0.38
G8 Metric 10R, 15R, 20R	0.50
Thorn 50R, 200R	0.50

THERMISTORS

PT34P	0.85
PT37P	0.85
PTH451A	0.75
VA1026	0.50
VA1104	1.00
GEC Dual	1.60
G11 Transient VDR	0.42

VALVES

30FL1	1.20
DY86	0.75
DY802	0.75
ECC82	0.75
PCF80	0.85
PCF802	0.95
PCL82	0.85
PCL84	0.85
PCL85	0.95
PCL86	0.95
PFL200	1.20
PL36	1.25
PL504	1.60
PL508	2.30
PL509	5.80
PY800	0.89
PY500A	2.30

EHT TRAYS

Decca 1830	5.90
Decca 2230	6.25
Decca 80	6.25
Decca 100	6.25
GEC 1028	6.25
GEC 2040	6.25
GEC 2110	6.25
GEC 2200	6.25
Grundig 5011	6.25
ITT CVC 5/8	6.25
ITT CVC 20	6.25
ITT CVC 45	6.25
Korting 90	6.95
Philips 520	6.50
Philips 550	6.50
Philips G9	6.25
Philips 570	6.50
Philips KT3	8.95
PYE 691/697	6.30
PYE 713 5 lead	6.50
PYE 713 4 lead	7.60
PYE 725/731	6.25
RRI 823	7.75
RRI T20	6.50
Tandberg TV2-2	6.50
Thorn 1500 3 stick	4.95
Thorn 1500 5 stick	5.50
Thorn 3000/3500	7.70
Thorn 8000	4.95
Thorn 8500	6.80
Thorn 9000	7.80
Telpro 561	7.00
Seimens Universal	5.50
TV11	0.85
TV13	0.85
TV18	0.95

LINE OUTPUT TRANSFORMERS

Autovox 90°	9.75
autovox 110°	9.75
Decca 1700 Mono	9.80
Decca 1830	9.80
Decca 2230	8.30
GEC 2110	9.50
GEC 20AX (diode split)	12.00
Grundig 1500 mono	13.70
Grundig 5010	11.50
ITT CVC5/8	10.25
ITT CVC20	10.75
ITT CVC30	8.75
ITT CVC45	9.75
Indesit mono	10.75
Korting 90	10.75
Korting 110°	12.50
Philips 210	9.90
Philips G8	8.90
Philips G9	8.50
Philips G11	12.95
Philips K30	14.95
Philips KT3	7.95
Philips 570	9.50
PYE 691 P.C.	13.00
PYE 725	8.95
PYE 731	8.95
PYE 169	10.75
RRI 640/793	11.75
RRI 774	12.90
RRI 823	11.90
RRI T20	12.90
SABA	12.50
Skantic	12.50
Thorn 1500 20"	7.00
Thorn 1500 24"	7.00
Thorn 1591	10.50
Thorn 1615	10.00
Thorn 1690/1	8.75
Thorn 9000	10.90
Thorn 9600	10.00

PLEASE ADD 65 PENCE POST/ PACKING TO YOUR ORDER TOTAL AND THEN 15% VAT. GOODS ARE DESPATCHED BY RETURN AND SHOULD BE RECEIVED WITHIN 4 WORKING DAYS

PARTS LIST

Control Circuits

Resistors (all ¼W, 5%)

R1 to R8, R10, R19, R27 to R33	4.7kΩ
R9	100kΩ
R11, R12, R18	10kΩ
R13, R34 to R40	470Ω
R14	1.8kΩ
R15, R20 to R26	1kΩ
R16	120kΩ
R17	22kΩ

Capacitors

C1	47μF, 16V
C2, C3	22pF
C4	10nF
C5	100nF

Semiconductors

TR1, TR2	BC183
TR3, TR7 to TR13	BFY51
TR4, TR14 to TR20	BD705
TR5, TR6	BD136
IC1	Zilog Z8681
IC2	74LS373
IC3	2716
IC4	4049
IC5, IC6	74LS07
IC7	74LS06
D1, D2	1N916
D3 to D9	1N4001

Others

S1 to S4	SPST DIL switches
S5	SPST momentary switch
XL1	7.3728 MHz crystal

Power Supply

Capacitors

C1	15000μF 16V
C2	4700μF 12V
C3, C4	10nF ceramic
C5	1000μF 12V

Others

BR1, BR2	Bridge rectifier 2A
S1	1–pole mains switch
X1	7805 regulator
T1	Transformer 240V AC 9V secondaries

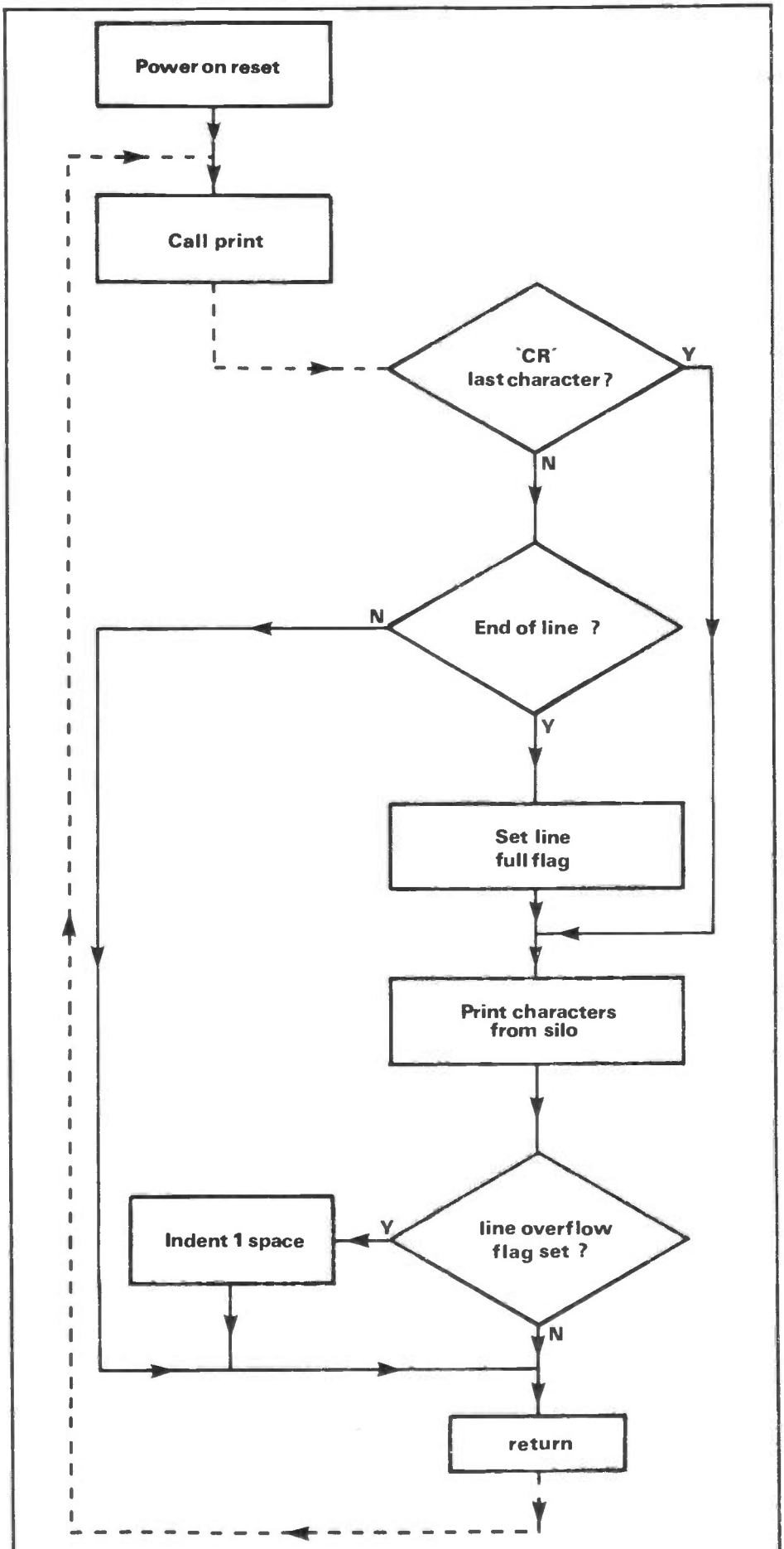

Fig 4 *Flowline of main polling routine*

is normal due to the Z8's architecture. Confirm that there is a clock on Z8 pins 2 and 3 at 7.373MHz; note that it is this clock that also determines the baud rate (being set by the switches on port O). Confirm that the current drawn is less than 400mA from the 5V rail and less than 10mA from the 12V rail.

If the ASCII input is now pulled high the printer should operate – but print garbage. The reason for this is that the Z8 is looking for a start bit which it sees when the input goes high, although the character it reads in will be all '1's, which is invalid. If the testing so far is satisfactory then proceed as in the next paragraph.

Operation

On switch-on ensure that all the print needles are not energised – otherwise they may overheat and burn out. Ensure that the correct baud rate is selected, as follows:

TABLE 2

S1	S2	S3	S4	
0	0	0	1	150 bauds
0	0	1	0	300 bauds
0	1	0	0	600 bauds
1	0	0	0	1200 bauds

Input a 'CR' (Carriage Return) from an ASCII keyboard and ensure that the printer performs a linefeed and paper-feed and that the head positions itself at the beginning of the next line. Now input 22 characters and ensure that nothing happens until the last one is input, at which point the complete line should be printed and a 'CR' 'LF' (Line Feed) performed. Note that the print head is now positioned one position in from the edge of the paper when the next line is printed to indicate a continuation line. This does not happen if a 'CR' is received.

In the software described no facility is included for printing lower-case letters. However, this facility just involves adding them to the look-up table should they be required.

A sample print-out is shown below

```
 THE QUICK BROWN FOX JU
  MPS OVER THE LAZY DOG
 . ABCDEFGHIJKLMNOPQRS
  TUVWXYZ 1234567890,
```

A flowline diagram of the main polling routine is shown in *Figure 4.*

Conclusion

Although this project was initiated as a software exercise on the Z8 it has proved to be an immensely useful method of obtaining hard copy at very low cost. Further, the Z8 part of the printer can also be used for alternative applications when a printer is not required – the one in the Author's establishment being used as a darkroom computer.

Hopefully, the Z8 will find many other useful applications in the control environment, the application just described being a very simple one. *GoOd PPrInTimG!*

```
                        Z8 ASSEMELER VER 1.4                    1

  1                     ;***ASC SRC***DOT MATRIX PRINTER PROGRAMME
  2                     ;(C)G.R MOORE 2 12 83
  3 0000                ;
  4 0000
  5                     ;DECLARATIONS
  6 0000
  7 0020                SILO    EQU     %20     ;BASE OF SILO
  8 0004                SILIN   EQU     4       ;SILO INPUT POINTER
  9 0005                SILOUT  EQU     5       ;SILO OUTPUT POINTER
 10 000E                LASTCHR EQU     6       ;LAST CHAR REC'D
 11 0000
 12 0000
 13 0000
 14                     ;SET UP INTERRUPT VECTOR
 15 0000
 16 0006                        ORG     6
 17 0006
 18 0006 004C                   WVAL    INMESS          ;SIO INTERRUPT
 19 0008
 20 0008
 21 0008
 22                     ;INITIALISATION
 23 0008
 24 000C                        OPT     LC
 25 000C
 26 000C 8F                     DI
 27 000D E6F884                 LD      R01M,#%84,01101101      ;RESET TX INT
 28                                                             ;INT ENBL, RX INT
 29 0010 E6F600                 LD      R00M,#%00               ;NO VECTOR
 30 0013 E6F701                 LD      R01M,#%01,10000001      ;WR/FN ENBL,RX
 31                                                             ;ENBL
 32 001F E6F60C                 LD      R06M,#%0C,00001100      ;SYNC CHAR
 33 0019 E6F70E                 LD      R07M,#%0E               ;SYNC CHAR
 34 001C E6F800                 LD      R08M,#0                 ;TRANSMIT DATA
 35 001F E6F90E                 LD      R09M,#%0E,00001110      ;VIE, NV, MIE
 36 0022 E6FA00                 LD      R10M,#0                 ;MISC TX & RX
 37 0025 E6FB56                 LD      R11M,#%56,01010110      ;TRX CLK=BAUD
 38 0028 E6FC06                 LD      R12M,#6                 ;BAUD RATE
 39 002B E6FD00                 LD      R13M,#0                 ;BAUD RATE
 40 002E E6FE80                 LD      R14M,#%80               ;BRG=XTAL/2
 41 0031 E6FF00                 LD      R15M,#0                 ;EXT CTRL
 42 0034 E6F5FF                 LD      R05M,#%FF,11111111      ;TRX ENBL, RTS
 43 0037 E6D420                 LD      SILIN,#SILO             ;INIT SILO PTRS
 44 003A E6D520                 LD      SILOUT,#SILO
 45 003D E6D600                 LD      LASTCHR,#0              ;CLEAR LAST CHAR
 46 0040 E6C000                 LD      IPR,#0                  ;INTERRUPT PRIORITY
 47 0043 9F                     EI
 48 0044 3100                   SRP     #00
 49 0046
 50 0046
 51 0046
 52                     ;PROGRAM STARTS
 53 0046
 54                     ;***LOOP***THIS IS THE MAIN POLLING LOOP
 55 0046
 56 0046 FF             LOOP:   NOP
 57 0047 FF                     NOP
 58 0048 D60058                 CALL    PRINT

                        Z8 ASSEMBLER VER 1.4                    2

 59 004B 8BF9                   JR      LOOP
 60 004D
 61 004D
 62 004D
 63                     ;SUBROUTINES START
 64 004D
 65                     ;***INMESS***THIS IS THE ASCII INPUT INTERRUPT ROUTINE
 66                     ;       PARITY IS DELETED AND THE CHARACTER IS THEN
 67                     ;       STORED IN THE LINE BUFFER
 68 004D
 69 004D E4F00E         INMESS  LD      LASTCHR,SIO     ;GET CHAR
 70 0050 56067F                 AND     LASTCHR,#%7F,01111111   ;DELETE PARITY
 71 0053 F5D604                 LD      @SILIN,LASTCHR  ;SAVE CHAR
 72 0056 2004                   INC     SILIN
 73 0058 BF                     IRET
 74 0059
 75 0059
 76 0059
 77                     ;***PRINT***THIS IS THE ROUTINE TO PRINT CHARACTERS FROM
 78                     ;       THE LINE BUFFER WHEN EITHER A 'CR' IS RCD OR
 79                     ;       THE BUFFER IS FULL. IF THE BUFFER WAS FULL
 80                     ;       THEN THE NEXT LINE IS INDENTED
 81                     ;       ONE SPACE TO SIMPLIFY READING. A BUSY SIGNAL
 82                     ;       IS GENERATED DURING PRINTING TO STOP ANY MORE
 83                     ;       CHARACTERS BEING INPUT
 84 0059
 85 0059 A60D0D PRINT   CP      LASTCHR,#%0D    ;LAST CHAR CR?
 86 005B 6B08           JR      EQ,PR1          ;JUMP IF YES
 87 005D A6D423         CP      SILIN,#(SILO+22)        ;END OF LINE?
 88 0060 EB54           JR      NE,EXPNT        ;IF NOT EXIT
 89 0062 76FL01         OR      FLAGS,#%02,00000001     ;SET LINE OVERFLOW
 90 0065 E6D420 PR1     LD      SILIN,#SILO     ;RESET SILO POINTER
 91 0068 B00E           CLR     LASTCHR         ;RESET LAST CHAR
 92 006A 46D150         OR      3,#%02,01010000 ;MOTOR, BUSY ON
 93 006D 8F             DI
 94 006E D600B8         CALL    HOME            ;HOME HEAD
 95 0071 E60520         LD      SILOUT,#SILO    ;RESET OUTPUT POINTER
 96 0074 E505ED PR2     LD      R13,@SILOUT     ;GET CHAR
 97 0077 A6ED0D         CP      R13,#%0D        ;CHECK FOR CR
 98 007A 6B27           JR      EQ,PR3          ;JUMP IF YES
 99 007C A6ED20         CP      R13,#%20        ;CNTRL CHR?
100 007F 1B1B           JR      LT,PR2A         ;JUMP IF YES
101 0081 26ED20         SUB     R13,#%20        ;CORRECT TO ZERO
102 0084 FC00           LD      R15,#0          ;CLEAR POINTER
103 0086 EC03           LD      R14,#3          ;SET PAGE
104 0088 CF             RCF                     ;CLEAR CARRY
105 0089 02FD           ADD     R15,R13
106 008B 02FD           ADD     R15,R13
107 008D 02FD           ADD     R15,R13         ;*5
108 008F 02FD           ADD     R15,R13
109 0091 02FD           ADD     R15,R13
110 0093 16EE00         ADC     R14,#0          ;CORRECT PAGE
111 0096 D600E6         CALL    PRCHR           ;PRINT CHAR
112 0099 D600DB         CALL    COUNT           ;SPACE
113 009C 2005     PR2A: INC     SILOUT          ;NEXT CHAR
114 009E A60536         CP      SILOUT,#(SILO+22)       ;END OF LINE?
115 00A1 EBD1           JR      NE,PR2          ;JUMP IF NOT
116 00A3 D600C3   PR3:  CALL    PAPER           ;LINE FEED
```

```
119 00AC 6B08           JR      Z,EXPRNT        ;JUMP IF NOT
120 00AE E70420         LD      @SILIN,#' '     ;INDENT SPACE
121 00B1 2004           INC     SILIN
122 00B3 56FCFE         AND     FLAGS,#%(2)11111110   ;RESET FLAG
123 00B6 9F             EXPRNT: EI
124 00B7 AF             RET
125 00B8
126 00B8
127 00B8
128                     ;***HOME***ROUTINE TO RETURN THE PRINT HEAD TO THE
129                     ;          START POSITION
130 00B8
131 00B8 760304         HOME:   TM      3,#%(2)00000100   ;HEAD HOME?
132 00BB EBFB           JR      NZ,HOME         ;JUMP IF NOT
133 00BD 760304         HT1:    TM      3,#%(2)00000100   ;HEAD READY?
134 00C0 6BFB           JR      Z,HT1           ;JUMP IF NOT
135 00C2 AF             RET
136 00C3
137 00C3
138 00C3
139                     ;***PAPER***ROUTINE TO FEED PAPER AND RETURN HEAD TO
140                     ;           HOME POSITION
141 00C3
142 00C3 460320         PAPER:  OR      3,#%(2)00100000   ;PAPER SOLENOID
143 00C6 8C0F           LD      R8,#15          ;NO OF TIMER PULSES
144 00C8 D600DB         PF1:    CALL    COUNT           ;1 CLOCK CYCLE
145 00CB 9AFB           DJNZ    R8,PF1          ;JUMP IF NOT FINISHED
146 00CD 56DBDF         AND     3,#%(2)11011111   ;SOLENOID OFF
147 00D0 8C2D           LD      R8,#45          ;WAIT 45 PULSES
148 00D2 D600DB         PF2:    CALL    COUNT
149 00D5 9AFB           DJNZ    R8,PF2
150 00D7 D600B8         CALL    HOME            ;HOME HEAD
151 00DA AF             RET
152 00DB
153 00DB
154 00DB
155
156                     ;***COUNT***ROUTINE TO PAUSE FOR ONE TIMING PULSE
157 00DB                        APPROX 1.7MS
158 00DB 760402         COUNT   TM      3,#%(2)00000010   ;1 TIMING PULSE
159 00DE EBFB           JP      Z,COUNT         ;JUMP IF LO
160 00E0 760202         CT1:    TM      3,#%(2)00000010
161 00E3 EBFB           JR      NZ,CT1          ;JUMP IF HI
162 00E5 AF             RET
163 00E6
164 00E6
165 00E6
166                     ;***PRCHR***CHARACTER PRINT ROUTINE  FETCHES 5
167                     ;           CONSECUTIVE BYTES FROM LOOK UP TABLE
168                     ;           IN ROM AND OUTPUTS THEM TO THE PRINT
169                     ;           SOLENOIDS
170 00E6
171 00E6 7C05           PRCHR:  LD      R7,#5           ;NO OF COLS
172 00E8 760302         PC1:    TM      3,#%(2)00000010   ;TIMING PULSE HI?
173 00EB 6BFB           JR      Z,PC1           ;JUMP IF NOT
174 00ED C22E           LDC     R2,@RR14        ;O/P CHAR COL
                         Z8 ASSEMBLER VER. 1.4                    4
175 00EF D600FF         CALL    TIM1            ;750US DELAY
176 00F2 E60200         LD      2,#0            ;RESET SOLENOIDS
177 00F5 760302         PC2:    TM      3,#%(2)00000010   ;TIMING PULSE LOW?
178 00F8 EBFB           JR      NZ,PC2          ;JUMP IF NOT
179 00FA A0EE           INCW    RR14            ;NEXT COL
180 00FC 7AEA           DJNZ    R7,PC1          ;LAST COL?
181 00FE AF             RET
182 00FF
183 00FF
184 00FF
185                     ;***TIM1***750US DELAY ROUTINE
186 00FF
187 00FF 46F10C         TIM1:   OR      TMR,#%(2)00001100   ;START T1
188 0102 A6F200         TIL:    CP      T1,#0           ;=0?
189 0105 EBFB           JR      NE,TIL
190 0107 56F1F3         AND     TMR,#%(2)11110011   ;STOP T1
191 010A AF             RET
192 010B
193 010B
194 010B
195 010B
196                     ;ASCII LOOK UP TABLE
197 010B
198 0300                ORG     %300
199 0300
200 0300 00             TABLE   BVAL    %00     ;20H
201 0301 00                     BVAL    %00     ;!
202 0302 00                     BVAL    %00
                                BVAL    %00
204 0304 00                     BVAL    %00
205 0305 00
206 0306 00             BVAL    %00     ;21H
207 0306 00                     BVAL    %00     ;!
208 0307 4F                     BVAL    %4F
209 0308 00                     BVAL    %00
210 0309 00                     BVAL    %00
211 030A
212 030A 00                     BVAL    %00     ;22H
213 030B 07                     BVAL    %07     ;"
214 030C 00                     BVAL    %00
215 030D 07                     BVAL    %07
216 030E 00                     BVAL    %00
217 030F
218 030F 14                     BVAL    %14     ;23H
219 0310 7F                     BVAL    %7F     ;#
220 0311 14                     BVAL    %14
221 0312 7F                     BVAL    %7F
222 0313 14                     BVAL    %14
223 0314
224 0314 24                     BVAL    %24     ;24H
225 0315 2A                     BVAL    %2A     ;$
226 0316 7F                     BVAL    %7F
227 0317 2A                     BVAL    %2A
228 0318 12                     BVAL    %12
229 0319
230 0319 23                     BVAL    %23     ;25H
231 031A 13                     BVAL    %13     ;%
232 031B 00                     BVAL    %00
                         Z8 ASSEMBLER VER. 1.4
233 031C 64                     BVAL    %64
234 031D 62                     BVAL    %62
235 031E
236 031E 36                     BVAL    %36     ;26H
237 031F 49                     BVAL    %49     ;&
238 0320 55                     BVAL    %55
239 0321 22                     BVAL    %22
240 0322 50                     BVAL    %50
241 0323
242 0323 00                     BVAL    %00     ;27H
243 0324 05                     BVAL    %05     ;'
244 0325 03                     BVAL    %03
245 0326 00                     BVAL    %00
246 0327 00                     BVAL    %00
247 0328
248 0328 00                     BVAL    %00     ;28H
249 0329 1C                     BVAL    %1C
250 032A 22                     BVAL    %22
251 032B 41                     BVAL    %41
252 032C 00                     BVAL    %00
253 032D
254 032D 00                     BVAL    %00     ;29H
255 032E 41                     BVAL    %41     ;)
256 032F 22                     BVAL    %22
257 0330 1C                     BVAL    %1C
258 0331 00                     BVAL    %00
259 0332
260 0332 14                     BVAL    %14     ;2AH
261 0333 08                     BVAL    %08     ;*
262 0334 3E                     BVAL    %3E
263 0335 08                     BVAL    %08
264 0336 14                     BVAL    %14
265 0337
266 0337 08                     BVAL    %08     ;2BH
267 0338 08                     BVAL    %08     ;+
268 0339 3E                     BVAL    %3E
269 033A 08                     BVAL    %08
270 033B 08                     BVAL    %08
271 033C
272 033C 00                     BVAL    %00     ;2CH
273 033D 50                     BVAL    %50     ;,
274 033E 30                     BVAL    %30
275 033F 00                     BVAL    %00
276 0340 00                     BVAL    %00
277 0341
278 0341 08                     BVAL    %08     ;2D
279 0342 08                     BVAL    %08     ;-
280 0343 08                     BVAL    %08
281 0344 06                     BVAL    %08
282 0345 08                     BVAL    %08
283 0346
284 0346 00                     BVAL    %00     ;2EH
285 0347 60                     BVAL    %60     ;.
286 0348 60                     BVAL    %60
287 0349 00                     BVAL    %00
288 034A 00                     BVAL    %00
289 034B
290 034B 20                     BVAL    %20     ;2FH
                         Z8 ASSEMBLER VER. 1.4
291 034C 10                     BVAL    %10     ;/
292 034D 08                     BVAL    %08
293 034E 04                     BVAL    %04
294 034F 02                     BVAL    %02
295 0350
296 0350 3E                     BVAL    %3E     ;30H
297 0351 51                     BVAL    %51     ;0
298 0352 49                     BVAL    %49
299 0353 45                     BVAL    %45
300 0354 3E                     BVAL    %3E
301 0355
302 0355 00                     BVAL    %00     ;31H
303 0356 42                     BVAL    %42     ;1
304 0357 7F                     BVAL    %7F
305 0358 40                     BVAL    %40
306 0359 00                     BVAL    %00
307 035A
308 035A 42                     BVAL    %42     ;32H
309 035B 61                     BVAL    %61     ;2
310 035C 51                     BVAL    %51
311 035D 49                     BVAL    %49
312 035E 46                     BVAL    %46
313 035F
314 035F 21                     BVAL    %21     ;33H
315 0360 41                     BVAL    %41     ;3
316 0361 45                     BVAL    %45
317 0362 4B                     BVAL    %4B
318 0363 31                     BVAL    %31
319 0364
320 0364 18                     BVAL    %18     ;34H
321 0365 14                     BVAL    %14     ;4
322 0366 12                     BVAL    %12
323 0367 7F                     BVAL    %7F
324 0368 10                     BVAL    %10
325 0369
326 0369 27                     BVAL    %27     ;35H
327 036A 45                     BVAL    %45     ;5
328 036B 45                     BVAL    %45
329 036C 45                     BVAL    %45
330 036D 39                     BVAL    %39
331 036E
332 036E 3C                     BVAL    %3C     ;36H
333 036F 4A                     BVAL    %4A     ;6
334 0370 49                     BVAL    %49
335 0371 49                     BVAL    %49
336 0372 30                     BVAL    %30
337 0373
338 0373 01                     BVAL    %01     ;37H
339 0374 71                     BVAL    %71     ;7
340 0375 09                     BVAL    %09
341 0376 05                     BVAL    %05
342 0377 03                     BVAL    %03
343 0378
344 0378 36                     BVAL    %36     ;38H
345 0379 49                     BVAL    %49     ;8
346 037A 49                     BVAL    %49
347 037B 49                     BVAL    %49
348 037C 36                     BVAL    %36
                         Z8 ASSEMBLER VER. 1.4
349 037D
350 037D 06                     BVAL    %06     ;39H
351 037E 49                     BVAL    %49     ;9
352 037F 49                     BVAL    %49
353 0380 29                     BVAL    %29
354 0381 1E                     BVAL    %1E
355 0382
356 0382 00                     BVAL    %00     ;3AH
357 0383 36                     BVAL    %36     ;:
358 0384 36                     BVAL    %36
359 0385 00                     BVAL    %00
360 0386 00                     BVAL    %00
361 0387
362 0387 00                     BVAL    %00     ;3BH
363 0388 5E                     BVAL    %5E     ;;
364 0389 36                     BVAL    %36
365 038A 00                     BVAL    %00
366 038B 00                     BVAL    %00
367 038C
368 038C 08                     BVAL    %08     ;3CH
369 038D 14                     BVAL    %14     ;<
370 038E 22                     BVAL    %22
371 038F 41                     BVAL    %41
372 0390 00                     BVAL    %00
373 0391
374 0391 14                     BVAL    %14     ;3DH
375 0392 14                     BVAL    %14     ;=
376 0393 14                     BVAL    %14
377 0394 14                     BVAL    %14
378 0395 14                     BVAL    %14
```

```
3BB 039D 51                BVAL    %51
389 039E 09                BVAL    %09
390 039F 06                BVAL    %06
391 03A0
392 03A0 32                BVAL    %32     ;40H
393 03A1 49                BVAL    %49     ;@
394 03A2 79                BVAL    %79
395 03A3 41                BVAL    %41
396 03A4 3E                BVAL    %3E
397 03A5
398 03A5 7E                BVAL    %7E     ;41H
399 03A6 11                BVAL    %11     ;A
400 03A7 11                BVAL    %11
401 03AB 11                BVAL    %11
402 03A9 7E                BVAL    %7E
403 03AA
404 03AA 7F                BVAL    %7F     ;42H
405 03AB 49                BVAL    %49     ;B
406 03AC 49                BVAL    %49
                        ZB ASSEMBLER VER 1.4
407 03AD 49                BVAL    %49
408 03AE 36                BVAL    %36
409 03AF
410 03AF 3E                BVAL    %3E     ;43H
411 03B0 41                BVAL    %41     ;C
412 03B1 41                BVAL    %41
413 03B2 41                BVAL    %41
414 03B3 22                BVAL    %22
415 03B4
416 03B4 7F                BVAL    %7F     ;44H
417 03B5 41                BVAL    %41     ;D
418 03B6 41                BVAL    %41
419 03B7 22                BVAL    %22
420 03B8 1C                BVAL    %1C
421 03B9
422 03B9 7F                BVAL    %7F     ;45H
423 03BA 49                BVAL    %49     ;E
424 03BB 49                BVAL    %49
425 03BC 49                BVAL    %49
426 03BD 41                BVAL    %41
427 03BE
428 03BE 7F                BVAL    %7F     ;46H
429 03BF 09                BVAL    %09     ;F
430 03C0 09                BVAL    %09
431 03C1 09                BVAL    %09
432 03C2 01                BVAL    %01
433 03C3
434 03C3 3E                BVAL    %3E     ;47H
435 03C4 41                BVAL    %41     ;G
436 03C5 49                BVAL    %49
437 03C6 49                BVAL    %49
438 03C7 7A                BVAL    %7A
439 03C8
440 03C8 7F                BVAL    %7F     ;48H
441 03C9 08                BVAL    %08     ;H
442 03CA 08                BVAL    %08
443 03CB 08                BVAL    %0B
444 03CC 7F                BVAL    %7F
445 03CD
446 03CD 00                BVAL    %00     ;49H
447 03CE 41                BVAL    %41     ;I
448 03CF 7F                BVAL    %7F

449 03D0 41                BVAL    %41
450 03D1 00                BVAL    %00
451 03D2
452 03D2 20                BVAL    %20     ;4AH
453 03D3 40                BVAL    %40     ;J
454 03D4 41                BVAL    %41
455 03D5 3F                BVAL    %3F
456 03D6 01                BVAL    %01
457 03D7
458 03D7 7F                BVAL    %7F     ;4BH
459 03D8 08                BVAL    %08     ;K
460 03D9 14                BVAL    %14
461 03DA 22                BVAL    %22
462 03DB 41                BVAL    %41
463 03DC
464 03DC 7F                BVAL    %7F     ;4CH
                        ZB ASSEMBLER VER 1.4
465 03DD 40                BVAL    %40     ;L
466 03DE 40                BVAL    %40
467 03DF 40                BVAL    %40
468 03E0 40                BVAL    %40
469 03E1
470 03E1 7F                BVAL    %7F     ;4DH
471 03E2 02                BVAL    %02     ;M
472 03E3 0C                BVAL    %0C
473 03E4 02                BVAL    %02
474 03E5 7F                BVAL    %7F
475 03E6
476 03E6 7F                BVAL    %7F     ;4EH
477 03E7 04                BVAL    %04     ;N
478 03E8 08                BVAL    %08
479 03E9 10                BVAL    %10
480 03EA 7F                BVAL    %7F
481 03EB
482 03EB 3E                BVAL    %3E     ;4FH
483 03EC 41                BVAL    %41     ;O
484 03ED 41                BVAL    %41
485 03EE 41                BVAL    %41
486 03EF 3E                BVAL    %3E
487 03F0
488 03F0 7F                BVAL    %7F     ;50H
489 03F1 09                BVAL    %09     ;P
490 03F2 09                BVAL    %09
491 03F3 09                BVAL    %09
492 03F4 06                BVAL    %06
493 03F5
494 03F5 3E                BVAL    %3E     ;51H
495 03F6 41                BVAL    %41     ;Q
496 03F7 51                BVAL    %51
497 03F8 21                BVAL    %21
498 03F9 4E                BVAL    %4E
499 03FA
500 03FA 7F                BVAL    %7F     ;52H
501 03FB 09                BVAL    %09     ;R
502 03FC 19                BVAL    %19
503 03FD 29                BVAL    %29
504 03FE 46                BVAL    %46
505 03FF
506 03FF 46                BVAL    %46     ;53H
507 0400 49                BVAL    %49     ;S
508 0401 49                BVAL    %49

509 0402 49                BVAL    %49
510 0403 31                BVAL    %31
511 0404
512 0404 01                BVAL    %01     ;54H
513 0405 01                BVAL    %01     ;T
514 0406 7F                BVAL    %7F
515 0407 01                BVAL    %01
516 0408 01                BVAL    %01
517 0409
518 0409 3F                BVAL    %3F     ;55H
519 040A 40                BVAL    %40     ;U
520 040B 40                BVAL    %40
521 040C 40                BVAL    %40
522 040D 3F                BVAL    %3F
523 040E
524 040E 1F                BVAL    %1F     ;56H
525 040F 20                BVAL    %20     ;V
526 0410 40                BVAL    %40
527 0411 20                BVAL    %20
528 0412 1F                BVAL    %1F
529 0413
530 0413 3F                BVAL    %3F     ;57H
531 0414 40                BVAL    %40     ;W
532 0415 38                BVAL    %38
533 0416 40                BVAL    %40
534 0417 3F                BVAL    %3F
535 0418
536 0418 63                BVAL    %63     ;58H
537 0419 14                BVAL    %14     ;X
538 041A 08                BVAL    %08
539 041B 14                BVAL    %14
540 041C 63                BVAL    %63
541 041D
542 041D 07                BVAL    %07     ;59H
543 041E 08                BVAL    %08     ;Y
544 041F 70                BVAL    %70
545 0420 08                BVAL    %08
546 0421 07                BVAL    %07
547 0422
548 0422 61                BVAL    %61     ;5AH
549 0423 51                BVAL    %51     ;Z
550 0424 49                BVAL    %49
551 0425 45                BVAL    %45
552 0426 43                BVAL    %43
553 0427
554 0427                   END

ERRORS = 0000

COUNT   00DB   CT1     00E0   EXPRNT  00B6   FLAGS   00FC
HOME    00BB   HT1     00BD   IMR     00FB   INMESS  004C
IPR     00F9   IRQ     00FA   LASTCH  0006   LOOP    0045
P01M    00FB   P2M     00F6   P3M     00F7   PAPER   00C3
PC1     00E8   PC2     00F5   PF1     00CB   PF2     0002
PR1     0065   PR2     0074   PR2A    009C   PR3     00A3
PRCHR   00E6   PRE0    00F5   PRE1    00F3   PRINT   0058
PROUT   00A6   RP      00FD   SILIN   0004   SILO    0020
SILOUT  0005   SIO     00F0   SP      00FE   SPH     00FE
SPL     00FF   T0      00F4   T1      00F2   TABLE   0300
TIL     0102   TIM1    00FF   TMR     00F1
```

HEX LISTING

```
:020006000004CAC
:10000C008FE6F856E6F600E6F7C1E6F50DE40006D5
:10001C005606F0E406F4E6F3BAE6F20FE6F103E670
:10002C00FB08E6FF80B00656FCFEE60420E6052041
:10003C00E60200E603009F3100FFFFD600588BF963
:10004C00E4F00656067FF506042004BFA6060D6BE9
:10005C0008A60436EB5446FC01E60420B006460321
:10006C00508FD600B8E60520E505EDA6ED0D6B2703
:0F007C00A6ED201B1B26ED20FC00EC03CF02FDA0
:10008B0002FD02FD02FD02FD16EE00D600E6D600D3
:10009B00DB2005A60536EBD1D600C35603AF76FCA5
:1000AB00016B08E70420200456FCFE9FAF76030487
:1000BB00EBFB7603046BFBAF4603208C0FD600DB08
:1000CB008AFB5603DF8C2DD600DB8AFBD600B8AF3C
:1000DB007603026BFB7603026EBFBAF7C0576030228
:1000EB006BFBC22ED600FFE6020076030 2EBFBA0F1
:1000FB00EE7AEAAF46F10CA6F200EBFB56F1F3AF4A
:10030000000000000000004F0000000700070014 7C
:10031000 7F147F14242A7F2A122313086462364928
:1003200055225000050300000001C224100041221C
:10033001C0014083E08140808 3E0808005030004D
:10034000000808080808006060000020100804028 7
:100350003E5149453E00427F400042615149462190
:10036000414548311814127F102745454539 3C4A09
:10037000494930017109050336494949360649495 9
:1003800029 1E003636000000563600000814224 1AF
:10039000001414141414004122140802015109061 7
:1003A000324979413E7E1111117E7F494949363EDD
:1003B000414141227F4141221C7F494949417F09F6
:1003C0000090901 3E4149497A7F0808087F00417FB9
:1003D000410020404 13F017F08142241 7F404040BE
:1003E000407F020C027F7F0408107F3E4141413E66
:1003F0007F09090906 3E4151214E7F091929464 6C8
:10040000494949310101 7F01013F4040403F1F20E0
:1004100040201F3F4038403F6314081463070870B2
:0704200008076151494543 43
:00000001FF
```

One Night's Work

PLUG-IN MODULE REPLACES 2532 EPROM

by D R Locke

This circuit is intended to provide a plug-in module that can replace a 2532 EPROM during the design stages of a ROM/EPROM. As the unit runs from the READ/WRITE line of the computer, correction of errors or re-programming is much faster and easier than with EPROMs.

The circuit

The unit, shown schematically in *Figure 1*, consists of a simple inverter (TR1) and two static RAMs (IC1,2). Address lines A_0 to A_{10} and Data Bus lines D_0 to D_7 are common to both IC's. Address line A_{11} is used to switch between the two static RAMs, with the aid of the output enable (OE) and the inverter TR1.

Resistors R1-R3 hold the chip unselected and in the READ mode. This allows the unit to be unplugged without losing the data within. When powered down or removed from the computer, battery B1 provides power for data retention through D2. In addition, diode D1 provides a DC block when the computer is powered down. This is to prevent excessive load being taken from the battery by the rest of the circuit.

Battery life will be several days with a fully charged battery. The battery itself is charged through D1 and R4 all the time that the unit is in circuit. The approximate charge time is typically between 1 and 2 hours.

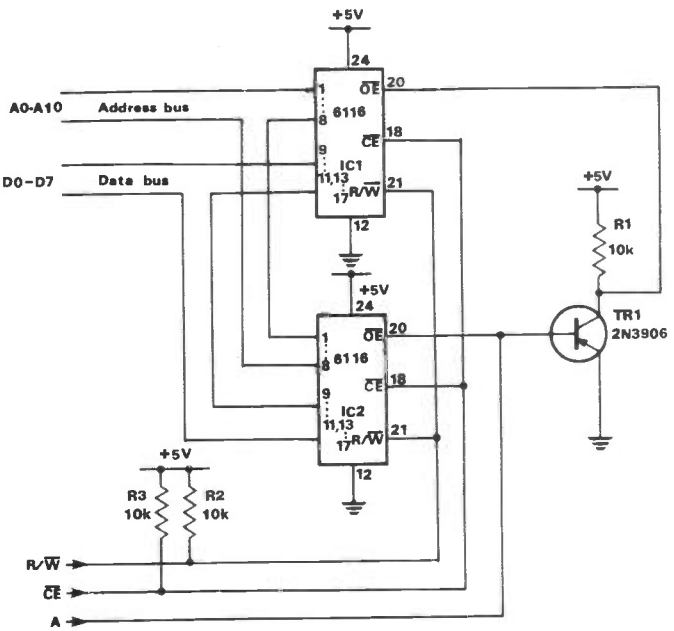

Fig 1a *Circuit diagram*

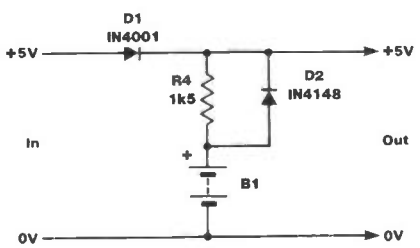

Fig 1b *Power supply*

PARTS LIST

Resistors

R1, R2, R3	10k 0.25W
R4	1k5 0.25W

Semiconductors

IC1, IC2	6116-35
TR1	2N3906
D1	IN4001
D2	IN4148

Miscellaneous

1 PCB back-up battery
2 12-way PCB connectors (Ambit)
1 veroboard/PCB

Construction and testing

Construction is fairly simple, but requires some dexterity. The board has to be small to fit in the space allowed by the average computer. Veroboard can be used but a PCB will give a neater result. Connect the headers on the solder side of the board, taking care to get the spacing between them correct.

Examine the board for short circuits and poor solder joints before plugging it in.

Once you are happy with the module, plug it into a 2532 EPROM socket on your computer. Connect the flying lead to the READ/WRITE line of the expansion bus connector.

The unit should now function as a 4K block of RAM at the address of the EPROM socket. Write a data pattern to the unit and read it back to check for READ/WRITE errors. Then turn the power to the computer off for a couple of minutes, then back on. The data written into the unit should still be present with no errors. This test will fail if the back-up battery has not been charged beforehand. Once programmed, the unit may be removed from the computer without loss of data.

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FT708R	70cm Handheld 1W	**£209.00 inc**
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NC8	Base quick charger + PSU	**£54.05 inc**
PA3	DC adaptor and charger	**£15.35 inc**
NC9C	Slow charger	**£8.80**
FNB2	Nicad Battery Pack	**£21.45**
FBA2	Battery pack sleeve	**£3.45**
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MMB10	Mobile bracket	**£8.05**

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430/726	70cms module	**£250.00 inc**
SAT726	Full duplex module	**£95.00 inc**
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SMC8C	220mA Charger (13A Style)		**£8.80 inc**
MMB11	Mobile Mount		**£26.85 inc**
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FT720RU	Transceiver 70cms 10W	**£229.00**

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MEMG7700	Memory option	**£69.00**
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Stourbridge Andrew G4BJY (0384) 390916

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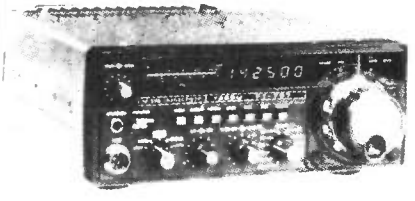

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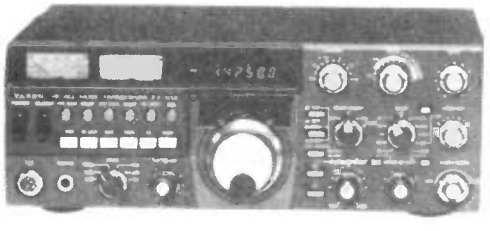

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SP102	External speaker	£52.50
FC102	Antenna coupler	£179.00
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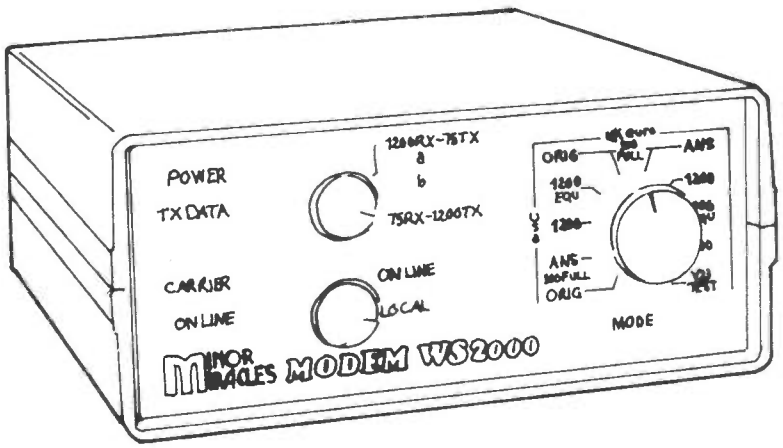
HIGH SPEED DATA

The next venture in amateur radio

In this article RJ Redding describes the reasons for radio amateur interest in high speed data transmission and explains the techniques that are involved



One of the finest aspects and most absorbing interests of amateur radio, is the pioneering of new techniques. The terms of the transmitting licence puts this beyond dispute, and it has been a continuous process since the earliest days.

Scientists knew about radio waves for decades, before the cat's whisker and home made coils of the hobbyist led to the growth of broadcasting.

Commercial pressures on the known wavelengths pushed amateurs into shorter and shorter ones, with the opening up of the higher frequency bands and the pioneering of techniques such as single side band and the narrow band FM, to meet each limitation as it was encountered.

Once a public service is well established, as is the case now with sound and vision broadcasting, the opportunities for original experimentation become slim. However, new components and techniques open up fresh possibilities, and possibly this is now the case in the transmission of high speed data, because of the ubiquitous microprocessor.

Although the home computer is viewed with mixed feelings by radio amateurs, it is undoubtedly here to stay, and there is a communication problem. Continually buying programs on tape cassettes has disadvantages, and there are currently two novel alternatives. One is 'Micronet', which makes use of Prestel to download programs, and the other is 'Basicode', which has recently been broadcast by 'The Chip Shop' on Radio 4 with considerable impact.

These are concerned with computer programs which apply mainly to games. There is a much bigger and wider use for the same technology, namely INFORMATION EXCHANGE and also there is a need to operate in plain English text without the restrictions inherent in any program language.

Data transmission

Amateurs are well used to 'data transmission' even if they call it CW, RTTY, or Amtor. In all cases, the information is contained in a binary signal which has two states, or to put it more plainly, either it is there or not there. This is, perhaps, an exaggeration, for Morse is really three-state, but again the speed of transmission is limited because we need time to distinguish between the dots and dashes.

On the other hand, if we use electronic logic for translation, the limitation becomes the speed with which the data can be input and the rate at which it can be printed out. For mechanical teleprinters this sets the speed at 45 or 55 baud, or at the most 110 baud.

If, however, we go on to the microprocessor and electronic storage, we can prepare text in a memory and then proceed to dump it into a communication channel to be received into another memory and subsequently printed out when required. The limitation is now a matter of communication, and determined by the channel quality and the available bandwidth.

Table 1 indicates the order of speed capability of a telephone line or a speech radio channel. The transmission speed is measured in 'baud', which may be loosely translated as 'bits per second'. It is perhaps more realistic to compare in terms of characters transmitted per second, because the number of bits varies from code to code.

RTTY tends to use a five bit code, whereas ASCII variously uses six, seven or eight with various 'protocols' and hence the apparent discrepancy between baud number and character rate.

To show what this means in practice, a

TABLE 1: Capability of a Radio Channel

Information	Frequency Range	Signal Deviation	Typical Speed wpm
Music (Stereo)	40-15K	75KHz	—
Broadcast (AM)	40-8K	10KHz	—
Mobile Speech	300-2.4K	3KHz	100
FSK Data	Shifted tones	200Hz	330
CW (Morse)	On/Off		12

ten minute news bulletin of the type transmitted by RSGB would take 80 minutes to transmit by Morse, 10 minutes by RTTY, 3 minutes at 300 baud ASCII, and less than one minute at 1200 baud ASCII.

Speed and storage

One may argue that we cannot follow the sense much faster than speech, so what is the point of sending it any faster? The new and significant import is *STORAGE*. We can compile a message or information at leisure, establish a link and at the appropriate moment, quickly dump it into the memory of another machine, from whence it can be utilised when required.

One does not have to listen or read through the entire bulletin to find an item; one can use the computer to search or scan whether there is anything on a particular topic of interest.

The next stage is, of course, to arrange to receive the news bulletin automatically – via a time switch regularly – so that the latest is available, in case any of the information is required. Thus we always have the latest information, for example, about satellite predictions and band conditions.

Such facilities are the essence of commercial electronic mail and networking, in that one can send a message at an appropriate time to be collected and used or responded to when convenient. Anyone who has participated in the 'telephone tango' in attempting to fix a date with a number of individuals, will appreciate the value of such a system, which is, of course, extendable in all sorts of directions.

At the moment these techniques are mainly used on the telephone network, and are highly developed in the USA. The reason is probably because local calls in many areas are free, whereas the use of networks, even amateur club ones in the UK, can prove very expensive and this is where the radio amateur can use his abilities to his own advantage.

I believe we can take the apparatus and techniques which are used on telephone lines and use them to great advantage on amateur radio communication channels. The problems in some ways are simpler because we are conditioned to simplex working as opposed to the duplex (both ways at once) operation, which is the norm in telephony.

To make the best use of this, I feel that we need to look very carefully at present day telephone practice and see how much we can leave out and how we can simplify the remainder to make it suitable for amateur radio use.

Let us first look at what has already been done with data to see how we may benefit from telephony-type practice.

Current practice in data transmission

Data transmission uses a 'modem' which is a shortened form of MODulator-/DEModulator in which a tone is shifted, ie frequency-shift keyed (FSK) by a small amount to indicate binary 'ones' or 'zeros'. Unfortunately, the various users have adopted different tones and degrees of shift as well as different speeds, and Table 2 approximates the spread of these.

This is far from absolute, because the American telephone systems differ from the rest of the world and the various cassette recording styles for home computers bear some similarity, but the number of different 'standards' nearly matches the number of machines.

Standards

It is hardly worth arguing the pros and cons for a further standard because of the versatility of electronics. It is possible to make one chip which will work on a large number of the 'standards', just as it is possible to write a computer program which will turn any dialogue of Basic into any other.

An ambitious project in a home computer club was well advanced in such a universal translation program when it was found highly desirable to play back a program on the same recorder on which it was made, to avoid the dissimilarity of individual magnetic heads. Perhaps the success and popularity of Basicode, as broadcast by Radio 4, is that this point is automatically satisfied in the philosophy.

Sending programs over the air

On many occasions amateurs have transmitted programs to one another, but invariably this has been from one machine to another of exactly the same type. Thus there is little doubt about the feasibility of such transmission, even at comparatively high speeds like 1500 baud used on the Dragon.

However, I think there is great advantage in adopting strictly the tones and format of the standard used universally on telephone lines, namely the CCIII and using plain ASCII for the text. The reason for this is that anyone with data equipment for a telephone line or a Prestel system can, with a little ingenuity, use this for programs and data reception from the air waves, and even to transmit as well if they have a licence. Further, there is a considerable market in used modems and surplus Prestel equipment which is ready made for adaptation to such amateur purposes, in just the same way as the existence of cheap teleprinters made RTTY popular 20 years ago.

RTTY and AMTOR

In suggesting this, I am in no way meaning to cast aspersions on existing RTTY and AMTOR practice, merely attempting to extend it. Indeed, many people who go for the high speed data will include the lower speed types because of their unique specialities. RTTY is an easy and cheap way of getting going with data and receiving commercial traffic, and AMTOR is a DX-form of it which has been well publicised recently, (March 1984 *R&EW.*)

It is supreme in what it was designed for, eg high accuracy, highly reliable transmission of message into the Telex-on-Radio (TOR) system which, because of its mechanical nature, is fairly slow.

In its amateur form, AMTOR, it requires an answering transmitter for each character and though the system has been developed into 'forward error correction' by doubling each transmission, it is hardly suitable for widespread broadcasting on channels that are available for news bulletins etc. It is limited to 110 baud, which is about one tenth of the speed at which a dot-matrix printer of computer practice can operate.

Tests

Again, this is a proposal on tests over a few months and open to modification in the light of experience. There will be mismatches and incompatibilities; for instance, most computers have some sort of interface, and one needs to unravel the mysteries of RS 232 or RS 423, although luckily most of it seems quite irrelevant for radio purposes.

TABLE 2: FSK Tones Used by Various Systems

System	Baud-rate	Frequency in Hz Mark (1)	Space (0)	Shift
RTTY & AMTOR	1-100	1445	1275	170
DUPLEX MODEM V21 (CCITT)	300	980 1650	1180 1850	200 200
DUPLEX MODEM BELL-US	300	1270 2225	1070 2025	200 200
V23 MODEM (CCITT)	600 or 1200	1300 1300	1700 2100	400 800
(Optional)	75	390	450	60

THE TRIO-KENWOOD 'TS-430S' TRANSCEIVER

A comprehensive review of one of the latest 'TS' series of transceivers by Anthony Stokes, G3ZRH

The TS-430S is a general coverage MW-SW transceiver introduced in the UK market during 1983 and performance of the set is substantially better than that of many earlier models.

The receiver has continuous coverage from 150KHz to 30MHz, and the transmitter operates on all of the amateur bands, although it can be made general coverage for non-amateur requirements.

The set is comparable with the Yaesu FT757 and Icom 751, although the latter is rather more expensive and does have some superior features. Weighing in at only 6.5Kg it contains no valves in the PA or driver stages, and therefore requires only a single supply of 13V at 20amps. The voltage (in the range 12-16V) is not critical regarding performance. It is thus much more portable than similar valve transceivers. The block diagram is shown opposite.

Capabilities

As well as CW/SSB/AM, FM may be received across the frequency spectrum. The sharpness of the selectivity in the AM position is such that 'slope detection' of narrow band FM (NBFM) signals does not work well, and therefore the optional FM board is required for satisfactory FM working.

Even the addition of the YK88A AM filter does not appreciably help the demodulating signals in the 27MHz citizens band, although it may be possible to zero-beat the carrier in the receiver SSB position.

The frequency stability of this receiver is so good that one can listen to AM music broadcasts for long periods on either USB or LSB.

Although the main tuning is in 100Hz or 10Hz steps – by microphone control if desired – there is also a receiver independent tuning control for obtaining final precision. As well as two independent VFO circuits there are eight 'memory' channels that may be preset independently to any frequency and mode, sequentially scanned if so desired. Another scanning facility enables the receiver to scan continuously between two preset frequencies until a signal is received that is strong enough to break through the squelch if this is set; this is particularly useful on ten metres where, for example, 29.52-29.69MHz may be continuously scanned until the squelch lifts and shows when an NBFM station is present. The transceiver has split frequency capability and can even transmit and receive in different modes. This is useful on, say, top band where the transmitter might be on AM, but the receiver on SSB.

Performance

The selectivity of the receiver is very good, helped by the tunable IF shift control and the IF notch filter. This is ably demonstrated, for example, on long wave DX reception or on 75 metres where amateur stations must be separated from non-amateur signals. With the YK-88CN 270Hz filter it is pleasant to enjoy a major improvement on 7 or 14MHz CW in the separation of stations without the 'ringing' effect of older AF filters. Although the sharpness of the IF filters in the Icom 751 is appreciably better, the author is well satisfied with the TS-430S selectivity characteristics. Only the FM detector circuit could profitably be improved upon. The quoted -6dB bandwidth of 15KHz is really too broad for working on 29 or 27MHz where channel separation is typically 10KHz but this complaint applies to all the current generation of general coverage Japanese transceivers. The sensitivity is good, and the addition of an external preamplifier only improved the overall S/N ratio by around 3dB, although the 'S' meter responded better to weaker signals.

Whilst the RF attenuator switch is both simple and effective (if seldom needed), it is regrettable that the noise blanker is relatively ineffective. It does prove fairly effective against RFI, but little else, unlike the Yaesu and Icom noise blankers which are effective against a wide variety of QRM. It is hoped that the manufacturers might improve on this in future models.

The transmitter PA is well designed, and whilst the output circuit is fixed at about 50ohm impedance, a standing wave ratio detector circuit ensures that power input to the PA is steadily reduced in response to a rise in SWR. Additionally there is a fan which switches on when the PA heatsink becomes warm, and if there is excessive heat generated the transmitter switches itself off until safe operating conditions are resumed.

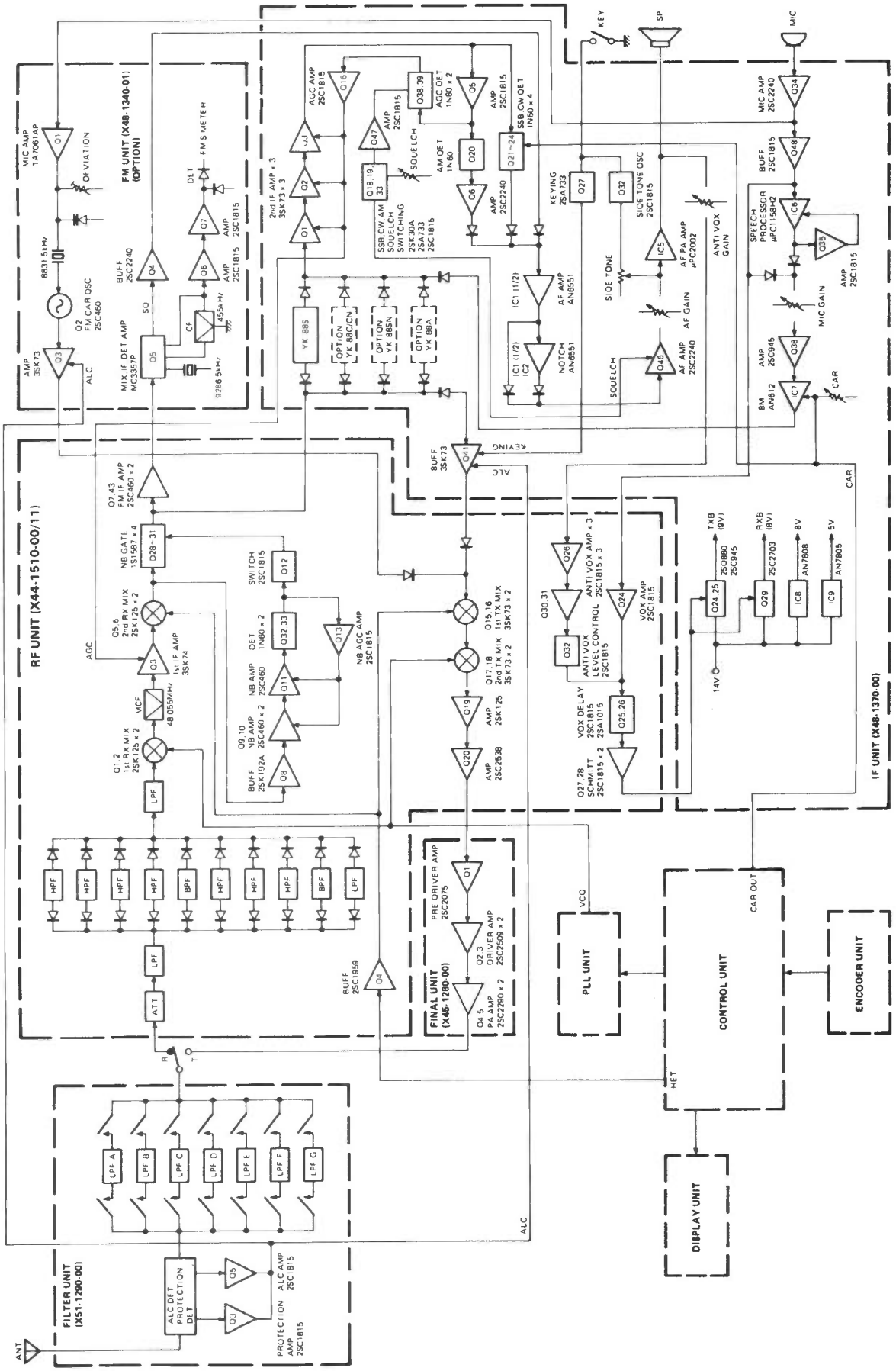
There appears to be adequate sensitivity in the microphone preamplifier and audio processor circuits, and the VOX or Morse key adjustable delay transmit-receive switching *is* fast enough, even for contest operation. Rear panel connections are provided for VHF transverter, linear amplifier, external speaker, Morse key etc. The output from the external speaker socket may conveniently be taken to the input of an RTTY decoder, so that headphones need not be unplugged from the front panel when operating in the 'teleprinter' mode.

Conclusions

Being only 10.6 x 10.1 x 3.8 inches the set provides a performance equal to or much better than many older sets of substantially greater dimensions. The maximum legally permitted CW power of 100W output is readily obtained on all bands 3.5-29MHz, but on AM it is recommended that 30W is not exceeded if modulation characteristics are to remain good, and on FM the driver AGC is set to obtain a 40W output. On SSB, more than 250W PEP input is possible.

The receiver is relatively immune to signal breakthrough but some weak spurious responses are occasionally perceptible, but scarcely at a level to cause any bother, and certainly far below the level of many current-production, transistorised, general coverage receivers. In addition to the main tuning knob there are push switches for changing the frequency in 1MHz steps, or in larger steps from one amateur band to another and the frequency is displayed to the nearest 10 or 100Hz.

The set can be thoroughly recommended where one does not wish to incur a larger outlay such as that required for an Icom 751 and is, on the whole, good value for money.



Block diagram of the Trio-Kenwood 'TS-430S' Transceiver

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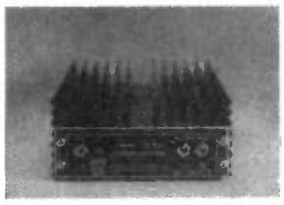

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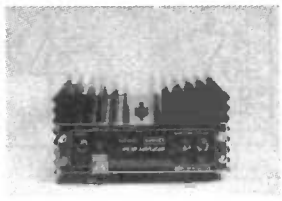

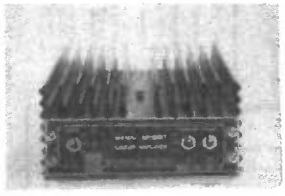

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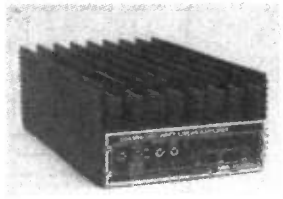

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MML144/100-HS	25W	100W				13.8V @ 12A	\	£149.95 (p&p £3.50)
MML144/100-LS	**1or 3W**	100W				13.8V @ 14A	\	£169.95 (p&p £3.50)
MML144/200-S	**3, 10 or 25W**	200W	CW.			13.8V @ 30A	\	£245 (p&p £4.50)

AM

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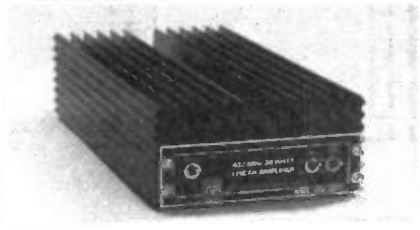
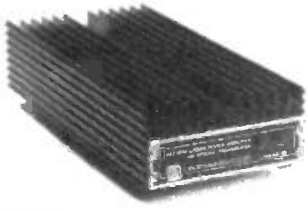
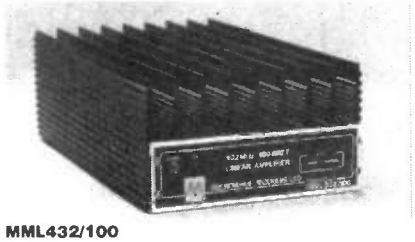


MML432/30-L



MML432/50



MML432/100

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MML432/100	10W	100W	CW.	—	—	13.8V @ 20A	\	£245 (p&p £4.50)

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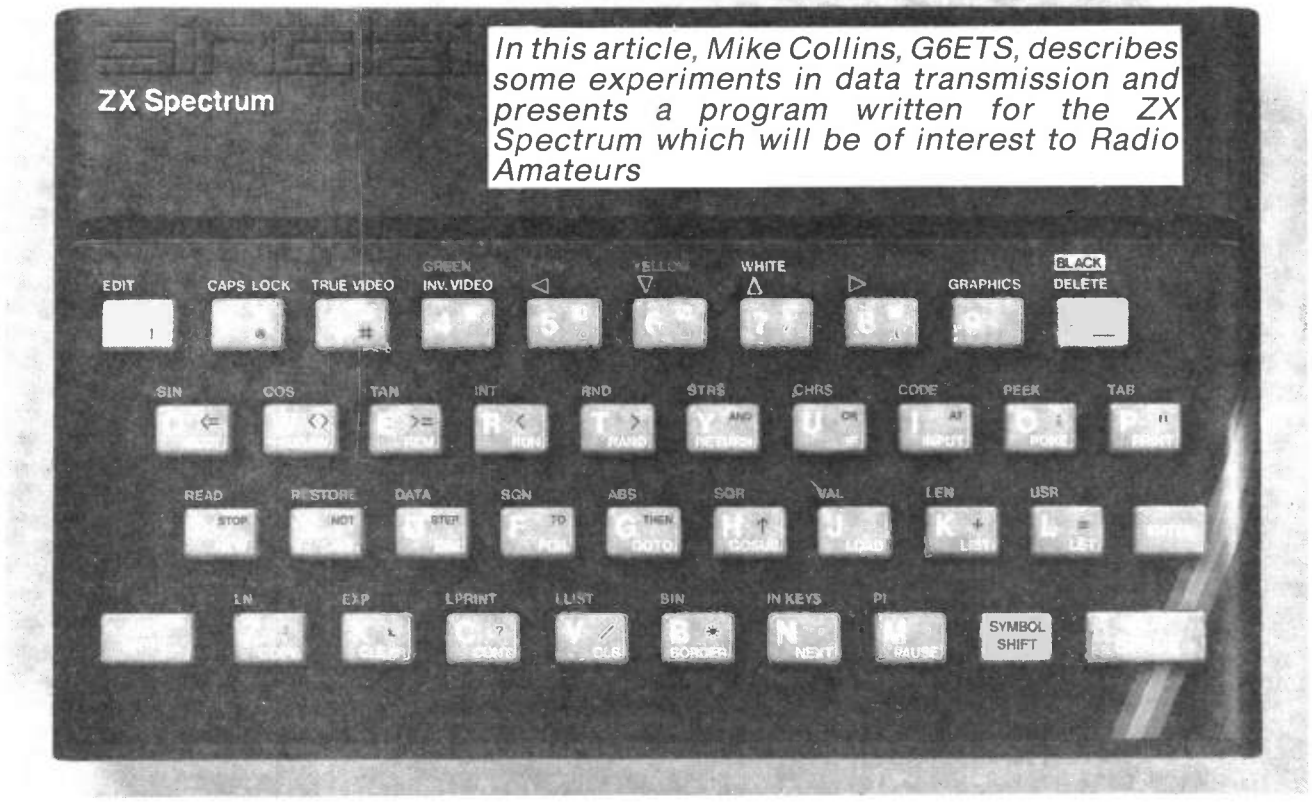

In this article, Mike Collins, G6ETS, describes some experiments in data transmission and presents a program written for the ZX Spectrum which will be of interest to Radio Amateurs

During spring and early summer last year, a group of other radio amateurs and myself, in the Norwich area, carried out data transmission experiments using ZX Spectrum computers and 2m VHF FM transceivers on a frequency of 144.7625 MHz.

The interface between the computer and the transceiver is a fairly simple matter. One has been designed and built by Paul G4VLS (ex G6LUN), a member of the group, who supplied several to other members.

However, to get started, a simple interface can be made by connecting the extension loudspeaker socket to the earphone socket on the computer for 'receive' and connecting a spare transceiver microphone socket to the microphone socket on the computer for 'transmit'. An additional pair of leads is connected to an on/off switch to key the transmitter.

The internal loudspeaker connections of most transceivers are disconnected when an extension loudspeaker is plugged in, thus an indication that the station is going to transmit data and this will alert receiving stations to connect their transceivers.

Performance

The group started with limited programming knowledge, and during our data transmission periods, we were all able to pass on hints, tips, information and ideas to assist each other in learning 'Basic'.

We started by transmitting simple programs from magazines or books and progressing to longer programs and 'Screen$' pictures. In general we had a fair amount of success, varying from 95% to 55% throughout the group, depending on factors that we previously agreed. These were listed during our many discussion sessions after each 'data transmission' period and are as follows:-

1. Transmit/receive frequency alignment of the different transceivers in the group.
2. Correct deviation at the 'transmitting' station.
3. The quality of recovered audio at the 'receive' stations, eg freedom from distortion and noise.
4. Extent of multipath reception and general man-made interference between the stations in the group.
5. Duration of the data transmission.
6. Power output of the 'transmitting' station.

It might come as a surprise to readers that 'Power output' is number 6, however the group found that received data transmission at a signal strength of about S1, could be successfully received, provided that the first five items on our list were maintained within close limits.

With regard to number 5 of the list, the group found that whilst short programs could usually be transmitted, the longer programs, which contain Screen$ and machine code segments, quite often failed. This was due to one or more factors on the 'list' and some members found this discouraging at first. We were all fairly pleased with the results after successive attempts.

The program

Our experiences will enable others to understand some of the problems concerning data transmission and I have produced a program that is of professional quality and easy to use for any data transmission application, whether it is for amateur or private mobile radio use.

My first objective was to determine what the program should be able to achieve, keeping it easy to use, reliable and well presented. Then I planned the

ASCII Data Listing.

```
40  CLEAR 28999
42  FOR i=29001 TO 29824
44  READ a: POKE i,a: NEXT i
45  STOP
50  DATA 22,9,0,49,46,32,80,114,101,112,97,114,101,32,109,101,115,115,
    97,103,101,13,13,50,46,32,68,105,115,112,108,97,121,32,99,117,114,
    114,101,110,116,32,109,101,115,115,97,103,101,13,13,51,46,32,68,105,
    115,112,108,97,121,32,115,116,111,114,101,100,32,109,101,115,115,97,
    103,101,13,13,52,46,32,83,97,118,101,32,109
52  DATA 101,115,115,97,103,101,32,116,111,32,116,97,112,101,13,13,53,46,
    32,84,114,97,110,115,109,105,116,32,109,101,115,115,97,103,101,13,13,
    54,46,32,82,101,99,105,101,118,101,32,109,101,115,115,97,103,101,16,
    7,22,21,0,32,69,78,84,69,82,32,65,32,78,85,77,66,69,82,32,49,32,84,
    79,32,54,32,22,1,5,68,73
54  DATA 83,80,76,65,89,32,67,85,82,82,69,78,84,32,77,69,83,83,65,71,69,
    32,22,21,1,80,82,69,83,83,32,69,78,84,69,82,32,84,79,32,82,69,84,85,
    82,78,32,84,79,32,77,69,78,85,32,22,1,10,69,78,84,69,82,32,77,69,83,
    83,65,71,69,32,22,1,5,68,73,83,80,76,65,89,32,83,84,79,82,69,68,32,
    77,69,83,83,65,71,69,32,22,1,7,83,65,86,69,32,77, 69,83,83
56  DATA 65,71,69,32,84,79,32,84,65,80,69,22,21,0,83,116,97,114,116,32,
    116,97,112,101,32,45,32,113,114,101,115,115,32,101,110,116,101,114,
    32,116,111,32,115,97,118,101,32,22,1,9,84,82,65,78,83,77,73,84,32,
    77,69,83,83,65,71,69,22,3,4,70,79,76,76,79,87,32,84,72,69,83,69,32,
    73,78,83,84,82,85
58  DATA 67,84,73,79,78,83,22,6,4,49,46,32,67,79,78,84,   65,67,84,32,79,
    80,69,82,65,84,79,82,13,13,50,46,32,71,73,86,69,32,79,80,69,82,65,84,
    79,82,32,68,69,84,65,73,76,83,32,79,70,32,67,65,76,76,13,13,51,46,32,
    87,72,69,78,32,67,79,78,78,69,67,84,69,68,32,45,32,83,87,73,84,67,72,
    32,84,79,32,32,32,32,32,32,84,82,65,78,83,77,73,84,32,65,78
60  DATA 68,32,80,82,69,83,83,32,69,78,84,69,82,32,22,1,9,82,69,67,73,69,
    86,69,32,77,69,      83,83,65,71,69,0,0,0,0,0,0,0,22,0,0,143,143,
    136,32,32,143,143,32,32,143,143,143,32,32,143,143,32,32,32,143,143,
    138,32,143,143,32,32,143,32,32,143,32,143,32,133,32,133,32,32,138,32,
    32,143,32,32,133
62  DATA 32,32,138,32,32,143,32,32,133,32,32,138,32,143,32,32,143,32,143,
    32,133,32,133,32,32,138,32,32,143,32,32,133,32,32,138,32,32,143,32,32,
    133,32,32,138,32,143,32,32,143,32,143,32,133,32,133,131,131,138,32,32,
    143,32,32,133,131,131,138,131,32,143,32,32,133,131,131,138,32,143,32,
    32,143,32,143,32,133,32,133,32
64  DATA 32,138,32,32,143,32,32,133,32,32,138,32,32,143,32,32,133,32,32,
    138,32,143,32,32,143,32,143,143,130,32,133,32,32,138,32,32,143,32,32,
    133,32,32,138,32,32,143,143,138,133,32,32,138,32,143,143,32,143,143,
    32,32,32,32,32,32,32,32,32,32,32,32,32,32,32,32,32,32,32,32,32,32,32,
    32,32,32,32,32,32,32,32,32
66  DATA 143,143,143,143,143,143,143,143,143,143,143,143,143,143,143,143,
    143,143,143,143,143,143,143,143,143,143,143,143,143,143,143
68  DATA 32,17,7,16,2,18,1,22,10,0,68,65,84,65,45,67,65,76,76,32,127,32,
    77,87,32,67,79,76,76,73,78,83,32,74,65,78,32,49,57,56,52,32,0
```

****NOTE: WHEN ALL DATA ENTERD AND PROGRAM RUN WITHOUT ERRORS - DELETE LINES 42 TO 68 ****

displays and layouts of the parts of the program. My first version was written in Basic, but although this was adequate, I was not satisfied with the operating speed, so I decided to write the program in machine code. The Input statement was retained in Basic.

The program is written in three parts and should be entered in the following order:

1. *ASCII Data Listing:* The very long data list contains all the screen printed items and control characters from ASCII code in a decimal format. The listing is essential for the correct display operation of the program and will need to be entered very carefully.
2. *Machine Code Listing:* This listing is the brain of the program and includes Hex code, Mnemonics and, as necessary, decimal coding. This Listing is not relocatable and should be assembled with any good assembler. I used UV 48K from ACS, which I find very good.
3. *Basic Program Listing:* This short Basic Listing is for inputting your information and interfacing the machine code routines.

Message preparation

The program has been written for either a 16K or 48K Spectrum in the same memory locations. It is Menu driven and, apart from a few notes to help the reader understand how to use it, should be self-explanatory. This is the Menu:

1. Prepare Message
2. Display Current Message
3. Display Stored Message
4. Save Message to Tape
5. Transmit
6. Receive

To prepare a message select (1) and print out the first line of your message, followed by 'enter' and continue until the last line is on the display, then press 'Enter' by itself. After a short delay the screen will clear and the menu will return.

To save message to tape, select (4) and when you have the tape ready press 'Enter' and your message will be written onto tape without a header.

To transmit, select (5) and follow instructions given. It is interesting to note that a complete 'screen' of informa-

Machine Code Listings

```
Org 29825;

Start       ;
Main        ; CD 85 74   call Menu (29829)
End         ; C9         ret
Menu        ; CD 33 76   call Clear (30259)
              CD 10 76   call Logo  (30224)
              11 49 71   ld de,29001
              01 A9 00   ld bc,169
              CD 3C 20   call 8252
              C3 97 74   jp Choice  (29847)
Choice      ; CD 9F 75   call Scan  (30111)
              FE 41      cp 49
              CA C0 74   jp z,Prepare (29888)
              FE 32      cp 50
              CA D2 74   jp z,Display (29906)
              FE 33      cp 51
              CA 07 75   jp z,Load    (29959)
              FE 34      cp 52
              CA 1C 75   jp z,Save    (29980)
              FE 35      cp 53
              CA 34 75   jp z,Transmit(30004)
              FE 36      cp 54
              CA 4C 75   jp z,Recieve (30028)
              FE 23      cp 35
              CA 1F 76   jp z,Break   (30239)
              C3 97 74   jp Choice    (29847)
Prepare     ; CD 33 76   call Clear   (30259)
              CD AF 75   call Plot    (30127)
              11 2F 72   ld de,29231
              01 10 00   ld bc,16
              CD 3C 20   call 8252
              C3 84 74   jp End       (29828)
Display     ; CD 33 76   call Clear   (30259)
              CD 7C 75   call Current (30076)
              CD AF 75   call Plot    (30127)
              21 18 79   ld hl,31000
              3E 16      ld a,22
              D7         rst 16
              3E 03      ld a,3
              D7         rst 16
              3E 00      ld a,0
              D7         rst 16
Loop        ; 23         inc hl
              7E         ld a,(hl)
              FE 0D      cp 13
              CA 01 75   jp z,Linefeed (29953)
              FE 20      cp 32
              FA E7 74   jp m, Loop   (29927)
              FE 7F      cp 127
              CA 8B 75   jp z,Retmenu (30091)
              FE 8F      cp 143
              F2 E7 74   jp p, Loop   (29927)
              D7         rst 16
              C3 E7 74   jp Loop      (29927)
Linefeed    ; 3E 0D      ld a,13
              D7         rst 16
              C3 E7 74   jp Loop      (29927)
Load        ; CD 33 76   call Clear   (30259)
              CD AF 75   call Plot    (30127)
              11 40 72   ld de,29248
              01 19 00   ld bc,25
              CD 3C 20   call 8252
              CD 6E 75   call Read    (30062)
              C3 81 74   jp Main      (29825)
Save        ; CD 33 76   call Clear   (30259)
              11 5A 72   ld de,29274
              01 3A 00   ld bc,58
              CD 3C 20   call 8252
              CD AF 75   call Plot    (30127)
              CD A7 75   call Check   (30119)
              CD 61 75   call Write   (30049)
              C3 81 74   jp Main      (29825)
Transmit    ; CD 33 76   call Clear   (30259)
              11 95 72   ld de,29333
              01 A4 00   ld bc,164
              CD 3C 20   call 8252
              CD AF 75   call Plot    (30127)
              CD A7 75   call Check   (30119)
              CD 61 75   call Write   (30049)
              C3 81 74   jp Main      (29825)
Recieve     ; CD 33 76   call Clear   (30259)
              11 3A 73   ld de,29498
              01 12 00   ld bc,18
              CD 3C 20   call 8252
              CD AF 75   call Plot    (30127)
              CD 6E 75   call Read    (30062)
              C3 81 74   jp Main      (29825)
Write       ; 3E FF      ld a,255
              DD 21 18 79 ld ix,31000
              11 60 02   ld de,608
              CD C2 04   call 1218
              C9         ret
Read        ; 37         scf
              3E FF      ld a,255
              DD 21 18 79 ld ix,31000
              11 60 02   ld de,608
              CD 56 05   call 1366
              C9         ret
Current     ; 3E 02      ld a,2
              CD 01 16   call 5633
              11 F3 71   ld de,29171
              01 1A 00   ld bc,26
              CD 3C 20   call 8252
              C9         ret
Retmenu     ; 3E 02      ld a,2
              CD 01 16   call 5633
              11 0E 72   ld de,29198
              01 20 00   ld bc,32
              CD 3C 20   call 8252
              CD A7 75   call Check   (30119)
            ; C3 81 74   jp Main      (29825)
Scan        ; CD A8 10   call 4264
              FE D0      cp 208
              28 F9      jr z,Scan    (30111)
              C9         ret
Check       ; CD 9F 75   call Scan    (30111)
              FE 0D      cp 13
              20 F9      jr nz,Check  (30119)
              C9         ret
Plot        ; 3E 02      ld a,2
              CD 01 16   call 5633
              D9         exx
              E5         push hl
              D9         exx
              FD 36 43 00 ld (iy + 25667),0
              FD 36 44 00 ld (iy + 25668),0
              01 7F 00   ld bc,127
              11 02 00   ld de,2
              CD BA 24   call 9402
              FD 36 43 00 ld (iy + 25667),0
              FD 36 44 AF ld (iy + 25668),175
              01 7F 00   ld bc,127
              11 02 00   ld de,2
              CD BA 24   call 9402
              FD 36 43 00 ld (iy + 25667),0
              FD 36 44 00 ld (iy + 25668),0
              01 00 AF   ld bc,44800
              11 01 01   ld de,257
              CD BA 24   call 9402
              FD 36 43 FF ld (iy + 25667),255
              FD 36 44 00 ld (iy + 25668),0
              01 00 AF   ld bc,44800
              11 00 01   ld de,256
              CD BA 24   call 9402
              FD 36 43 00 ld (iy + 25667),0
              FD 36 44 9E ld (iy + 25668),158
              01 7F 00   ld bc,127
              11 02 00   ld de,2
              CD BA 24   call 9402
              D9         exx
              E1         pop hl
              D9         exx
              C9         ret
Logo        ; 3E 02      ld a,2
              CD 01 16   call 5633
              11 53 73   ld de,29523
              01 03 01   ld bc,259
              CD 3C 20   call 8252
              C9         ret
Break       ; CD 33 76   call Clear     (30259)
              11 57 74   ld de,29783
              01 29 00   ld bc,41
              CD 3C 20   call 8252
            ; 3E 7F      ld a,127
              DB FE      in a,(254)
              1F         rra
              D0         ret nc
              18 EC      jr Break      (30239)
Clear       ; 3E 02      ld a,2
              CD 01 16   call 5633
              06 18      ld b,24
              CD 44 0E   call 3652
              C9         ret
Memclear    ; 06 FF      ld b,255
              21 18 70   ld hl,31000
              3E 00      ld a,0
Loop 1      ; 23         inc hl
              77         ld (hl),a
              10 FC      djnz Loop 1 (30277)
              06 FF      ld b,255
              21 18 7A   ld hl,31256
Loop 2      ; 23         inc hl
              77         ld (hl),a
              10 FC      djnz Loop 2 (30286)
              06 60      ld b,96
              21 19 7B   ld hl,31513
Loop 3      ; 23         inc hl
              77         ld (hl),a
              10 FC      djnz Loop 3 (30295)
              C9         ret
```

tion will be transmitted in about 7 seconds with this program, compared with about 45 seconds for the Sinclair Screen$ command.

In conclusion

It is hoped that this article and program Pwill be of interest to many readers of *R&EW* and that it will encourage more amateurs to experiment with 'data transmission'. Any reader who has any difficulty in entering the program, can obtain a copy on tape from me at the following address:- *Mike Collins, 5 Stafford Ave, Costessey, Norwich, Norfolk NR5 0QF*, or *telephone 0603 666260* during working hours.

Acknowledgements

I would like to express gratitude to the members of the group, G4VRX (ex G8JQQ) Dave, G4VLS (ex G6LUN) Paul, G40LP Richard, G4GIE John and G4RMN Mich who took part in the experiments and provided the results which promoted the idea of this program.

I would also like to thank Dr I Logan whose books were used to teach myself Machine Code, Mr P Lyons (National Field Manager of Aircall PLC) and G6PAM Derek who both persuaded me to prepare the article for publication.

****

Basic Program Listing.

```
10    BORDER 4: PAPER 4: INK 9: CLS
40    CLEAR 28999
45    LOAD "M/Code" CODE 29000
50    RANDOMIZE USR 29825
100   RANDOMIZE USR 30270: LET A$ =""
110   INPUT AT 0,0; LINE B$: IF B$<>"" THEN LET A$ = A$ + B$ + CHR$ 13:
      PRINT AT 3,0; A$: GOTO VAL "110"
120   GOSUB VAL "700"
130   GOTO VAL "50"
700   LET DC = 31000: FOR Z = 1 TO LEN A$: POKE DC + Z, CODE A$(Z): NEXT Z
710   LET DC = DC + Z: POKE DC, 127
720   RETURN
1000  SAVE "Data-call " LINE 10: SAVE "M/Code" CODE 29000,1300: STOP
```

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Compiled by Arthur C Gee G2UK

It is now eighteen months or more since the 'new bands' became available for amateur use. The 10MHz allocation of 10100-10150 KHz became available on 1st January 1982, whilst allocations in the 18 MHz and 24 MHz – 18068-18168 KHz and 24890-24990 KHz – became available on 1st October 1982.

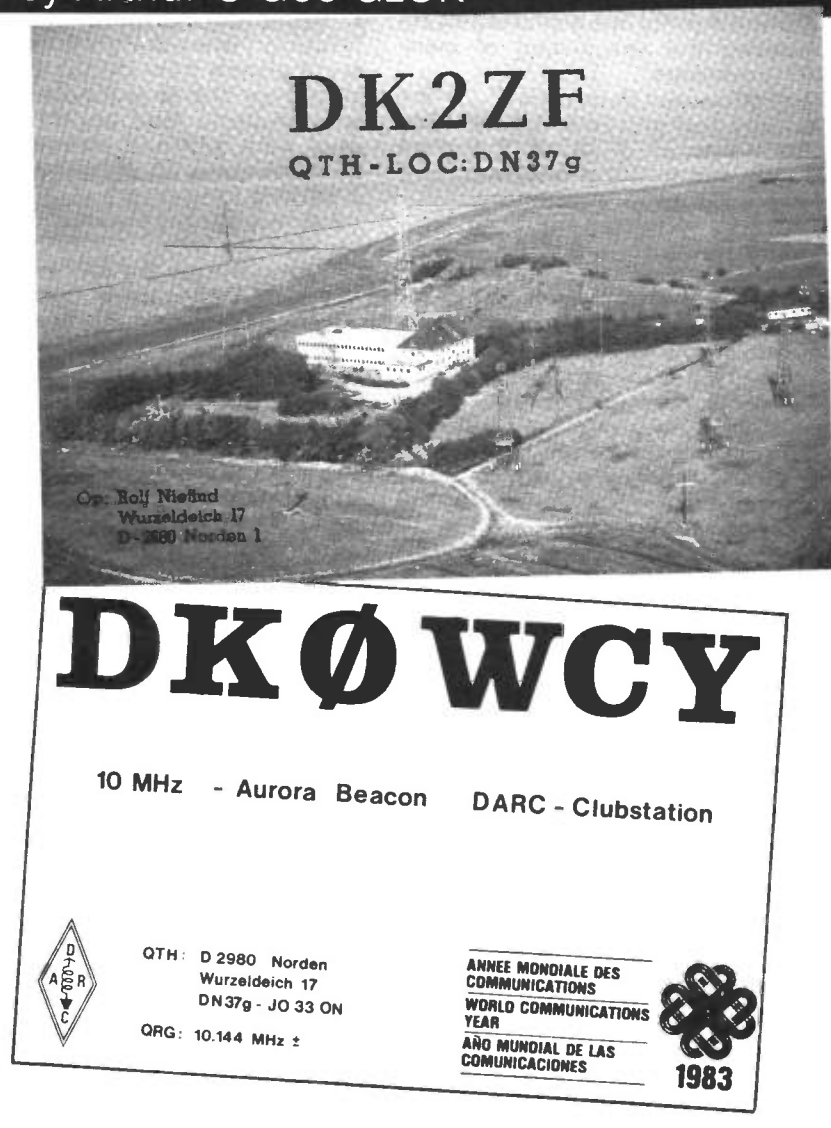
Activity on these bands has been increasing quite noticeably in recent months, particularly on 10MHz where some amateur station activity can be found at most times. Activity on 18MHz can best be described as 'sparse', whilst on 24MHz very little in the way of reports of activity has been seen.

Writing about these new allocations, Richard Baldwin in the IARU news feature in the January 1984 issue of *QST*, reminds readers of how close to failure the request for these frequency allocations came, when they were discussed at the World Administrative Radio Conference in Geneva in 1979. Not all countries at this Conference were in agreement with the proposals, by any means. However, the day was won, and these allocations went through. It was agreed that these bands, 'will remain allocated to the fixed and land mobile service, until amateur primary status is achieved, not later than 1st July 1989.'

In view of the limited width of 'new' bands and in order not to cause interference to the primary user by others it was agreed that fairly severe restrictions should be applied, particularly on 10MHz. Because of the anticipated popularity of this band, vis-a-vis the other two, use was to be restricted to CW and RTTY. Contests would not be sponsored on these bands nor would contacts be credited for awards.

Do these voluntary, mutually agreed restrictions please everyone, asks Richard Baldwin? No, naturally they do not! There is considerable pressure being brought to permit SSB and the crediting of DX contacts for the DXCC award.

But, says Richard, 'sometime in the near future another General World Administrative Radio Conference will occur and the ITU will be taking another look at the allocation table. One of IARU's goals will then be to try and get expanded privileges for 10MHz. We will be in a better position to achieve these if we have done nothing to violate the terms under which we now occupy these bands, ie, we remember we are there on a secondary basis and that we do not cause intereference to primary users'.



Two QSL cards sent to G2UK from Rolf Niefind DK2ZF, who is the keeper of the 10MHz beacon at Nordeich Radio

The 10MHz beacon at Norden, Germany, on 10144KHz is still functioning well, and is a good indicator of conditions on this band. It is installed at NORDEICH RADIO, one of the German Coastal stations. Its callsign is DK0WCY – see these notes for October 1983.

'New look' newsletter

The British Amateur Radio Teleprinter Group has just up-dated its Newsletter. It has a new name *'Datacom'*, and a new look. As their editor, Ian Wade, G3NRW, says, 'The new name was chosen because we felt that a professionally printed magazine with more than 100 pages was hardly a newsletter any more and we also needed a name which would roll off the tongue more easily and would tell the world that BARTG is about data communications. Hence the name *'Datacom'*. Ian goes on to say: 'Data communica-

tions in BARTG is just what it says – communicating data, in its widest sense, from one point to another by radio. One of the oldest forms of data is, of course, RTTY, but the Group has also been concerned for a long time with many other forms, such as ASCII, AMTOR, FAX, weather broadcasts, satellites, telemetry and so on. At one time, the word *data* was used by some to denote ASCII transmission, to distinguish it from RTTY, but this rather narrow definition has now been overtaken by the reality of computer-to-computer communcation in many different forms, with modes like Packet Radio and developments like digital repeaters stimulating the imagination of many BARTG members.'

The first issue of *Datacom* is a truly fine effort, and does great credit to Ian Wade as its editor. It is to be published quarterly, and should attract many more members to BARTG.

UOSAT 2

Can you imagine the disappointment which must have fallen upon the UOSAT 2 team? After a mamoth effort to build the satellite to meet a launch date opportunity, a faultless launch and two orbits in which perfect, strong, telemetry signals were received, they suddenly ceased on the third orbit. UOSAT was over the Pacific Ocean at the time and no obvious reason for the failure has become apparent. Since then, 'deathly silence!' There have been some reports that signals have been heard, but so far no telemetry has been recorded and the cause of the trouble cannot therefore be determined.

It looks as though another effort, similar to that needed to get UOSAT 1 off a similar 'hook' shortly after its launch, will be needed to 'bring the bird back to life.' All we can do at the moment, is to wish Martin and his team success and to express to them our sympathy in their dilemma.

Dr Martin Sweeting spent several days at the end of March at Jodrell Bank Radio Telescope using the 85 foot antenna to see if signals from UOSAT 2 could be picked up. The 85 foot antenna with a crossed-dipole feed on 145 MHz was used both within a narrow 2.5 KHz bandwidth and with a wider bandwidth of ± 100 KHz.

The receiver and the antenna was first checked out using UOSAT 1 and with radio noise from the sun and the star Cassiopia. With these test sources, everything worked well. The UOSAT 1 signal peaked to +75dB above the minimum discernable signal level and provided the best UOSAT telemetry data the team had ever heard! So if UOSAT 2 was still radiating even the weakest of beacon signals, it should have been audible. OSCAR 10 was also tracked and signals from 42.000 km right out at apogee from the 145.810MHz beacon were 55dB above noise.

UOSAT 2 was tracked on evening and morning passes but nothing could be detected that could be reliably ascribed to UOSAT 2. So it looks as though it's 'back to the drawing board', to try to come up with something else to explain UOSAT 2's demise!

Top of the class

Norfolk radio amateur Martyn Jordan was recently presented with a bronze medal for having the highest marks in the country in the City and Guilds Radio Amateurs examination. He lives at Edgefield, Lyng. Aged 34, Mr Jordan is a Norwich fireman. He puts his success down to the hard work of his tutor at the Fakenham Adult Education Centre, Mr Roger Rayner. He first became interested in radio during his schooldays at the Alderman Jex School, Norwich, which has a shortwave radio receiver. His call is G4VAO. He is a member of the Firefighters Net, an international radio club for firemen. Eight thousand students passed the test.

Chinese Amateur Radio Society

Amateur Radio is once again active in China. The Chinese Radio Sports Association has recently applied for membership of IARU.

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DATA FILE

Ray Marston takes an in-depth look at National Semiconductor's LM381/LM382/LM387 range of dual audio-preamplifier ICs

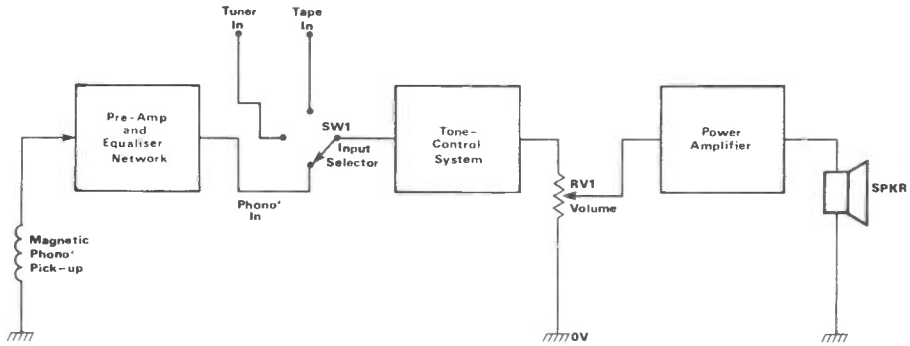


Figure 1 *Block diagram of one channel of a 'hi-fi' system*

Introduction

Each channel of a modern stereo 'hi-fi' audio system can be represented by a number of inter-connected blocks, as indicated in *Figure 1*. Here, input signals from either a radio tuner, a tape (cassette) deck, or a phono' pre-amplifier are selected via SW1 and then fed to the input of a power amplifier stage via a tone-control system and a volume control. In practice, the tone control system may include refinements such as 'scratch' and 'rumble' filters, etc.

Typically, the tone-control system needs to be driven by input signals with mean amplitudes of tens or hundreds of millivolts. Signals of suitable amplitude are usually available directly from the output of a tape or tuner unit, but not directly from the output of a magnetic phono' pick-up. In the latter case, therefore, the phono' signal must be passed to the tone-control input via a suitable pre-amplifier stage, as indicated in the diagram.

Several manufacturers produce dedicated ICs specifically intended for use in audio pre-amplifier and tone-control applications. These devices are designed to give excellent power-supply ripple rejection, low signal distortion a wide bandwidth, and a very low noise figure.

Among the best-known of such devices are the LM381/LM382/LM387 range of dual audio pre-amplifier ICs, available from National Semiconductors.

LM381/LM382/LM387 ICs

National Semiconductors produce a range of five low noise dual pre-amp ICs, these being the LM381 and LM381A, the LM382, and the LM387 and LM387A: the 'A' suffix devices are simply premium versions of their type, with superior low-noise figures. *Figures 2* to *4* show the outlines of each of these ICs, together with the actual circuit of one of the identical pair of amplifiers housed in

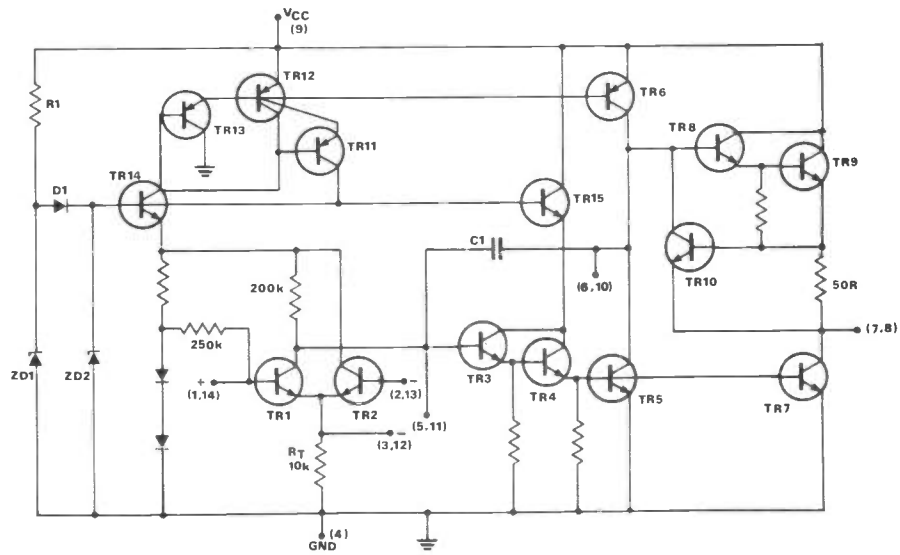


Figure 2 *Circuit of the LM381/LM381A dual low-noise preamplifier*

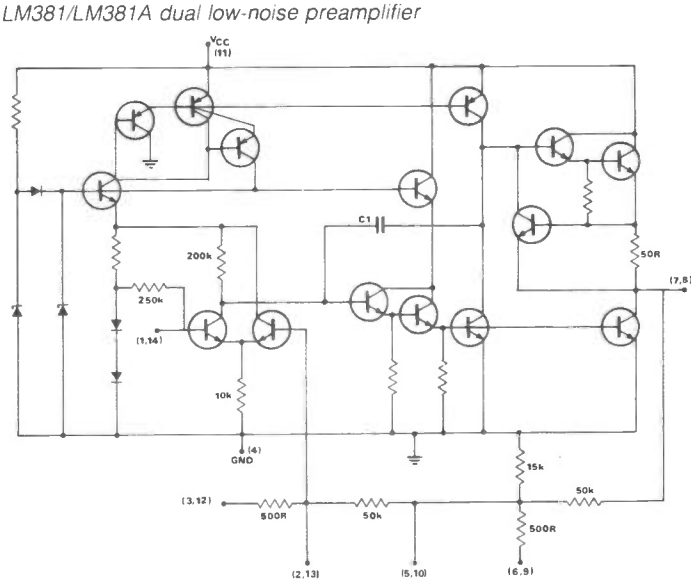


Figure 3 *Circuit of the LM382 dual low-noise preamplifier*

in each package, and *Figure 5* gives a summary of their performances.

All five of these ICs are designed to operate from single-ended power supplies. They all use the same BASIC amplifier circuitry, but differ in minor internal details and in their pin-outs. They incorporate internal compensation and comprehensive power supply decoupler, regulator circuitry, and can give large output voltage swings and a wide power bandwidth. The various ICs differ in the following respects.

The LM381 and LM381A have provision for externally optimising their noise figures and for adding external compensation (for narrow-band or low-gain applications). These ICs are normally used in the differential input configuration, but can be used in the 'single ended' input mode in ultra-low-noise applications.

The LM382 has no provision for adding external compensation or for operation in the single-ended input configuration, but has a built-in resistor matrix that enables the user to select a variety of closed-loop gain options and frequency-response characteristics.

Finally, the LM387 and LM387A are 'utility' versions of the LM381/LM381A, with only the input and output terminals of each amplifier externally accessible, and with no provision for external frequency compensation or single-ended input operation.

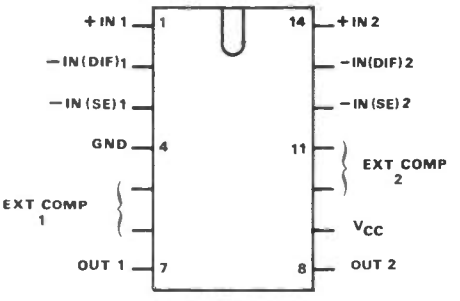


Figure 2a *Outline of LM381/LM381A*

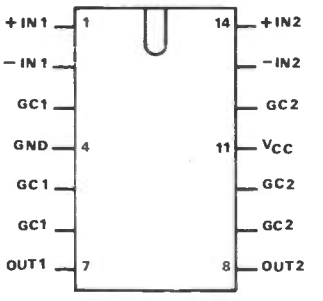


Figure 3a *Outline of LM382*

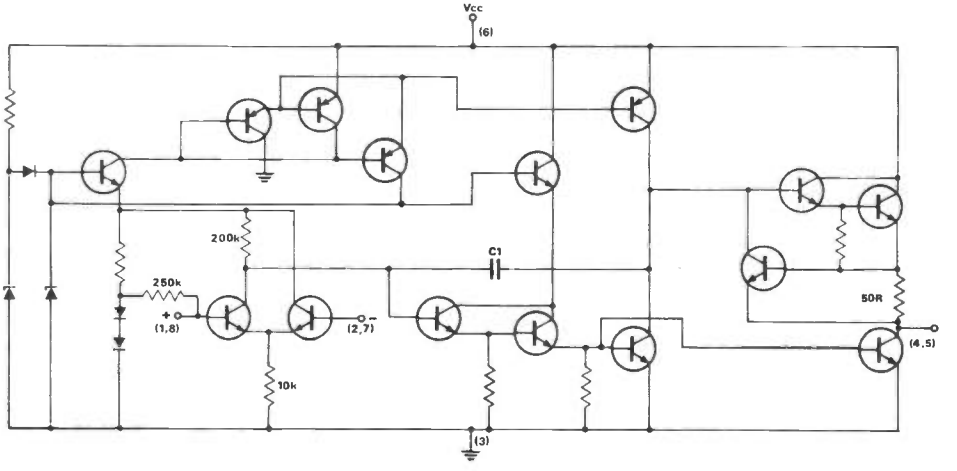
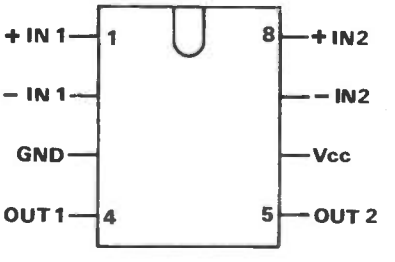


Figure 4 *Circuit and outline of the LM387-LM387A dual low-noise preamplifier*



LM381/LM381A basics

It has already been stated that the National Semicomductors range of five pre-amp ICs all use the same basic internal circuitry, but differ in minor details.

The operation of the entire range of devices can thus be understood by taking a close look at the circuitry of the LM381/LM381A shown in *Figure 2*. This circuit in fact comprises four major sections, these being a 1st-stage amplifier (Q1-Q2), a 2nd stage amplifier (Q3 to Q6), an output stage (Q7 to Q10), and a biasing network (Q11 to Q15). *Figure 6* shows a simplified 'equivalent' circuit of a complete pre-amplifier, showing its four major sections.

The Q1-Q2 1st-stage input amplifier of the IC is powered via the internal biasing network, and has a biasing potential of 1.2V permanently applied to Q1 base via a 250k series resistor. This 1st-stage can be operated as either a differential or a single-ended amplifier (a differential stage generates 41% more noise than a single-ended stage).

When used in the differential mode, the Q1-Q2 amplifier must be 'balanced' by feeding 1.2V to Q2 base via an external biasing network connected as shown. When used in the ultra-low-noise single-ended mode, Q2 must be turned off by grounding its base, and Q1 must be 'balanced' by feeding 0.6V to Q2 emitter via the external biasing network. This 1st-stage amplifier gives a voltage gain of x80 when used in the differential mode, or x160 in the single-ended mode.

	LM381	LM381A	LM382	LM387	LM387A
V Supply	9V – 40V	9V – 40V	9V – 40V	9V – 30V	9V – 40V
I Quiescent (Typ)	10mA	10mA	10mA	10mA	10mA
Power Bandwidth (20V P-P)	75KHz	75KHz	75KHz	75KHz	75KHz
Supply Rejection Ratio at 1KHz (Typ)	120dB	120dB	120dB	110dB	110dB
Equivalent noise input Figure, μV RMS Typ	0.5	0.5	0.8	0.8	0.65
Equivalent noise input Figure, μV RMS Max	1.0	0.7	1.2	1.2	0.9

Fig 5. *Performance characteristics of the five dual pre-amplifier ICs.*

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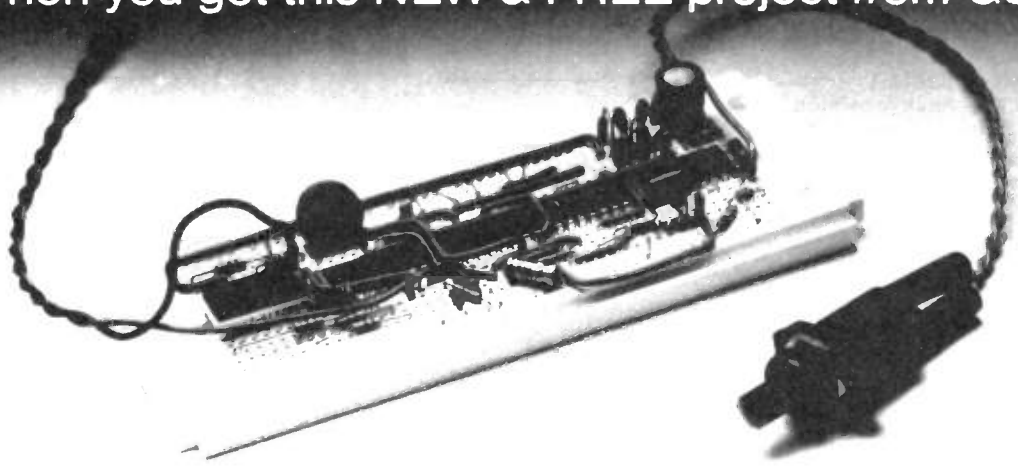

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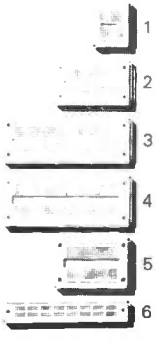

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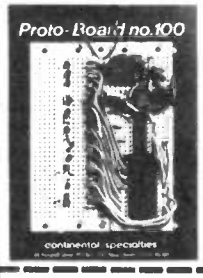

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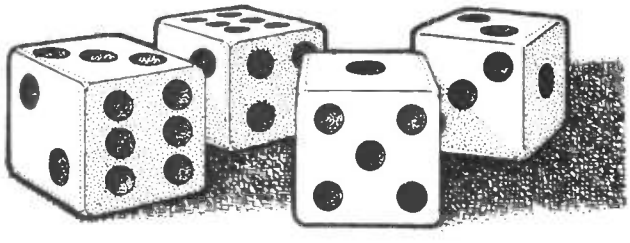

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The 2nd-stage amplifier comprises common emitter stage Q5 (with constant-current load Q6), which is driven from the output of Q1 via Darlington emitter follower Q3-Q4. This 2nd-stage amplifier gives an overall voltage gain of about 2000, and is internally compensated via C1 to give unity gain at 15MHz. This compensation provides stability at closed-loop gains of x10 or greater. At lower gains, an external capacitor can be wired in parallel with C1 to provide suitable compensation.

The output stage of the amplifier comprises Darlington emitter follower Q8-Q9, which is provided with an active current sink via Q7. Transistor Q10 provides short-circuit protection by limiting the output current to 12mA.

The biasing network of the amplifier is designed to give a very high supply-signal rejection ratio (120dB), and consists essentially of very-high-impedance constant-current generator Q11-Q12-Q13, which is used to generate a ripple-free reference voltage across ZD2. This reference voltage is then used to power the first two stages of the amplifier via Q14 and Q15, and to provide internal biasing to Q1 base.

Differential operation

The LM381 or LM381A IC can be operated in either the differential-input or the single-ended-input modes. Differential-input operation is suitable for use in all general-purpose applications in which a 'good' low-noise performance is required. Single-ended-input operation is recommended for use only in applications where an ultra-low-noise performance is needed.

To use a LM381 or LM381A pre-amp in the differential-input mode, the IC must first be biased so that its output takes up a positive quiescent value that is independent of variations in supply voltage, and this can be achieved by connecting potential-divider R1-R2 between the output and the non-inverting input of the IC as shown in *Figure 7* , thus forming a dc negative-feedback loop. The inverting input terminal of the IC (Q1 base, in *Figure 6*) is internally biased at roughly 1V2 above zero: consequently, when R1 and R2 are connected as shown in *Figure 7* , dc negative feedback causes the non-inverting input terminal to take up a value equal to that of the inverting terminal (1V2). The amplifier output therefore attains a dc value of 1V2 x (R1+R2)/R2, and can be set at any desired value by suitable choice of R1/R2 ratio. In practice, R2 should have a value less than 250K.

The *Figure 7* circuit can be made to act as a non-inverting ac-amplifier by simply ac-coupling the input signal to the non-inverting input terminal of the amplifier. In this configuration the circuit has an input impedance of about 250K: input signals must be limited to 300 mV rms maximum, to avoid excessive distortion.

The dc voltage gain of the above

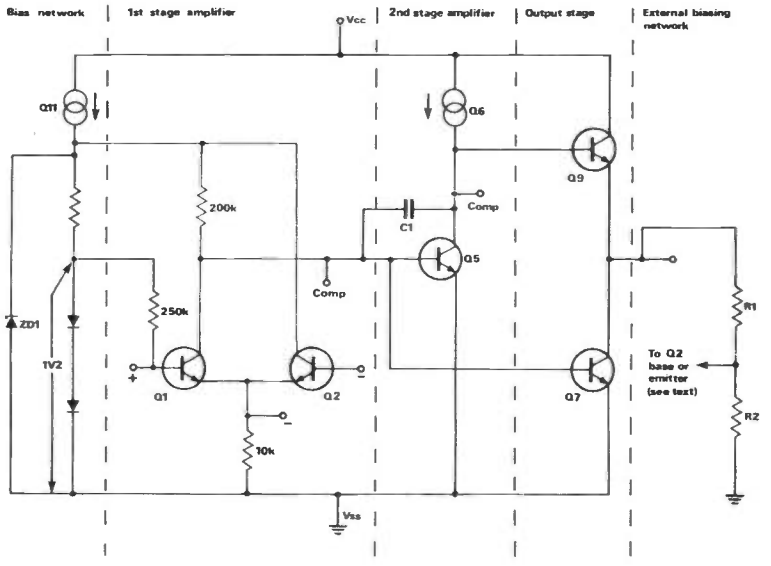


Figure 6 *Equivalent circuit of the LM381/LM381A amplifier*

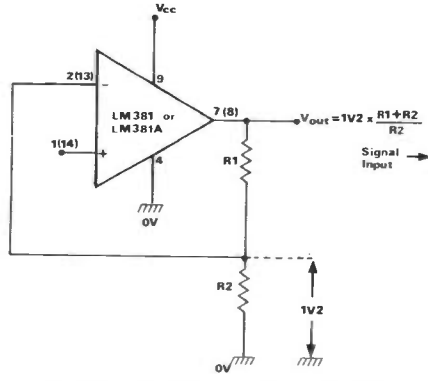


Figure 7 *Differential biasing of the LM381 or LM381A*

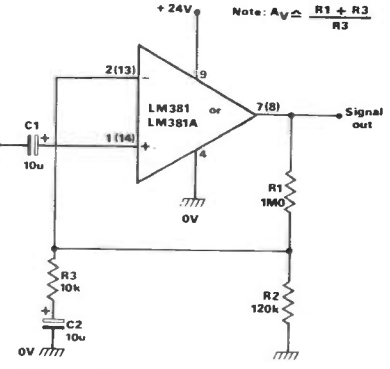


Figure 8 *Low-noise x100 non-inverting amplifier*

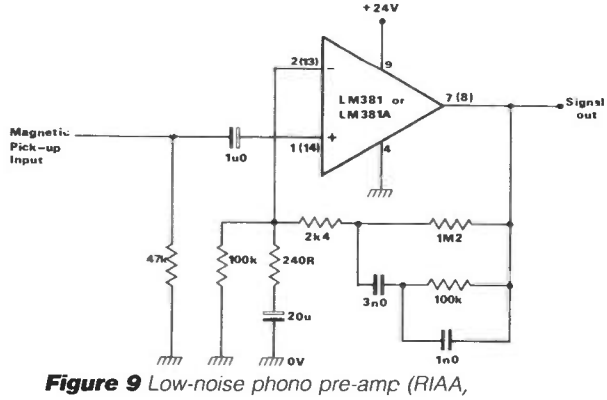


Figure 9 *Low-noise phono pre-amp (RIAA,*

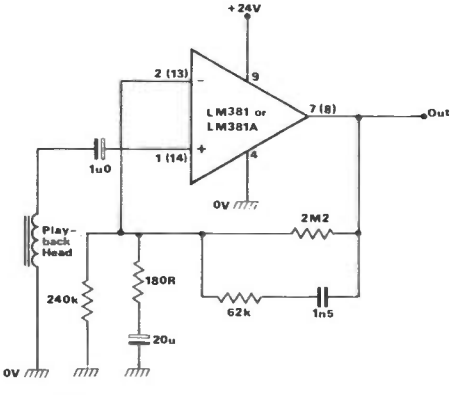


Figure 10 *Low-noise tape playback amplifier (NAB)*

circuit is determined by R1 and R2. If the desired ac-gain differs from the dc-value, the desired ac-gain can be obtained by ac-shunting one or other of the bias-network resistors. *Figure 8* for example, shows the circuit of a low-noise x100 non-inverting amplifier. In this case the dc-gain is determined by R1 and R2 and is less than x10, but the ac-gain is determined mainly by R1 and R3, and approximates x100.

The above 'shunting' technique can easily be expanded to provide frequency-dependent ac-gain in various 'filter' applications. *Figure 9* for example, shows the circuit of a low-noise phono' pre-amp with RIAA equalisation, and *Fig 10* shows a tape playback.

The *Figure 7* circuit can be made to act as an inverting ac-amplifier by simply ac-grounding the non-inverting terminal and feeding the input signal to the inverting terminal via a gain-determining resistor, as shown in *Figure 11* . Here, bias resistors R2 and R3 give a dc-gain of roughly x10, and thus set the quiescent output at +12V. The ac-gain, however, is determined by the R3/R1 ratio, and has a value of x10 in this example: the input impedance roughly equals the value of R1. Finally, *Figure 12* shows how the above circuit can be made to act as a unity-gain 4-input audio mixer by simply providing each of the four input channels with its own series-input resistor.

Figure 11 *Low-distortion (<.05) x10 inverting amplifier*

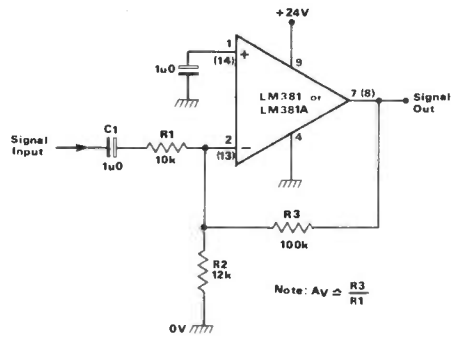
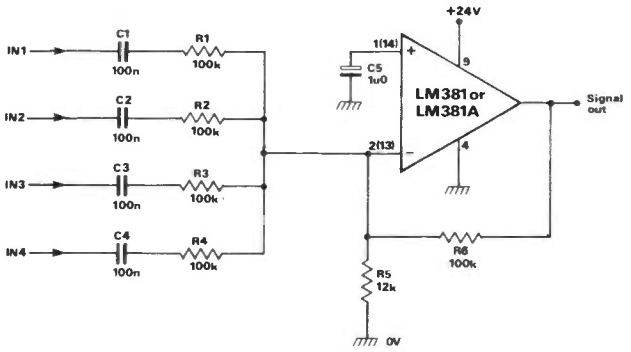


Figure 12 *4-input unity-gain audio mixer*



Single-ended operation

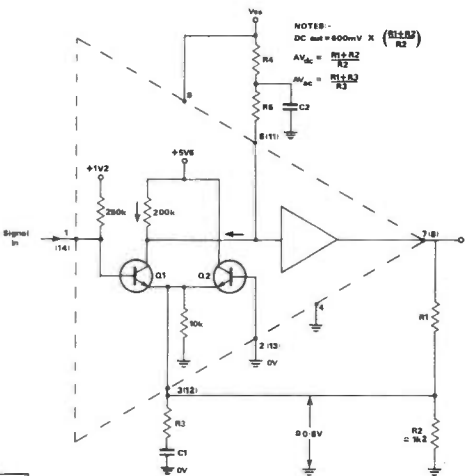
The LM381A can be operated in the single-ended input mode in applications where an ultra-low-noise performance is needed. This mode can be understood with the aid of *Figure 13,* which shows (within the dotted lines) a simplified representation of the IC, together with external biasing components, etc.

In *Figure 13,* the Q1-Q2 differential '1st-stage' amplifier is shown powered via the internal 5V6 regulator, and has its Q1-collector signal fed to the output via a dc-amplifier. The IC can be connected into the basic 'single-ended' configuration by simply grounding the base of Q2 as shown, thereby disabling Q2. Note in athis case, however, that the circuit can no longer be dc-biased via Q2 base, so biasing must be achieved by using feedback to Q2 emitter.

Suitable dc-biasing can be obtained by connecting potential divider R1-R2 as shown, so that roughly 600mV is developed across R2 when the IC output is at the desired dc-voltage level. Thus, if a quiescent output of +12V is needed, R1 and R2 must give a dc-voltage gain of x20. R2 can, if desired, be shunted by R3-C1, to give an ac-voltage gain that is greater than the dc value.

Note in the above biasing circuit that R2 is in fact wired in parallel with the internal 10K emitter resistor of Q1, and thus causes the emitter and collector 'current density levels' of Q1 to increase above their normal values of about 15uA. In practice, however, it can be shown that the noise generation of Q1 varies with collector current density, and is mini-

Figure 13 *LM381A with external components for single-ended varied-current-density operation*



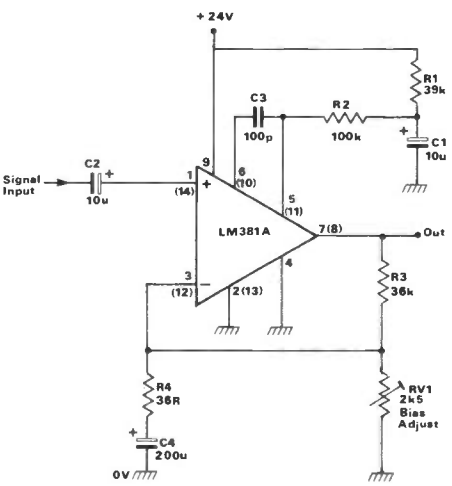


Figure 14 *Ultra-low-noise x1000 pre-amplifier*

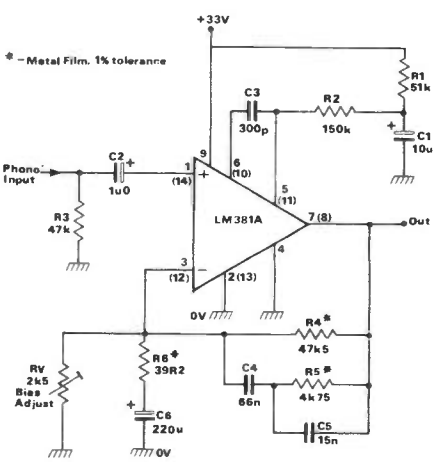
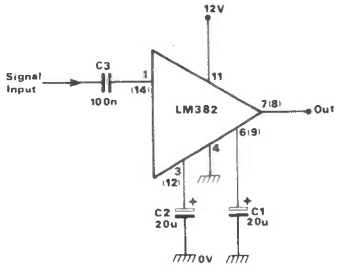


Figure 15 *Ultra-low-noise magnetic phono' pre-amp with RIAA equalisation*

mum at a density of about 170uA. Consequently, the circuit generates minimum noise when R2 has a value of about 1K2. To prevent Q1 collector from saturating at this current level, the internal 200K collector resistor of Q1 must be by-passed and the major part of the current provided via external load resistors R4-R5, which are decoupled via C2.

The *Figure 13* 'single-ended' circuit is intended for use as a non-inverting amplifier only, and has a typical input impedance of about 10K. Ideally, input signals to the circuit should have source impedances below 2K0, and all resistors should be low-noise metal-film types. *Figures 14* and *15* show a pair of practical versions of the ultra-low-noise circuit. *Figure 14* is a x1000 amplifier, and *Figure 15* is a magnetic-phono' pre-amplifier with RIAA equalisation. In both cases, RV1 is used to set the dc output voltage at half-supply value. In *Figure 14*, C3 is used to limit the upper 3dB point of the frequency curve to 10KHz.



GAIN	REQUIRED CAPACITOR
40dB	C1 only
55dB	C2 only
80dB	C1 and C2

Figure 16 *LM382 used as a fixed-gain non-inverting amplifier with a 12-volt power supply*

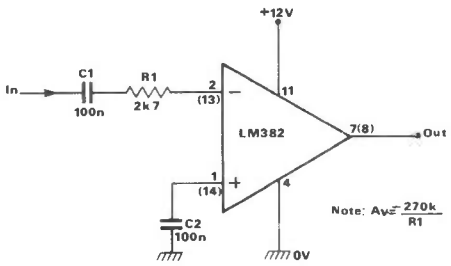


Figure 17 *40dB inverting amplifier*

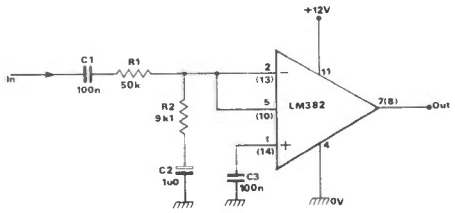


Figure 18 *Unity-gain inverting amplifier*

LM382 circuits

The internal circuitry of each half of the LM382 is identical to that of the LM381, except that the addition of a 5-resistor matrix and the elimination of certain terminals means that this IC cannot be used in the 'single-ended' input mode and has no facility for external compensation; but the addition of the resistor matrix means that bias- and filter-network design can be greatly simplified. It should be noted that this matrix is specifically intended for use in applications in which the IC is powered from a 12V supply.

Figures 16 to *19* show various ways of using the LM382 with a 12V supply. *Figure 16* shows how to use the IC as a non-inverting amplifier with an ac-gain of 40, 55 or 80dB. *Figure 17* shows the circuit of an inverting amplifier with a gain of 40dB, and *Figure 18* shows a unity-gain inverting amplifier. Finally, *Figure 19* shows a phono' pre-amp with RIAA equalisation.

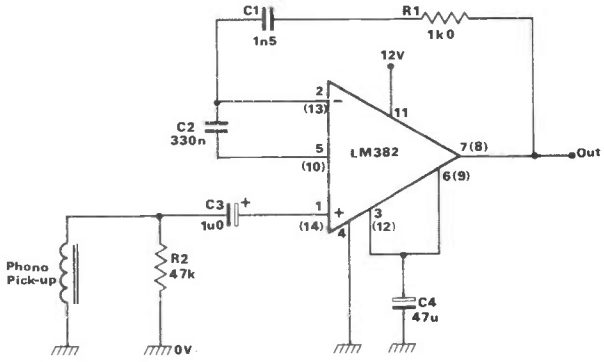


Figure 19 *Phono pre-amp (RIAA)*

LM387 circuits

The internal circuitry of each half of the LM387/387A is identical to that of the LM381, except for the elimination of certain terminal connections. The elimination of these terminals means that the IC can only be used in the 'differential' input mode, without external compensation. The IC is, nevertheless, quite versatile, and *Figures 20* to *26* show some practical applications of the LM387 (or LM387A) IC.

Figure 20 shows how to connect the IC as a non-inverting amplifier with an ac-gain of 52dB. The dc-gain (and thus the quiescent output voltage) is determined by R1 and R2, and the ac-gain is determined by R1 and R3. *Figure 21* shows how to modify the circuit for use as a phone pre-amp with RIAA equalisation, and *Figure 22* shows how to modify it for use as a NAB tape playback amplifier.

Figures 23 to *26* show various ways of

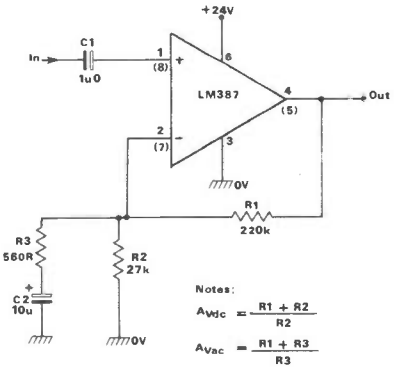


Figure 20 *LM387 non-inverting ac amplifier with a gain of 52 dB*

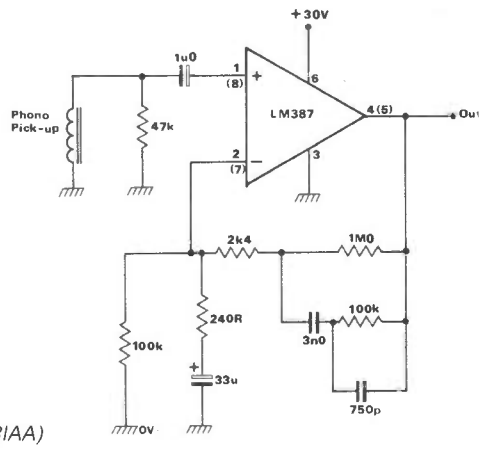


Figure 21 *LM387 phono pre-amp (RIAA)*

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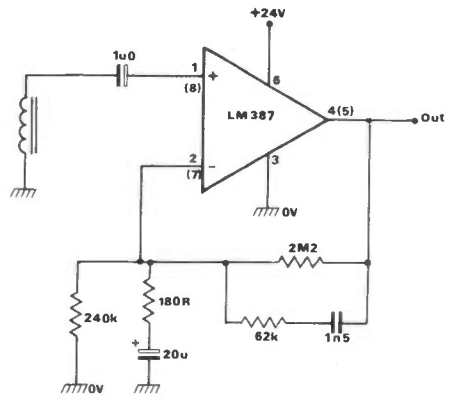

Figure 22 *LM387 tape playback amplifier (NAB)*

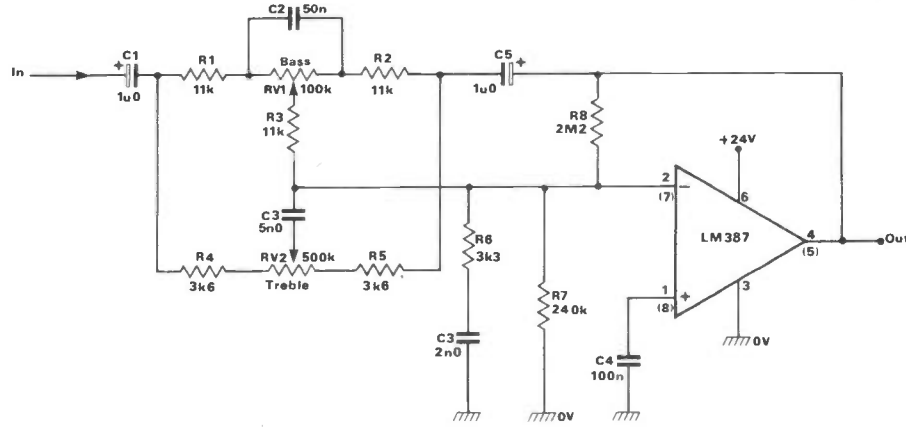

Figure 23 *LM387 active tone-control circuit*

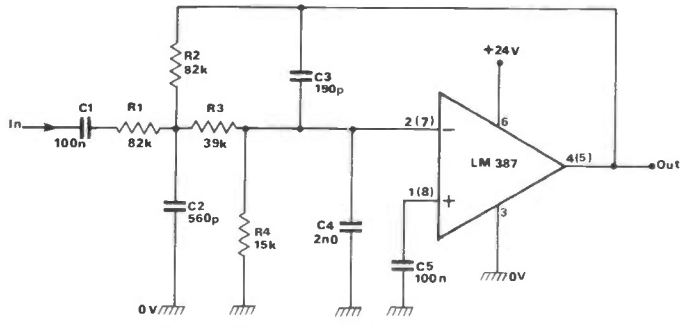

Figure 24 *Rumble filter*

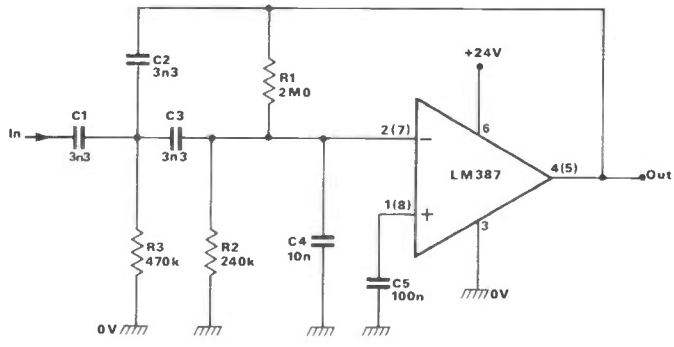

Figure 25 *Scratch filter*

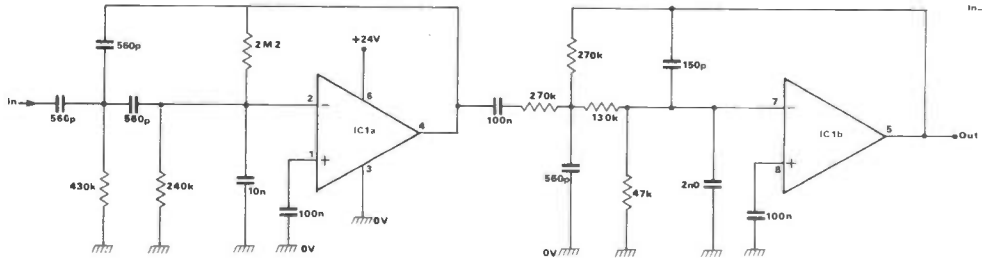

Figure 26 *Speech (300Hz – 3 KHz) filter*

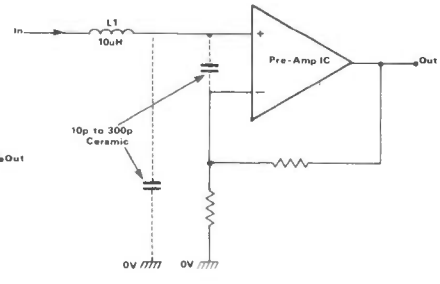

Figure 27 *RF pick-up elimination circuitry*

various ways of using the LM387 in the inverting-amplifier mode in active filter applications. The *Figure 23* circuit is that of an active tone-control that gives unity gain with its controls in the 'flat' position, or 20dB of boost or rejection with the controls fully rotated.

The 'rumble' filter of *Figure 24* is actually a 2nd-order high-pass active filter that rejects signals below 50Hz and does so with a slope of 12dB/octave. The 'scratch' filter of *Figure 25* is a 2nd-order low-pass filter that rejects signals above 10KHz. Finally, the 'speech' filter of *Figure 26* consists of a 2nd-order high-pass and a 2nd-order low-pass filter wired in series, to give 12dB/octave rejection to signals below 300Hz or above 3KHz.

Usage hints

In this article we've looked at various circuits based on the LM381/LM382/LM387 range of ICs. These ICs are, however, high-gain, wide-band devices, and in practice, some care must consequently be taken in the construction of these circuits if they are to work correctly. The two most-frequently encountered problems are those of RF-instability, and RF 'pick-up'.

The RF-instability problem is usually caused by inadequate high-frequency power supply decoupling: note that in ALL pre-amp circuits the power supply to the IC must be RF-decoupled by wiring a 100n ceramic or 1n0 tantalum capacitor directly across the power supply pins of the IC.

The RF 'pick-up' problem manifests itself in the pick-up and demodulation of AM broadcast signals. This problem can usually be eliminated by wiring a 10uH RF choke in series with the IC input terminal, and perhaps by also decoupling the input terminal (or terminals) with a low-value capacitor, as shown in *Figure 27*.

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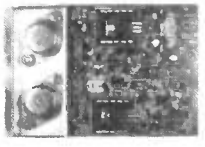

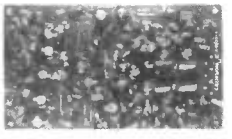

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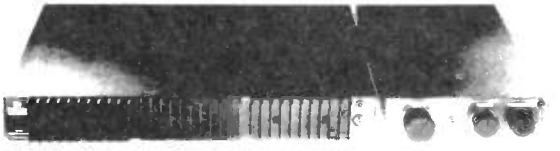

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NOTES FROM THE PAST

Comments on the world of radio originally written 25 years ago

This veteran can recall the days in the early 1920's, when, mains electricity was not widely available when it did arrive it was by means of rather unsightly wooden poles and overhead wires.

Another Old Timer, ET, has written: 'Since last year I have retired down here in remote North Cornwall where we are still without electricity supply. It's almost like the good old days, except that modern dry batteries are reasonably reliable and present-day valves are so economical in their current demands.'

Ninety-five per cent of the real Old Timers will well remember being without mains. They were still a great rarity in private houses at the conclusion of World War 1 – and for a good few years after.

We had only bright emitters taking 4 or 6 volts at not less than one amp apiece, and you can guess what they did to the clumsy and crude accumulators of that period. It was not the chief worry that they lasted only one evening or so between charging.

Few and far

The worst problem was hauling them to the nearest charging station, and these were few and far between.

Some of the more enterprising motor garages had a 'Charging Board', and it made a real hole in my limited pocket-money – which I found equally as hurtful as having to haul the darn things backwards and forwards.

Radio enthusiasts were easily identifiable by the acid burns on their jackets and, indeed, when one went to visit friends one invariably looked around to see how many more holes had been burned in their living-room carpet. Distracted housewives spent much time and ingenuity searching out matching rugs, etc, to cover the gaping scars.

For myself, I had to haul my batteries nearly a mile to get them recharged and, although still only a schoolboy, the waste of time and energy irked me sorely. The avoidance of tiresome jobs always stimulates my imagination, so I invented what was many years later to re-appear as the wheeled shopping-stick. This consisted of a stout walking cane, two 6in pram wheels and a box platform designed to keep the battery upright when held at the transit angle. Perhaps in those more leisurely days most groceries, etc, were delivered. Anyway, nobody copied my 'invention' for shopping purposes.

However, twenty-five years later, when I came back from World War II and everyone had to fetch and carry, I found half the housewives in the country busily tripping each other up with their wheeled shopping-sticks.

Down our way

Eventually the electric mains came right to the end of the road in the select South London suburb in which we then lived. It was the real stuff, too. 200 volts AC. Adjacent districts which had been wired some years earlier were of supposedly 'safe' voltages of 35 or 50 volts DC or some other queer figure. I was so excited that I shot round to the Electric Company's office without even asking my parent's permission. Oh, yes, they would bring it to our front door for a mere £35, after which we would have to get an approved contractor to wire the house. I used all my schoolboy eloquence on Dad and Mum to take advantage of this modern blessing. I even argued that we should not wait for the neighbours to have it first. Let the Jones's keep up with us! Whether that argument carried any weight I don't know, but at last Dad decided to have it laid on to the ground floor only, 'to start with'.

While no one had yet seriously considered mains-operated sets I had long since dreamed of battery charging; and to my joy, in addition to having it installed on the ground floor, we also had a lighting point put in our rather large cellar. There were, of course, no metal rectifiers available at that time and as the mains were AC, I got busy collecting jam jars, chemicals and bits of metal to try my hand at chemical charging. I couldn't find out much about it, and it seemed that nobody else knew much either, but such minor considerations did not deter me.

I had everything two or three days later in readiness, and the big moment to switch on arrived. No explosions – just a few gentle bubbles, and off I went to school.

Now, I had never known Mother to go in that cellar before, but for some extraordinary reason she decided to go down there that very morning. She was horror-stricken at the sight of my jam jars bubbling away merrily. Indeed, according to her version they were boiling and seething like a witch's cauldron, and she was convinced the house would be going sky-high at any moment.

She rushed off the fetch Dad, and by the time she got there she also claimed she saw sparks dancing up and down the wires. So convincing was her story that apparently he dared not go too near it, and finally contented himself with switching off at the mains.

Of course, there was a terrible row and I was forbidden to carry out any more experiments with chemical charging, hence I have had less experience of this than any other branch of old-time radio acivity. I might add that I spent several more years trundling my wheeled stick backwards and forwards – a most humiliating experience for a bright, proud youth whose family actually had their own electricity supply right to the house!

Two-way traffic

It is curious how slowly wrong ideas die. Years ago there was a belief that crystal sets gave a 'purer' tone than valve sets. I suppose it was the association of ideas. A crystal set must obviously be crystal clear! There are still many people who believe that the two aerial sockets at the back of their TV receivers are one for the picture and the other for the sound. To one such believer who I met this week I remarked it was amazing that the signals knew which hole to go in! At first he agreed that it was quite as remarkable as TV itself, but after a little reflection he said he thought it was probable that something inside the set 'draws' the respective signals into the appropriate holes. Which only goes to show that you can think of an explanation for anything if you ponder on it long enough. However, it is better to get to the truth of the matter and the radio amateur is well served in this by membership of the Radio Society of Great Britain (RSGB).

RSGB

The following short comment on support for the Radio Society of Great Britain is as apt today as when it was written twenty-five years ago. This is essentially a democratic body and is, in its major principles, truly representative of a world-wide movement. It has much good service to the hobby both at home and in Europe to its credit. The youthful amateur to-day has a lot to thank it for, and he should do everything in his power to strengthen its position. The Society represents his sheet-anchor in the maintenance of national goodwill, and may yet be his sole safeguard against possible future curtailment of his privileges by an autocratic officialdom.

MC1648 (SL1648)
Voltage Controlled Oscillator

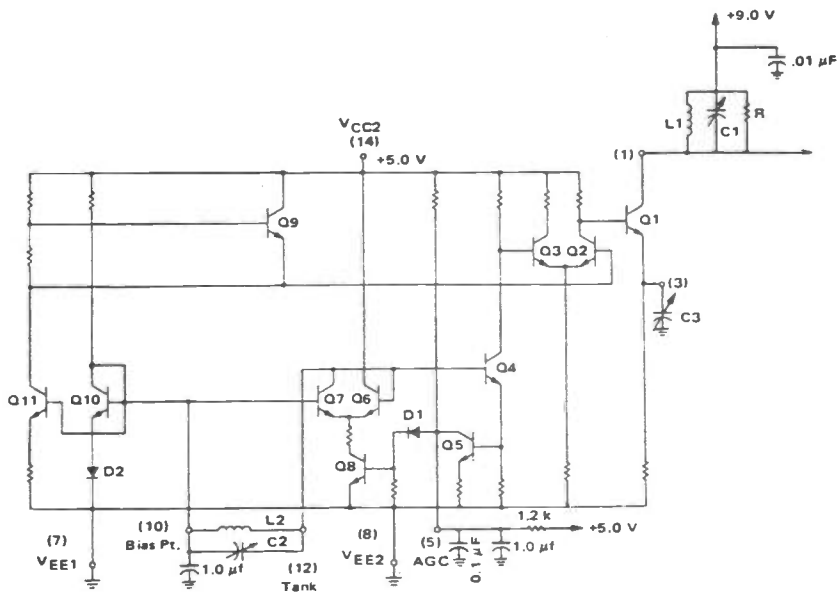
The term 'VCO' is in fact a small misnomer, since the MC1648 is only the active part of the circuit - the tank coil and the tuning varactor are outside, and can be user-designed to operate anywhere in the range from virtually DC to 150MHz.

Why this instead of a familiar one transistor oscillator? The answer is simple - the tank circuit is essentially a two-terminal circuit, with the minimum of circuit strays, enabling the maximum possible tuning range to be achieved.

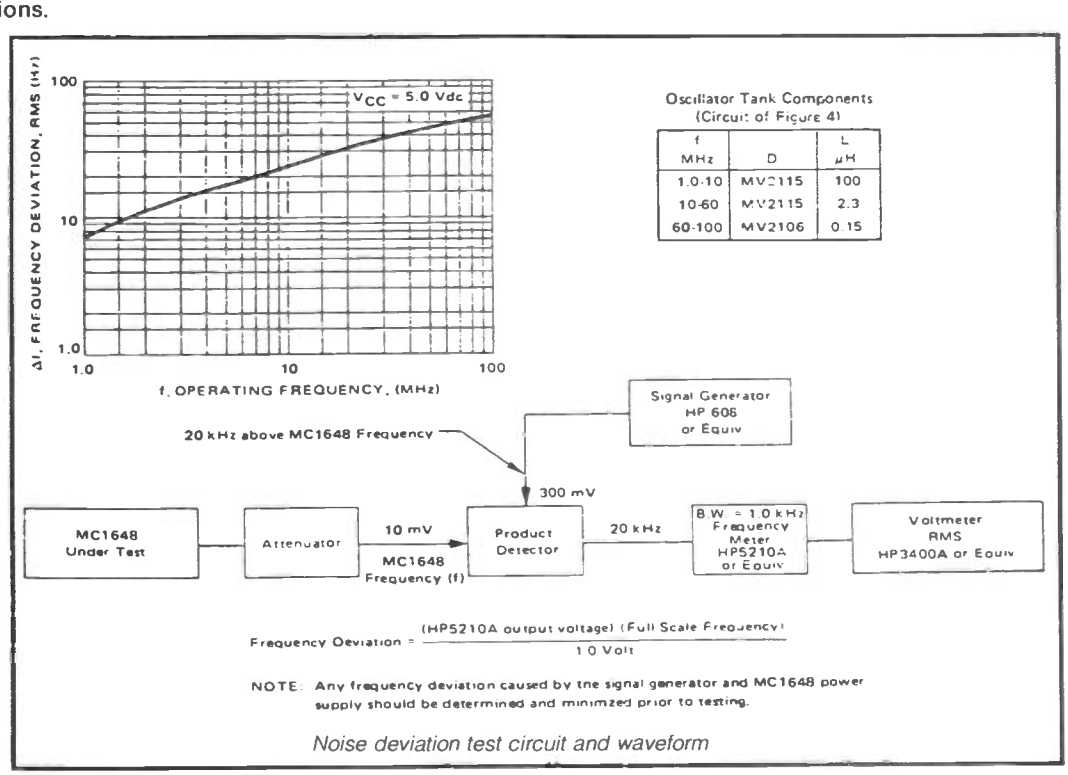
Q6 and Q7 form a positive feedback pair like many now found in one-chip AM radio ICs, with AGC in a feedback loop to provide a stable output level and obtain maximum frequency response. Q4 isolates the oscillator pair from the loading effects of the output driver stage and to feed the AGC stage formed around Q5.

The device is primarily aimed at the synthesiser designer - the circuit illustrated here shows the MV1401 - although these days the TOKO KV series offer better value for money and a wider choice of applications and frequency ranges.

The MC1648 is also well suited to applications in instrumentation - particularly as a result of the AGC and buffered output, and the simplicity of single point range switching. The low noise characteristics also score when the output of the device is mixed with a crystal oscillator in wide ranging mixer generator applications.

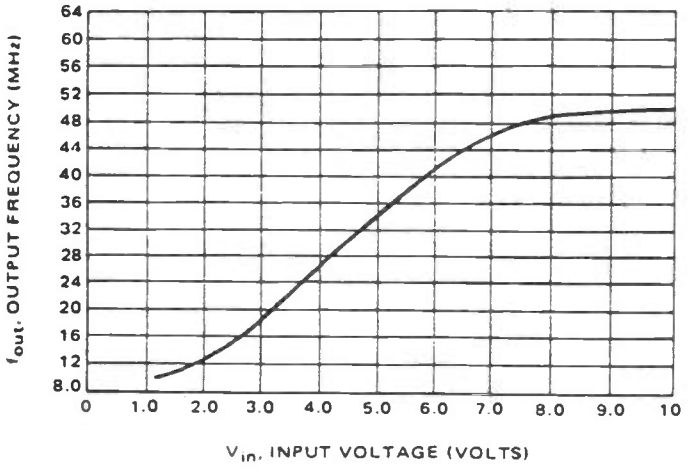


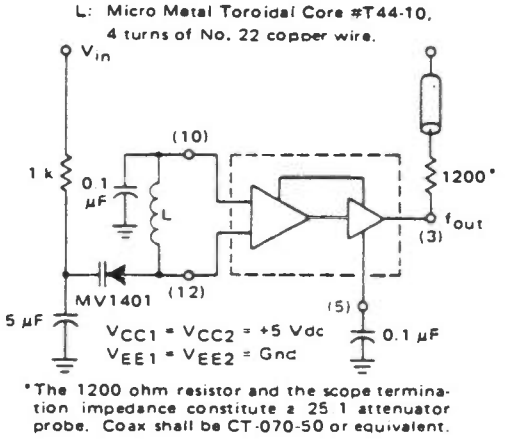
Circuit schematic used for collector output operation



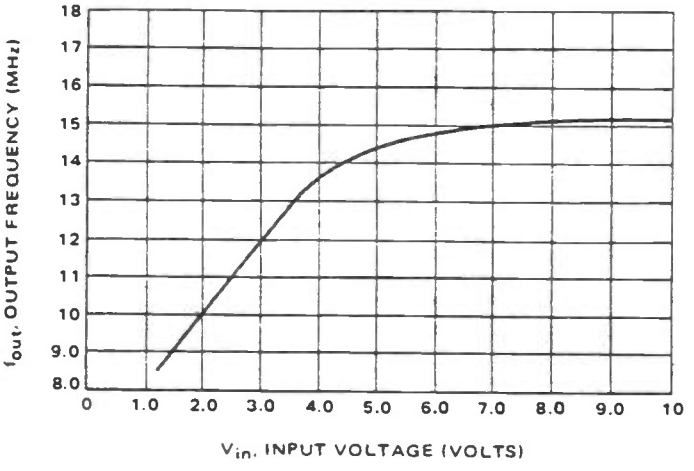
Noise deviation test circuit and waveform

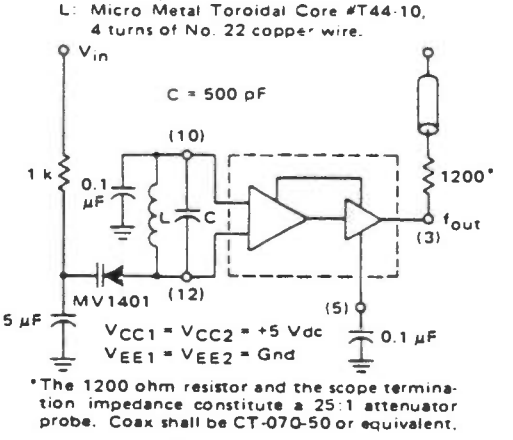
TRANSFER CHARACTERISTICS IN THE VOLTAGE CONTROLLED MODE USING EXTERNAL VARACTOR DIODE AND COIL. $T_A = 25^oC$



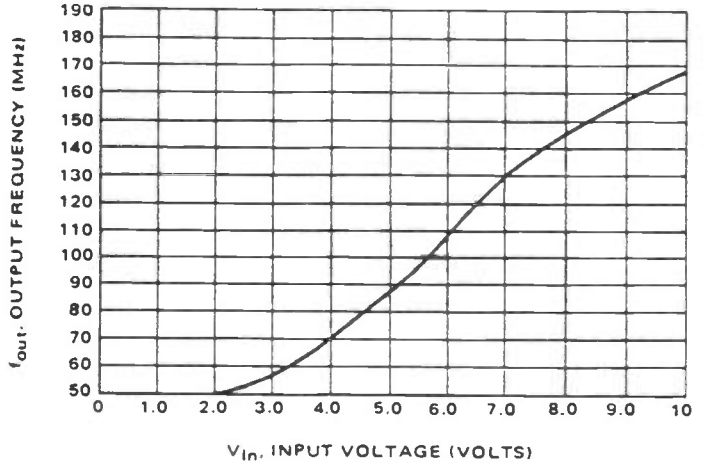


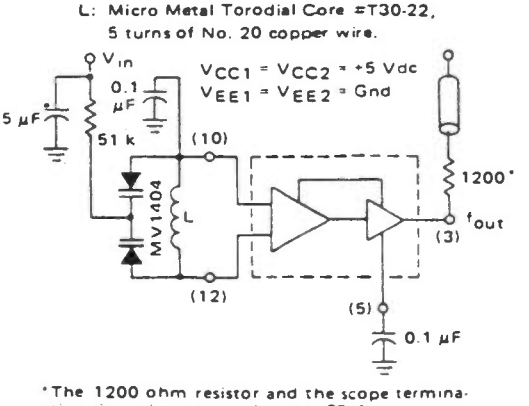
*The 1200 ohm resistor and the scope termination impedance constitute a 25:1 attenuator probe. Coax shall be CT-070-50 or equivalent.





*The 1200 ohm resistor and the scope termination impedance constitute a 25:1 attenuator probe. Coax shall be CT-070-50 or equivalent.





*The 1200 ohm resistor and the scope termination impedance constitute a 25:1 attenuator probe. Coax shall be CT-070-50 or equivalent.

What price

HF Equipment		
IC-751	All band AM FM SSB CW - Gen Cov Rx 32 Memories	1049 00
PS35	Internal switched mode power supply	149 00
SM6	Desk microphone	34 50
HM12	Hand microphone with up down scanning	16 50
EX310	Voice synthesizer module	39 00
RC10	Frequency controller unit	29 95
CR64	High stability xtal unit	49 95
FL32	9MHz CW RTTY filter 500Hz	39 00
FL63	9MHz CW RTTY narrow filter 250Hz	39 00
FL33	9MHz AM filter 6KHz	32.50
FL70	9MHz SSB wide filter 2 8KHz	35 50
FL52a	455KHz CW RTTY filter 500Hz	79 00
FL53a	455KHz CW RTTY narrow filter 250Hz	79 00
IC-745	All band SSB CW AM(Rx only) Gen Cov Rx 16 mems	839 00
PS35	Internal switched mode power supply	149 00
SM6	Desk microphone	34 50
HM12	Hand microphone with up down scanning	16 50
EX310	Voice synthesizer unit	39 00
EX242	FM unit Tx & Rx	32 50
EX241	Marker unit	15 95
EX243	Curtis keyer unit	39 00
FL45	9MHz CW filter 500Hz	45 00
FL44a	455KHz SSB narrow filter 2 4KHz	79 00
FL52a	455KHz CW RTTY filter 500Hz	79 00
FL53a	455KHz CW RTTY narrow filter 250Hz	79 00
FL54	9MHz CW RTTY narrow filter 270Hz	39 00
IC-740	No longer available Accs still in stock	
PS740	Internal switched mode power supply	149 00
SM5	Desk microphone	34 50
EX241	Marker unit	15 95
EX242	FM unit	32 50
EX243	Curtis keyer	39 00
FL44	455KHz SSB filter 2 4KHz	79 00
FL45	9MHz filter 500Hz	45 00
FL52	455KHz CW RTTY filter 500Hz	79 00
FL53	455KHz CW RTTY narrow filter 250Hz	79 00
FL54	9MHz CW RTTY narrow filter 270Hz	39 00
IC-730	10 80 Mtrs compact transceiver	659 00
PS15	External power supply 20amps	119 00
PS20	External power supply with speaker 20 amps	176 00
SM5	Desk microphone	34 50
HM7	Hand microphone with pre amp	14 95
EX202	LDA unit for use with AT100 500	13 50
EX203	CW audio filter	14 50
EX205	Transvertor unit	14.00
EX195	Marker unit	17 00
FL44	455KHz SSB filter 2.4KHz	79.00
FL45	9MHz CW filter 500Hz	45.00
FM04	FM unit Tx & Rx	49 00
IC-720A	No longer available. Accs still available.	
PS15	External power supply - 20 amps	119 00
PS20	External power supply with speaker 20 amp	176.00
CF1	Cooling fan for PS20	24.00
SM5	Desk microphone	34.50
FL32	CW narrow filter	39 00
FL34	AM xtal filter	34 00
BC10	Memory back up unit	5 95
FM03	FM unit Tx & Rx	89.00
IC-R70	General Coverage Receiver 0.1 -30MHz	549 00
EX257	FM unit	32.50
FL63	CW narrow filter	39.00
FL44a	455KHz SSB filter	79.00
CK70	DC cable kit	5 75
7072	Interface unit to transceive with IC720A	97.50
IC-R71	All mode Gen Cov Rx, k'pad entry. 32 memories	649.00
RC11	Remote control unit for above	49.00
IC-2KL	1KW PEP Linear, auto band switching, complete with –	
2KLPS	Power supply to run 2KL linear	1303.33
IC-AT100	100Watt Automatic antenna tuner	269.00
IC-AT500	500Watt Automatic antenna tuner	369.00
IC-PS30	Systems power supply, 25 amps continuous	229.00
IC-AH1	Mobile antenna, 3.5MHz–30MHz	199.00
VHF Equipment		
IC-271E	Multimode base station, 25w 32 memories	629.00
IC-271H/E	High power version of above, 100w	789 00
PS25	Internal switched mode power supply	89.00
EX310	Speech synthesizer unit	39.00
AG20	Internal receive pre-amp	49.00
SM6	Desk microphone	34.50
IC-290D	25W Multimode mobile, 5 memories, scanning mic	469.00
IC-27E	25W FM mobile, 9 memories, multi function display	319.00
UT16	Voice synthesizer unit	25 00
IC-25H	45W FM mobile, high power version of old IC25E	359 00
BU1	Memory back up unit for mobiles	24 50
	DC leads (flat pin or square 6 pin)	4 50
	DC Plugs (flat 4 pin)	30
	DC Sockets (flat 4 pin)	30
IC-2E	Synthesized hand portable, 1 5 watts	169 00
IC-O2E	Synthesized hand held keypad entry LCD display	229 00
ML1	10 watt booster unit for 2E	69 00
BP3	Standard battery pack	25 00
BP2	Low volts high capacity (long life)	38 00
VP4	Empty battery pack takes 6 x AA size cells	7 95
BP5	High volts high capacity (high power)	48 00
BP7	High volts high capacity (for use with O2E ONLY	59 00
BP8	Low volts high capacity	49 00
DC1	12v regulator pack (2E ONLY)	12 50
CP1	12v charger lead for cigar lighter	4 95
FA2	Helical antenna	7 50
LC1	Leatherette case (BP5)	5 00
LC2	Leatherette case (BP4)	5 00
LC3	Leatherette case (BP3)	5 00
LC11	Case for O2E (BP3)	5 00
T L1	Heavy duty leather case (all batt packs)	21 27
BC25E	240v wall charger for 2E	6 69
BC25U	110v wall charger for 2E (USA)	6.69
BC16E	240v wall charger for O2E (BP8 BP7)	9 95
BC30	Desk top drop in charger (fast and slow) old packs	56 35
BC35E	Desk charger all packs new & old (fast slow)	56 35
HM9	Speaker microphone	16 50
IC-202S	SSB Portable - CW, 3 watt output	199 00
BC15E	AC Charger 240v	41 80
BC20	DC Charger 13 8v	41 80
	DC lead	1 75
	Telescopic antenna	1 50
LC25	Leatherette carrying case	8.25
FA1	Helical screw in antenna	7 50
UHF Equipment		
IC-471E	Multimode base station, 25watts, 32 memories	699 00
IC-471H	High power version of above. 75watts.	879 00
PS25	Internal switched mode power supply	89 00
EX310	Voice synthesizer unit	39.00
SM6	Desk microphone	34 50
IC-490E	Multimode mobile, 10 watts, 5 memories	495.00
IC-45E	FM mobile, 10 watts, 5 memories	329 00
BU1	Memory back up unit for mobiles	24.50
	Spare DC leads (flat 4 pin or square 6 pin)	4.50
	DC plugs & sockets (flat 4 pin)	.30
AG1	Mast head pre-amp for 471/451/490	49 00
IC-4E	Synthesized hand portable, 1.5 watts	219 00
IC-O4E	Synthesized hand held, k pad entry LCD	T B A
FA3	Flexi 1 4 wave antenna	7 50
	Accessories same as IC2E/O2E	
IC-402	SSB portable - CW 3 watts output	257.00
BC15E	AC charger 240v	41 80
BC20	DC charger 13 8v	41 80
	DC lead	1 75
LC25	Carrying case	8 25
1.2 GHz Equipment		
IC-120	FM mobile, 1 watt output. 40MHz coverage mems	439.00
BT23E	Bit Zero 23e 1296MHz linear, lw in 7 8w out	179 00
50 MHz Equipment		
IC-551	Multimode base station, supplied SSB CW only	379 00
EX106	FM unit	112 00
EX107	VOX unit	49 00
EX108	Pass band tune unit	97 50
IC-505	Multimode portable 3.10watt, supplied SSB only	382 00
EX282	FM unit	28.50
BP10	Nicad pack	59.00
BC15	Charger unit	6 50
LC10	Carrying case	22.50
Mobile Mounting Brackets		
MMB5	Mount for 251E, 451E 720A, 730	12 50
MMB6	Mount for 240.	12.50
MMB7	Mount for 245E	12.50
MMB8	Mount for 255E, 260E	12 50
MMB9	Mount for 290E, 490E	12 50
MMB10	Mount for 25E, 45E, 120	12.50
MMB11	Mount for 22U, 24G	12.50
MMB12	Mount for R70, 740, 271E, 471E	12 50
MMB16	Mount for 2E, 4E, O2E, O4E	6.95
MMB18	Mount for 751	T.B.A.
SS1	Shoulder strap for handhelds	7.50

IC-745 £839.

The World

ICOM's IC-745 is the all-in-one transceiver featuring an HF all band SSB, CW, RTTY, AM (receive only) ham transceiver, plus a general coverage receiver. Options for FM transceive and an internal power supply make the IC-745 the complete transceiver in an all-in-one package.

The receiver section features a 100KHz to 30MHz general coverage receiver, this allows access to all HF bands plus all the frequencies in between. The IC-745 has an adjustable AGC circuit and DFM (Direct Feed Mixer) giving a wide dynamic range of 103dB with an intercept point at +18dBm. Exceptionally clean reception is achieved with a low noise PLL circuit and a 70MHz first IF.

The IC-745's features include IF shift, 16 programmable memories with lithium battery back-up, passband tuning, a noise blanker both wide and narrow, threshold level control, notch filter, receive audio tone control and an all mode squelch. Also available is a front end switchable receiver preamp providing 12dB gain. RIT has a ±1KHz range.

The transmitter section of the IC-745 features two powerful 2SC2904 transistors running a conservative 100 watts at 100% duty cycle rated output. Also included are a speech compressor and VOX circuits. The 600 ohm microphone system is adaptable to the modern mic of your choice. Monitor circuitry allows the operator to hear sidetone in CW and SSB.

We could go on all day about the 745, but if you need the full story get in touch with us and we will send you a detailed leaflet.

You can get what you want just by picking up the telephone. Our mail-order dept. offers you: free, same-day despatch whenever possible, instant credit, interest-free H.P., telephone Barclaycard and Access facility and a 24 hour answering service.

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Thanet ICOM

perfection?

Microphones

HM3	4 Pin hand microphone (IC240)	12.50
HM5	4 Pin hand microphone noise cancelling	20.00
HM7	8 Pin hand microphone (IC-24G, 730, 720A)	14.95
HM9	Speaker microphone for hand helds	16.50
HM10	8 Pin microphone with up/down scanning	29.00
HM11E	8 Pin microphone with up/down scanning + tone call	22.50
HM12	Up/down scanning mic for new sets (271/471/751/745)	16.50
SM2	4 Pin base microphone	34.50
SM5	8 Pin base microphone	34.50
SM6	Base microphone for new sets (271/471/751/745)	34.50

Ext Speaker/Headphones/Headsets

SP3	Matching speaker for ICOM sets	45.00
SP4	Mobile speaker with magnetic mount	19.55
HP1	Good quality headphones	28.50
HS10	Headset and boom mic for ICOM hand helds	18.40
HS10SB	PTT switch box for HS10	18.40
HS10SA	VOX unit for HS10	20.70

ICOM Global digital clock

Attractive gold colour, gives time in cities all over the world. Pulsating red LED's, LCD readout with alarm. 195mm 59.00

TONO CW/RTTY/ASCII Terminals

9000E	Communications computer, RTTY, CW, ASCII, TX/RX	669.00
550	CW RTTY decoder, inc CW practice, and CW transmit	299.00
5000E	Communications terminal & k board, inc AMTOR, VDU	799.00
9100E	As 9000E with amtor	699.00
CRT1200G	High quality video monitor with green display	136.00

TONO Linears

MR250W	144–146MHz, 10–15W drive, 180–200W out, RX pre-amp	325.00
MR150W	144–146MHz, 10–15W drive, 120–140W out, RX pre-amp	169.00
MR100W	144–146MHz, 10–15W drive, 80–90W out, RX pre-amp	99.00
2M50W	144–146MHz, 1–3W drive, 30–45W out, no pre-amp	59.00

NEW "G" Series

2M40G	144–146MHz, 1–3W drive, 20–35W out, RX pre-amp	79.00
2M90G	144–146MHz, 10–15W drive, 70–90W out, RX pre-amp	115.00
2M130G	144–146MHz, 10–15W drive, 110–130W out, RX pre-amp	160.00
4M60G	430MHz, 3–15W drive, 40–60W out, RX pre-amp	159.00

TONO Pre-amps

RX144	2 metre mast head pre-amp & control box	65.00
RX430	70 cm mast head pre-amp & control box	70.00

TELEREADER Equipment

CWR685E	CW/RTTY/ASCII terminal & k board, with VDU, TX/RX	730.99
CWR675E	RX only version of 685E, with inbuilt printer/VDU	599.00
CWR670E	CW/RTTY ASCII RX only, use with TV or VDU	349.00
	12 pin plug for 670/675/685	6.00
CWR610	CW RTTY decoder, slow morse practice	159.00
CWR610E	As 610 with adjs baud rate from front panel (45–600)	175.00
	13 pin plug for 610/610E	4.75
CM40PS	40 character dot matrix printer, 11.5cm paper roll	199.00

ZENITH Monitors

123E	12 inch with green display, good quality	109.25
122E	12 inch with amber display, good quality	125.00

TAL, ASP Series System 6 antennas

ASP2016	138–512MHz 1/4 wave whip with threaded adaptor	2.56
ASP3976	66–138MHz 1/4 wave whip with threaded adaptor	5.21
ASP3936	130–174MHz 1/2 wave whip with barrel spring, 3dB	18.63

Mounts for above

K57	Fits 1/2 wave, 3/8 inch hole, snap-in type	3.10
K440	Fits 1/4 wave, 3/8 inch hole, snap-in type	1.55
K145	Fits 1/2 wave, 3/4 inch hole, snap-in with claw mount	5.43
K65	Fits 1/4 wave, 3/4 inch hole, deep claw with 17ft cable	9.31
K47	Fits 1/2 wave, 3/4 inch hole, wing mount	7.17
KR47	Fits 1/2 wave, 3/4 inch hole, narrow wing mount	12.42
K220	Fits 1/2 wave, magnetic mount with 17ft cable	12.10
K220A	Fits 1/4 wave, magnetic mount with 17ft cable	12.10
M161	Fits 1/2 wave, boot lip mount, needs K57	3.88
M161	Fits 1/4 wave, boot lip mount, needs K440	3.88
KR193	Fits 1/2 wave, swivel ball mount	4.03
K67	Ground plane kit for all whips	16.30

3000 Series System 6 antennas

TAP3006	60–110MHz, 1/4 wave whip with threaded hinge	7.76
TAP3016	110–512MHz, 1/4 wave whip with threaded hinge	7.76
TAP3026	144–174MHz, VHF 1/2 wave, 3dB gain, threaded hinge	10.86
TAP3676	144–174MHz, VHF 1/2 wave, 3dB gain, with spring	12.42
TAP3456	420–440MHz, UHF 3dB gain, with threaded adaptor	14.74
TAP3466	450–470MHz, UHF 3dB gain, with threaded adaptor	14.74
TAP3696	420–440MHz, UHF 5dB gain, with shock spring	18.63
TAP3666	450–470MHz, UHF 5dB gain, with shock spring	18.63

Mounts for above

K68	Snap in adaptor for 3/8 inch hole	2.32
K145	Snap in adaptor with claw fits 3/4 inch hole	5.43
K72	Wing mount with 17ft of cable, fits 3/4 inch hole	11.64
K66	Claw mount with 17ft of cable, fits 3/4 inch hole	7.76
K65	1/2 inch deep claw mount with 17ft cable, 3/4" hole	9.31
K220	Magnetic mount with 17ft of cable	12.10
ASPR332E	Gutter clip with 10ft of cable	11.79
M161	Boot lip mount needs K68	3.88
KR223	Duraflex noiseless spring	10.86
K67	Ground plane kit	16.30

Base station antennas

ASP655	130–174MHz economy base, 1/2 wave with g-plane	27.94
TAP4009	156–174MHz Colinear, 3dB gain	50.45
ASPD682	160–166MHz Colinear, 4.5dB gain	194.00
ASPE682UK	164–172MHz Colinear, 4.5dB gain	194.00
ASPD700	450–460MHz Colinear, 7dB gain	163.90
ASP2006	156–174MHz Unity gain	47.44

Low profile/Heavy-duty antennas

ASP2001	66–88MHz dome shape, 12db	55.89
ASP2000	105–108MHz TX, 138–141MHz RX dome shape, 4.5dB	73.74
ASP2002	162–174MHz dome shape, 3.5dB	55.89
ASP2021	162–173MHz fin shape, 1dB	55.89
ASP4005	450–470MHz dome shape, 0.5dB	31.05

Marine antennas 156–162MHz

ASM37E	1/2 wave unity gain, deck mount, with 20ft cable	26.90
ASM38E	Colinear, 3dB gain, deck mount, with 20ft cable	39.32
ASM77E	1/2 wave unity gain, mast mount with 3ft cable	19.67
ASM88E	As above with 60ft of cable	27.83
ASM98E	Dipole, with deck bulkhead mount & 20ft of cable	24.21
TAM1001	1/2 wave unity gain, lightweight whip style	24.84
TAM1003	Emergency antenna (CH16), c/w special bracket	23.28

Mounts/Accessories for above:

ASM42	Heavy duty rachet mount all angles	25.88
ASM91	Vertical deck mount, fold over	10.35
K509	Stand off bracket (13cm), for 1001, 1005, 1006, 88E	5.74
TAM108	Antenna extension rod (1.5m)	31.05
ASM93	Antenna support bracket	5.16
CS100	Good quality extension speaker	11.37

Antenna matching units

AMU100	1.5–99MHz 200 watts pep	99.00
AMU400	1.5–60MHz 400 watts pep	116.43

Prices include VAT at 15%.
We reserve the right to change prices without giving prior notice.
As well as ICOM equipment we also stock the following:
TONO & TELEREADER CUE DEE DATONG MICROWAVE MODULES MUTEK LAR WELTZ YAESU JAYBEAM TAL G-WHIP DRAE B.N.O.S. BEARCAT TRIO and many accessories. Items listed are subject to availability.

IC-471E £699.

ICOM
d System

The IC-471E is the most advanced 430 MHz transceiver available today, it covers the spectrum from 430-440MHz with FM, SSB, or CW using the most advanced 10Hz PLL system. The IC-471E is suitable for simplex, repeater operation, moonbounce or satellite work, and has features found on no other transceiver.

Some standard features include 32 tunable memories, a high visibility fluorescent display, RIT readout, scanning, 12V DC or AC operation with optional power supply.

The UHF receiver section of the IC-471E features FET front end and mixer, a 70.4515 MHz first IF, low noise PLL locked to 10Hz and an AGC circuit. Sensitivity is less than 0.3uV for 12dB Sinad without the optional GaAs FET preamp which adds another 15dB.

The transmitter section provides 25 watts of power in FM, SSB and CW, this can be varied in all modes from 1 to 25 watts. The design of the IC-471E is based on an entirely new CPU chip that is easy to operate and offers the maximum number of functions available. A lithium battery memory backup is featured maintaining the sets memory for up to 7 years. An internal computer interface option is available as well as the IC-PS25 internal switching AC power supply.

The 471E has a speech synthesizer that announces the displayed frequency, ideal for blind operators, this is an optional extra along with the SM6 desk microphone and 22 channel memory extension with scan facilities.

As you can see from this brief description the IC-471E, (and its 2 meter brother the IC-271E) are very versatile sets indeed. More detailed literature can easily be obtained from Thanet Electronics Limited.

Agent: Gordon G3LEQ, or telephone Knutsford (0565) 4040. Please telephone first, anytime between 0900 – 2200 hrs.

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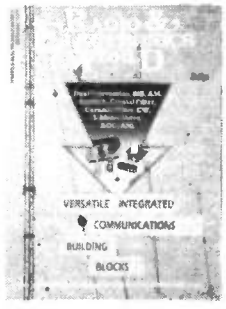
NEW IMPROVED

Radio & Electronics World

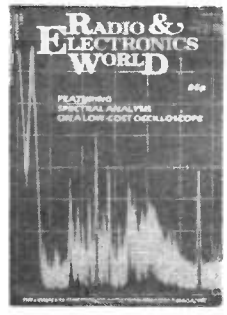
The communications, electronics & computers magazine

BACK ISSUE SERVICE

All issues from October 1981 onwards are still available, with the exceptions of January 1982 and February 1982. All orders must be pre-paid, the cost of each issue being £1.00 inclusive of postage and packing. A contents index spanning the issues from October 1981 to September 1983 is available on receipt of a stamped addressed envelope. To ensure that you don't miss any future issues, we suggest that you place a regular order with your newsagent or complete the subscription order form found in this issue.

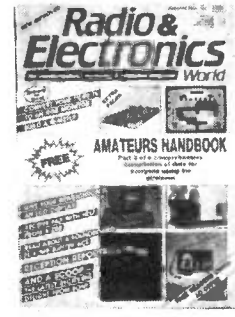


OCTOBER 1983
Designs — Modular Communication Systems Part 1; 4 Channel Audio Mixer Part 2; Tone Bursts: PF70 Conversion. *Features* — Noise Blanking Techniques; The Lambda Diode; A Guide to HF Coils Part 1: The Chromicro (Colour Processing); Timeplex; Data Brief – The NEC PC1037H Double Balanced Modulator; Amateur Radio World. *Reviews* — Tandy VSC-1000 (Variable Speech Control); Yaesu FT-77 (Solid State HF Transceiver)

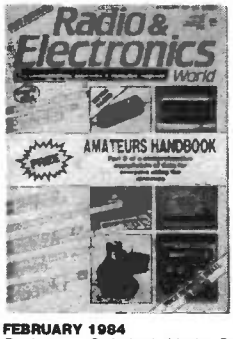


NOVEMBER 1983
Designs — Communications Building Blocks (Front Ends); Poor Man's Spectrum Analyser; Wideband FM Stereo Tuner Module Part 2; 4 Channel Audio Mixer Part 3; Three Digit Timer. *Features* — Squelch Systems; Expansion Bus (First add-on — A light pen); A Guide to HF Coils Part 2. Data Brief — NE564 PLL Tone Decoder. *Reviews* — Meteor 100, 600, 1000 (All-British Frequency Counters); Personal Pearl (For text and information manipulation)

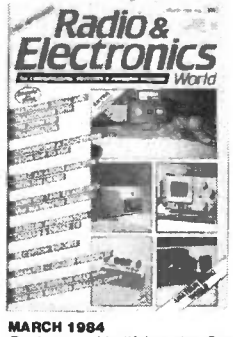
DECEMBER 1983
Designs — Poor Man's Spectrum Analyser Part 2; Communications Building Blocks Part 2; A 4001/4011 Tester; Continuity Tester. *Features* — Inside the Sinclair Flat TV; An in-depth probe; A Circuit Designers Guide to Batteries; Data File on Op-Amps Part 1; Metal Detectors in Warfare; Data Brief 1-LM1821S Video IF PLL Synchronous Detector; Data Brief 2-SL6270 Gain Controlled Audio Amplifier; An RS232C Interface for Your Dragon 32. *Reviews* — ALDEN Weather Chart Recorder Kit; Digithurst MicroSight 1.



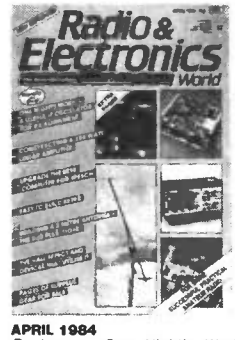
JANUARY 1984
Designs — Communication Building Blocks (Active Antennae); FAX Receiver; RGB Interface for the Ferguson TX-90; A Couple of Voltage Detectors; LCD Capacitance Meter; Cymar Q-meter (An aid to winding coils); Zener Diode Checker; A Drinker's Delight; LCD Display Option for the Rewbichron II. *Features* — A Novel Receiver (Sony); Capacitors for Coupling, De-coupling and Filtering; Data File on Op-Amps Part 2; Farewell to Test Card 'F'; A Soundboard for the Jupiter Ace; Data Brief – MC1377 Colour Signal Encoder.



FEBRUARY 1984
Designs – Switched Mode Power Supplies; Crowbar Protection Circuit; Switched Step Attenuator; Universal NiCad Charger; Communications Building Blocks (IF Amplifiers); Real Time Calendar Clock. *Features* – Data File on Op-Amps; Six Antennas from Three Wires (Double your directions without doubling your cost); Designers Update (Helical Filters); Moving Pictures from Wax – 'Phonovision'; Computers, Communications and Applications; Data Brief – Low cost, wide range varicap diodes.



MARCH 1984
Designs — Modifying the Pye PF1 Pocketfone Receiver; Communications Building Blocks (IF Amplifiers); One Night's Work (Audio-Amp); 200W PEP Transmatch. *Features* — Sony ICF 7600D Receiver; Data File on Op-Amps; UOSAT-B; AKD Absorption Wavemeter; Data Brief — Hitachi HA 1197 AM Tuner; Oscar 10 and its Orbit Parameters; Programmable Sound Generator (the AY8910 family); Random Morse Computer Program; ICOM World Clock.



APRIL 1984
Designs — One Night's Work (IF Oscillator); HF Linear Amplifier; The Piano Keyer — only £5 for Perfect Morse; Peak-Reading LED RF Wattmeter; Speech and the Computer — Make the Beeb Micro Talk!; 2 Metre Tiger Antenna. *Features* — Hall Effect Devices — Exploiting Magnetisms' Effect on Conductors; Data File — CMOS Bilateral Switches and Mult;plexer/Demultiplexer ICs; Data Brief-TD 2002A Linear IC

MAY 1984
Projects –One Week's Work VHF/UHF Frequency Meter); Spectrum Analyser Update; Assembling a Logic Probe Signal Generator; 2 Metre J-Stick Aerial; SX-200 Relative S-Meter. *Features* – Data File – 4046B Phase-Locked Loop CMOS IC; Hamey HM203-4 Oscilloscope review; A Beginners Guide to Meteor Scatter Propagation; High & Low Measurements – A Guide to Measuring Outside the Conventional Ranges

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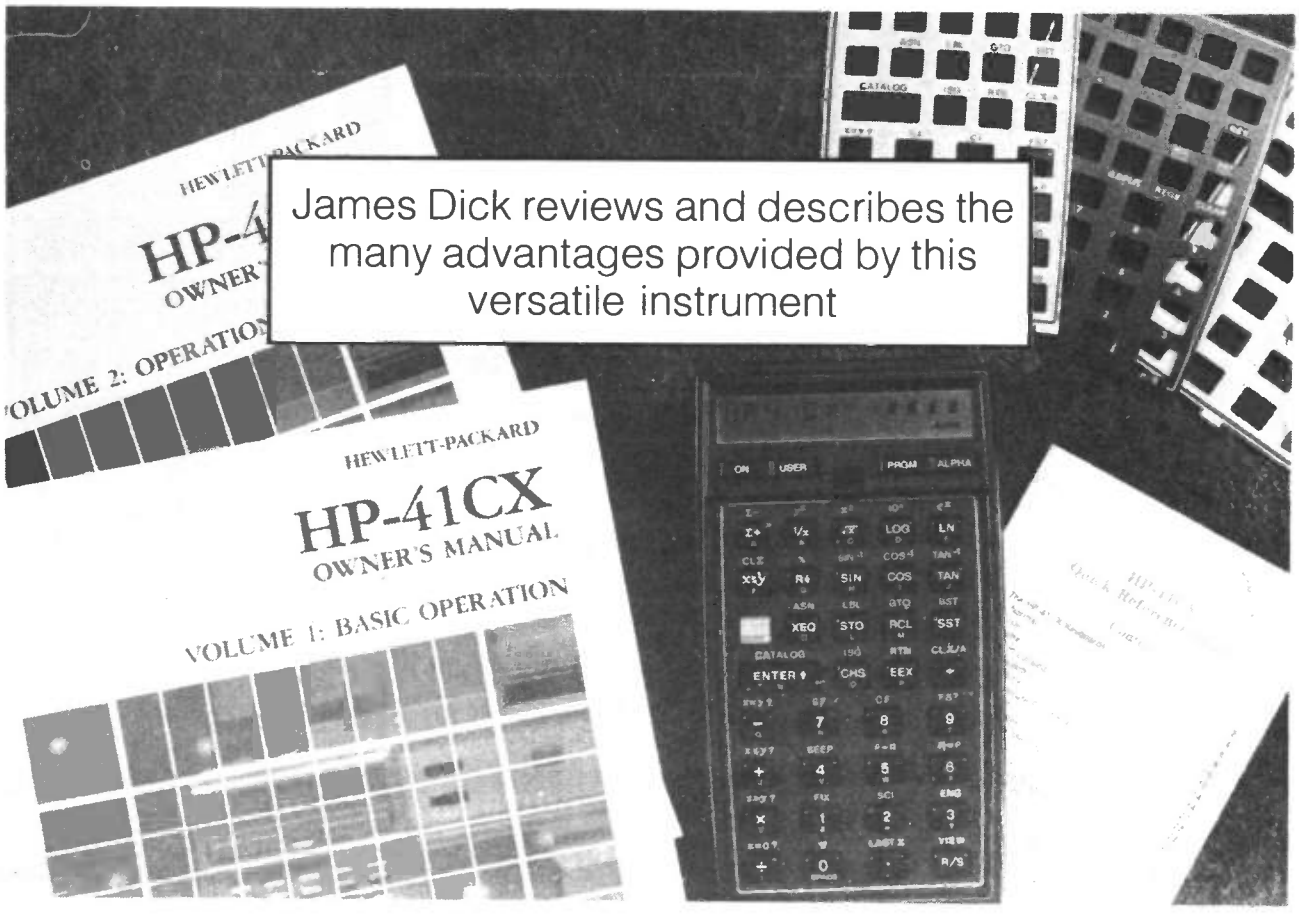


James Dick reviews and describes the many advantages provided by this versatile instrument

Now that the computer is firmly established in the home, numerous manufacturers are producing a new species, referred to as 'portable computers'. They come in all shapes and sizes – some with built-in cassette, printer, and discs. The marketing philosophy is simple: the professional businessman has come to expect a computer in the office, so, when he travels, he should be able to take one along. In the midst of this boom, it seems strange that any company should be troubled to produce a new handheld calculator. After all, with so much computing power even in home systems, a calculator might be expected to be less than what is wanted. However, Hewlett-Packard (makers of exceedingly nice calculators) have decided to do just that.

The new 41

Following the HP41C, and the 41CV, the HP41CX is the newest family member. Weighing in at a mere 7 ounces and fitting into the back pocket of the author's jeans, it is a true pocket machine – ideal for the busy engineer or executive who needs to wander around acquiring and analysing data.

With over 200 functions (including the usual trigonometric, base-conversion, statistical...) the 41CX is well suited to the task. Indeed, the operating system is a staggering 24 kilobytes. Programming is simplicity itself – like most programmable calculators, the user just types in the keystrokes as if the problem was being solved manually. The CX's memory will swallow up to 3000 program steps. There are extensive program editing facilities as well as a filing system which enables the user to create files of programs, data, or ASCII text.

Most of this is common place these days – so what is so special about the 41CX? The clue lies in Hewlett-Packard's description of the 41CX as a low cost portable system controller. The calculator (if that is a fair description) is really the heart of an expandable system. A magnetic card reader allows storage and retrieval of programs or data, a thermal printer can provide a permanent record of results, and an optical wand will ingest bar-code.

On examining the rear of the 41CX, the user will spy four hatches that may be removed to plug in the peripherals mentioned above – and a whole family of incredible interface modules. Incredible because the 41C series can now talk system-speak in dialects of RS232C, IEEE488, Video signals, or HP-IL.

The HP-IL interface allows the 41C series to control up to 30 peripherals in a loop which chains all the devices together. Information, in frames of 11 bits, is passed round the loop and returns to the 41C for verification; transfer rates of 50Kbaud can be achieved. Using the 41CX, the built-in clock can selectively wake up some of the loop peripherals, perform a measurement at a set time, and then put the whole loop to sleep again; over 30 time functions (such as day-of-the-week and number-of-days-between-two-dates) are available.

If the vast number of instruments with IEEE488 and RS232 protocols is considered, it is clear that Hewlett-Packard have produced a winner. There is even an HP-IL interface kit for design engineers and hobbyists to link up their custom made hardware to the loop.

At home

The impressive parade of technology described above is all very well for the commercial purchaser – but what of the hobbyist? There is no danger of a beginner being left out in the cold. An excellent set of documentation is supplied. Pre-written software modules are available for antenna design – including calculation of beam patterns for aerial arrays, shortwave transmission path calculations, and RF path loss. So the 41CX will feel at home in the shack – but even away from the radio room, other software packs do general electrical calculations. Plug in an 'Electrical

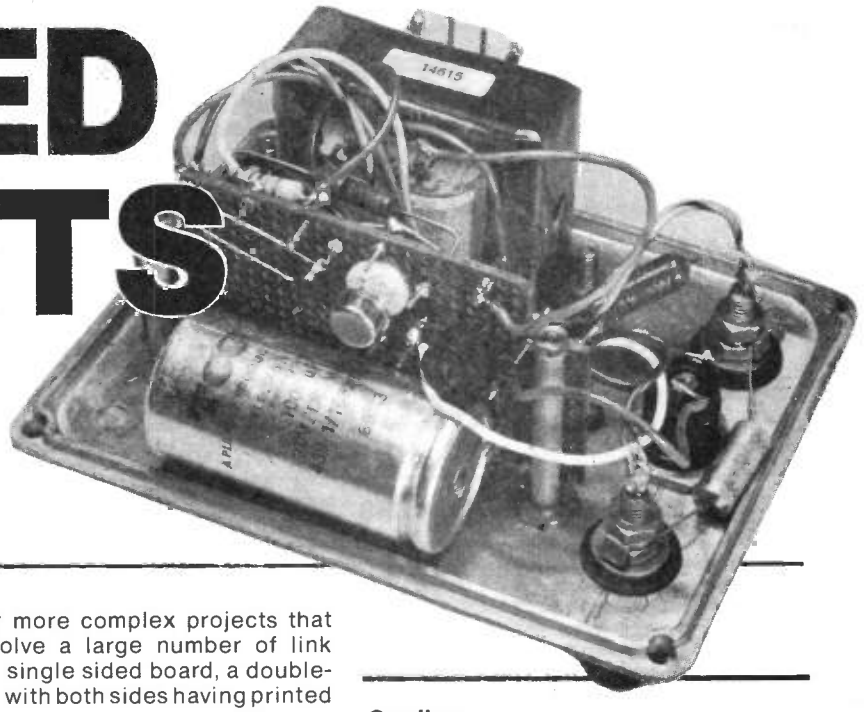
HP41CX CALCULATOR

Engineering' module, and the 41CX will help you design active filters, optimise class A amplifiers, or calculate transmission line impedances.

Once you have constructed an interface kit, the rig can no doubt be linked-in along with a monitor. Indeed, without any add-ons, the vast memory space for programs allows the DX-er access to useful information – a short program will calculate beam headings and estimated best frequency for a contact with known longitude and latitude. The satellite user may program in the orbital elements to obtain altitude and azimuth for VHF/UHF aerial pointing.

At just over £200 for the basic unit, the 41CX represents good value-for-money as a pocket computer. Although the add-on units and modules are not cheap, the end product is hard to match for ease of use, flexibility, and sheer professionalism.

PRINTED CIRCUITS



David Silvester, G4TJG, presents some thoughts for the amateur constructor

Ten years ago most amateur circuits were constructed on one of two types of insulated boarding.

The first, a plain synthetic resin bonded paper (SRBP) board with holes drilled at 0.1 inch intervals was used by making circuit connections in tinned copper wire on the reverse side of the board to the components. This method of construction is illustrated in the photograph.

The second method used 0.1 or 0.15 inch veroboard with straight printed lines in copper foil on the reverse side of the board, the components being soldered to the printed wires as in normal printed circuit board (PCB) construction. The veroboard method is still used for small projects but for most work, printed circuit boards reign supreme.

Types of boards

Many advertisers offer PCBs made for articles published in the electronic magazines, but how does the designer of a new circuit turn his idea into a working project?

The printed circuit board, as supplied, consists of an insulating sheet of SRBP or glass fibre with a thin copper foil bonded onto one side. Double-sided boards are also available and these are used in radio frequency projects, one side of the board being used as a ground plane. For more complex projects that would involve a large number of link wires on a single sided board, a double-sided PCB with both sides having printed wires can be produced, but we will return to this later.

Breadboarding can be used to check the constructor's own design with a low frequency circuit, but RF circuits must be made on double sided PCBs from the outset. Since it is easier to show an actual rather than a theoretical design we shall start from the 9V power supply shown in *Figure 1*.

Circuit drawing

The next step is to draw the circuit using actual component shapes and, when ICs are needed, photocopies from the suppliers catalogues can be cut up and used. Small pieces of paper showing ICs, transistors and other components can be stuck to a larger sheet and wiring added in another colour.

An alternative method is to stick the photocopies to one piece of paper and cover with a sheet of drafting film on which the wiring can be drawn in pencil. It is very easy to correct the pencil lines on the drafting film as it is less prone to damage when rubbing out lines. Note that the drawing is of the circuit looking onto the component side of the board. If a number of wires need to cross over each other, the drawing may be altered by rotating the components and redrawing the wires. In some cases it will be impossible to remove all the crossovers but the aim is to reduce them to the smallest number possible. *Figure 2* shows such a 'rough' drawing viewed looking down onto the component side of the board.

The next part of the procedure depends upon the method the designer decides to use for actual circuit production. All PCB production requires that a protective material (etch resist) is placed over the copper foil that will form the final circuit thus allowing the etching solution (normally ferric chloride) to

Caution

Toxic and corrosive chemicals are necessarily used in the processes described in this article. Ensure that an adequate degree of ventilation is available, do not inhale the vapours or smoke during processing and do not splash the liquids. Keep the chemicals away from the eyes and *AWAY FROM CHILDREN*. Wash the hands thoroughly after using these chemicals.

Figure 1 *The 9V power supply*

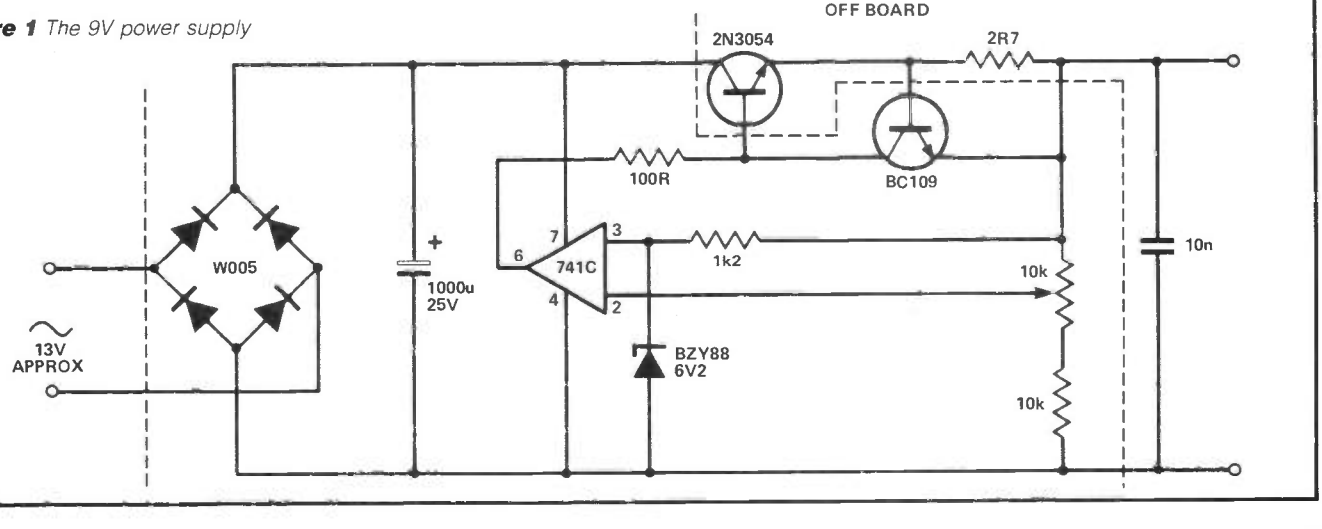


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Figure 2 *A 'rough' drawing viewed looking down onto the component side of the board*

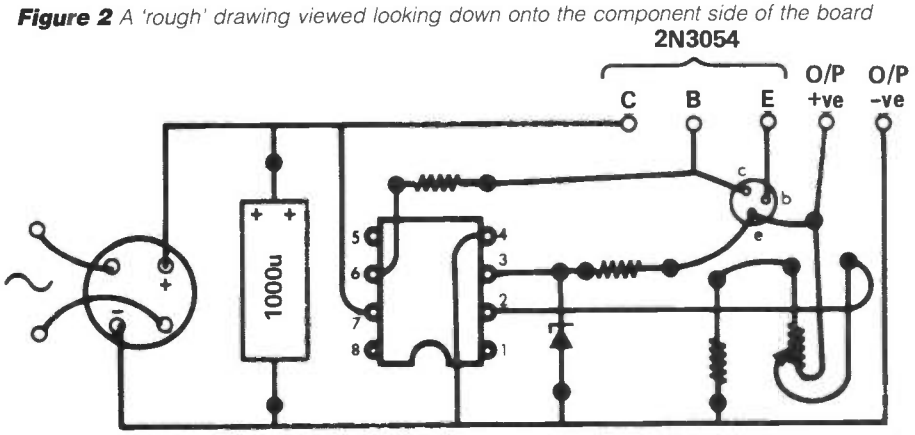
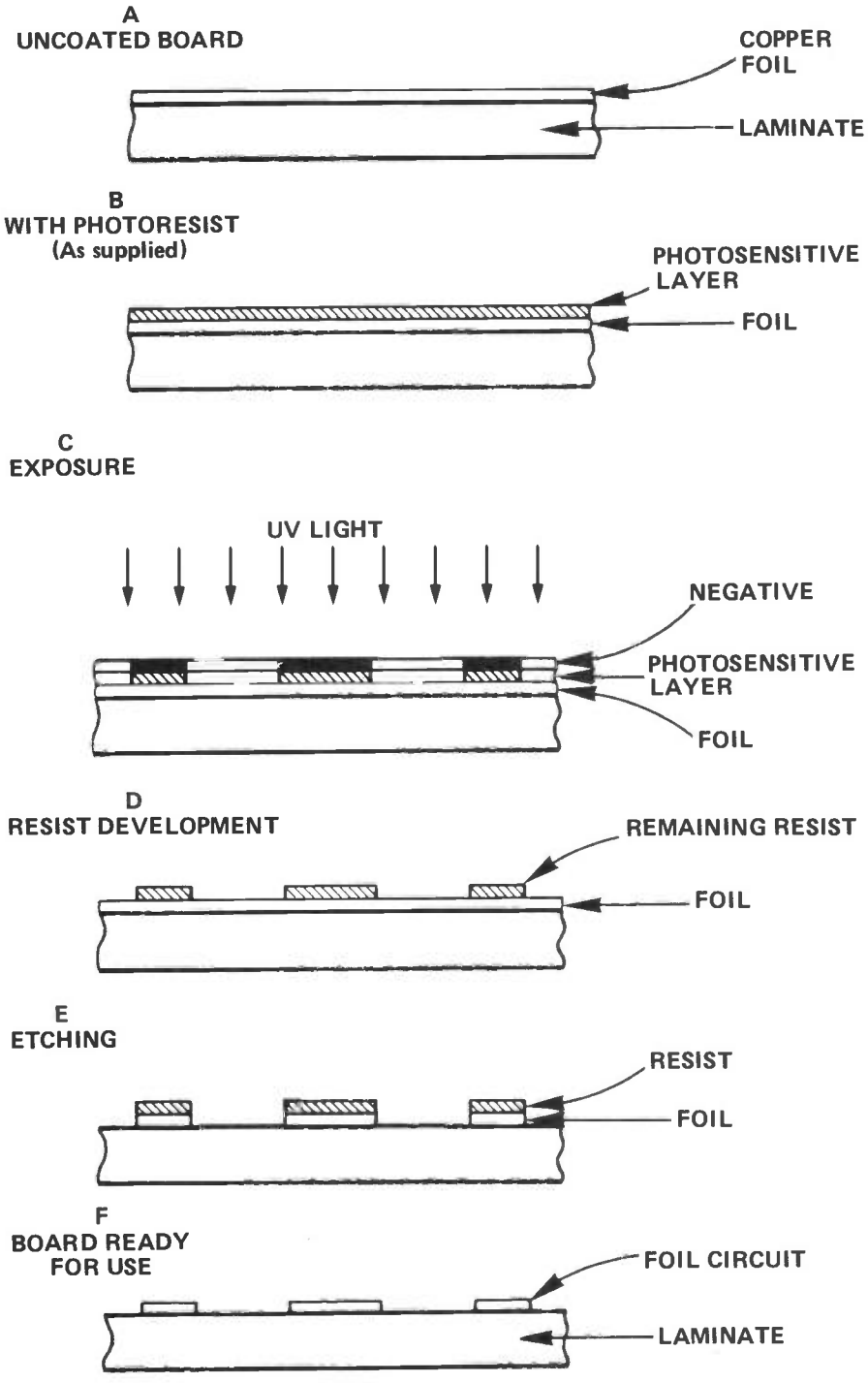


Figure 3 *The various stages in the photo-etching process*



remove the unwanted foil. The etch resist must then be removed, prior to drilling the board and soldering the circuit together. There are a number of alternative ways of applying the etch resistant material to the board. The large-scale rough drawing is used to show the wiring diagram from the foil side of the board by viewing from the wrong side against a bright light. The drafting film method makes this a simpler proposition.

Etching processes

Observe the cautions stated under the heading of this article when carrying out the following procedures. When using a system in which the etch resist is applied directly to the board, the reverse view of the rough drawing is used and this is copied using correctly sized spots and lines for the components required. The PCB must be cleaned thoroughly before use and Vim or Jif household cleaners are suitable if used sparingly.

Although there are a number of ways of applying the resist, (etch resistant ink pens, etch resistant transfers or in emergency, sellotape), the masking of the copper is rather difficult since the foil carries no guide as to the correct location for the wires. The constructor must also take extreme care when working with etch resistant transfers or inks as errors are difficult to correct and the remainder of the copper foil must be kept free of fingerprints, which will interfere with the etching process. A 1mm wide strip of foil is capable of carrying over 1 amp, but for all high power applications, the width of the foil carrying heavy currents should be increased substantially.

More complicated boards

The method described so far is satisfactory for simple circuits of up to four ICs but what happens when we need 10 ICs and, say, 30 other components on the PCB? The simplest method now becomes the more professional photo-etching process. The illustrations of *Figure 3* show the process in full and this method does not require a darkroom or even a UV exposure box to work satisfactorily. It should be noted however that a UV box does ensure a constant source of light and provides reliable results.

The most difficult part of this method is the drawing of the negative shown in *Figure 3c*, but even this is substantially easier than drawing the circuit onto the copper foil directly and the negative can be used to make many identical boards if required.

The negative may be drawn on either clear acetate film (as used in overhead projectors) or translucent drafting film. When using drafting film the negative is drawn with the view shown from the component side of the board, *Figure 4a*, and the surface which is drawn on is placed against the photosensitive layer before exposure.

The translucent sheet can prevent a

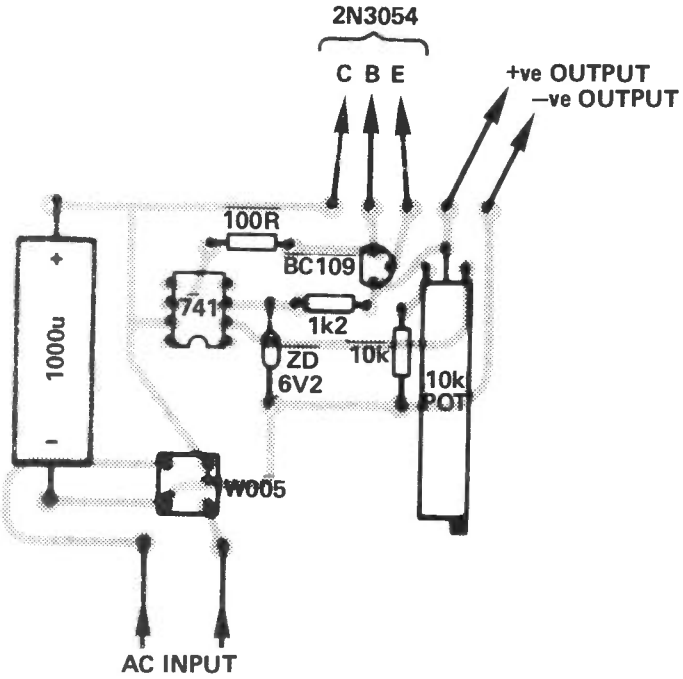


Figure 4a *Component side view*

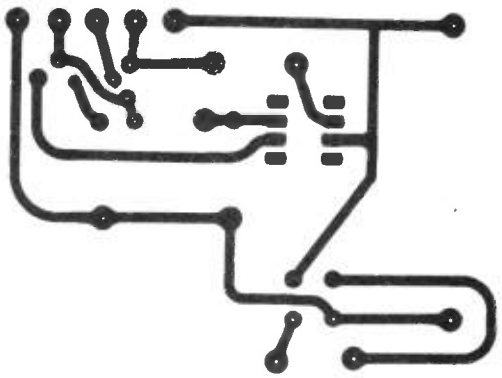


Figure 4b *Copper foil side view*

clear outline being formed if it comes between the drawing and the photoresist layer, and I would recommend adopting the same method even when using acetate film. When the negative is being drawn, a sheet of 0.1 inch graph paper should be placed below the acetate film to act as a reference. Transfers covering the pin layouts of a vast range of components, as well as plain circles for resistors etc, are easily available and these can be placed on the acetate sheet with great speed and accuracy, due to the 0.1 inch grid of graph paper. This is because most components have lead outs set at 0.1 inch intervals or multiples thereof.

The wiring between transfers can be put on in either of two ways, using black tape or by direct drawing with a 1mm hollow point drafting pen and indian ink. I have used Rotaring pens and TT ink which, like the drafting film and acetate sheet, are available from office equipment suppliers. Special ink rubbers which remove the ink without marking the acetate film are also available.

Figure 4 shows the negative drawn from *Figure 2*, using these transfers, and is on a 1:1 scale with the final PCB.

Double sided boards for RF use, when the second side of the PCB is left as a plane copper foil, can be treated as a single sided board when drawing the negative. The lines connecting the components will be substantially larger than with low frequency designs and the remaining copper on the board will be left as an earthed copper screen except for thin etched lines around the live connections. After drawing the outlines of the enlarged areas, matt black model enamel can be used to fill in. Double sided boards with both sides having printed wires will need locating holes drilled into the PCB and on the two negatives to allow accurate alignment during exposure.

Photosensitive boards

Photosensitive boards may be purchased ready-made or an uncoated board may be sprayed with photosensitive lacquer. Coating of the board should be carried out in the following way.

Having cleaned the board sufficiently to make the copper layer water 'wetable', it is dried thoroughly with a clean cloth or paper tissues. The board is then sprayed with photosensitive lacquer in a darkened corner of the room and allowed to dry for about ten minutes. It is most important that the board is kept dust-free. When the board is dry, it can be baked at 70°C for 20 minutes or left at room temperature for a further 24 hours prior to exposure. The photoresist is exposed through the negative, about 10 minutes is needed with a UV light box having two 8 watt lamps, although sunlight can be used for exposure but the results vary considerably.

After exposure, the board is developed in a dilute solution of sodium hydroxide (caustic soda). About 6-7 grams (1 tablespoon full) per litre seems to be best. This will leave a coloured resist over the foil that will form the final circuit. It is best to check that there are no scratches in the photoresist layer which would cut one of the required connections. Faults can be corrected using an etch resistant ink pen. Etching in ferric chloride is carried out next and is much faster if one uses a warm to hot ferric chloride solution, and a neat way of achieving this is to use a hot water bath. Always etch in a non-metallic container, for example, an old 1 gallon ice-cream tub made of *thick* plastic, or if using a water bath a suitable glass dish. After washing excess etchant off the board, the photoresist is removed with an organic solvent, such as acetone which seems to work best. The board can now be drilled with a 1mm bit and, with RF double sided boards which were etched on one side only, the copper foil around the component holes can be cut back with a ⅛inch drill to prevent the components shorting to earth.

Sodium hydroxide and acetone should be available from a chemists shop although you may have to order them. Ferric chloride and other suitable etchants are sold by many electronic component suppliers, either in anhydrous (powdered) form, or as an already made up concentrated solution.

Please note

These chemicals can do some extremely unpleasant things to your skin and eyes. Use rubber gloves at all times, wash all equipment very thoroughly when finished and keep separate from household utensils. The author normally wears glasses and would always advise that eye protection be worn when working with chemicals.

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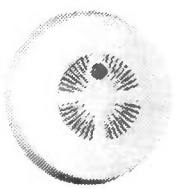

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IDEAL FOR HOMES, HOTELS & GUEST HOUSES, CARAVANS, BOATS, ETC.
• MICROCHIP technology, no mechanical parts. • Maintenance free. • No wiring needed. • Runs off transistor battery, lasts for a year. • Money back guarantee.

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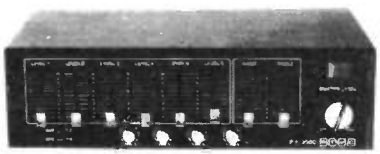
Made to sell for over £300! Must be heard to be believed. Made in England by World famous British manufacturer. SPECIFICATIONS: Bi-Directional 5 speaker system. Drive units: 2x25mm soft dome tweeters, 2x13cm polymer cone mid range speakers, one 24cm bass unit. Impedance: 8ohms. Rated power 200W peak max. Sensitivity: 87 dB @ 1W. Freq. range: 45 to 20,000 Hz Finish: Satin walnut veneer, with brown trim. Size: 35½"x8½"x15¾". Weight. 27kgs.

£99.95 a stereo pair. Buyer collect only!

MONO MIXER AMP

Ideal for Church halls & Club houses. **£45.00** + £2.00 p&p.

50 WATT Six individually mixed inputs for two pick ups (Cer. or mag.), two moving coil microphones and two auxiliary for tape tuner, organs, etc. Eight slider controls - six for level and two for master bass and treble, four extra treble controls for mic. and aux. inputs. Size: 13¾"x6½"x3¾" app. Power output 50 watts R.M.S. (cont.) for use with 4 to 8 ohm speakers. Attractive black vinyl case with matching fascia and knobs. Ready to use.



VHF STEREO TUNER KIT

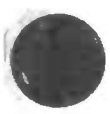
* SPECIAL OFFER! *

£13.95 Plus £2.50 p&p

This easy to build 3 band stereo AM/FM tuner kit is designed in conjunction with Practical Electronics (July '81 issue). For ease of construction and alignment it incorporates three Mullard modules and an I.C. IF. System.
FEATURES: VHF, MW, LW Bands, interstation muting and AFC on VHF. Tuning meter. Two back printed PCB's. Ready made chassis and scale. Aerial: AM - ferrite rod, FM - 75 or 300 ohms. Stabalised power supply with 'C' core mains transformer. All components supplied are to strict P.E. specification. Front scale size: 10½" x 2½" approx. Complete with diagram and instructions.

HI-FI SPEAKER BARGAINS

AUDAX 8" SPEAKER

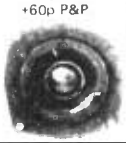


High quality 40 watts RMS Bass/Mid. Ideal for either HiFi or Disco use this speaker features an aluminium voice coil and a heavy 70mm diameter magnet. Frequency res: 20Hz to 7KHz. Impedance: 8 ohms. **£5.95** +£2.20 p&p.

AUDAX 40W FERRO-FLUID HI-FI TWEETER

Frequency response: 5kHz 22kHz. Size: 60mm square. Impedance: 8 ohms. **£5.50** +60p P&P

GOODMANS TWEETERS



8 ohm soft dome radiator tweeter (3¾"sq.) for use in up to 40W systems;

£3.95 each plus £1.00 p&p, or **£6.95 a pair** plus £1.50 p&p.

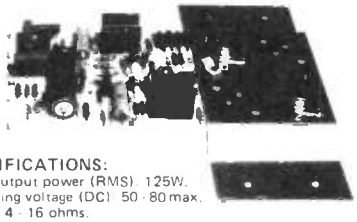
125W HIGH POWER AMP MODULES

KIT **£12.00** + £1.15 p&p

BUILT **£17.50** + £1.15 p&p

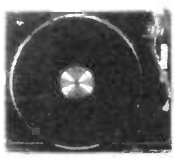
The power amp kit is a module for high power applications disco units, guitar amplifiers, public address systems and even high power domestic systems. The unit is protected against short circuiting of the load and is safe in an open circuit condition. A large safety margin exists by use of generously rated components, result, a high powered rugged unit. The PC board is back printed, etched and ready to drill for ease of construction and the aluminium chassis is preformed and ready to use.
Supplied with all parts, circuit diagrams and instructions.

ACCESSORIES: Stereo mains power supply w/transformer £10.50 +£2.00 p&p. Mono version, £7.50 + £2.00 p&p.



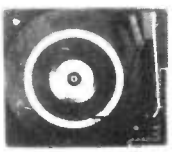
SPECIFICATIONS:
Max. output power (RMS): 125W.
Operating voltage (DC): 50 - 80 max.
Loads: 4 - 16 ohms.
Frequency response measured @ 100 watts: 25Hz - 20KHz.
Sensitivity for 100 watts: 400mV @ 47K.
Typical T.H.D. @ 50 watts, 4 ohms: 0.1%
Dimensions: 205 x 90 and 190 x 36 mm.

BSR RECORD DECKS



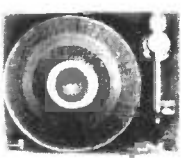
3 speed, auto, set-down, with auto return. Fitted with viscous damped cue, tubular aluminium counter-weighted arm, fitted with ADC magnetic head. Ideally suited for home or disco use.

£25.95 plus £1.75 p&p.



Auto-Changer model - takes up to 6 records with manual override. Supplied with stereo ceramic cartridge.

£12.95 plus £1.75 p&p.



Manual single play record deck with auto return and cueing lever. Fitted with stereo ceramic cartridge 2 speeds with 45 rpm spindle adaptor ideally suited for home or disco. 13"x11" approx.

£14.95 + £1.75 p&p.

SPECIAL OFFER! Replacement stereo cassette tape heads - £1.80 ea, add 50p p&p to order.
Philips stereo magnetic cartridge. £3.95 + 60p p&p.

PLINTH TO SUIT BSR RECORD PLAYER DECK (with cover) Size 16½"x 14¾"x 2¾". Cover size. 14½" x 13½"x 3½". Due to fragile nature of this item, buyer to collect only. **ONLY £8.95.**

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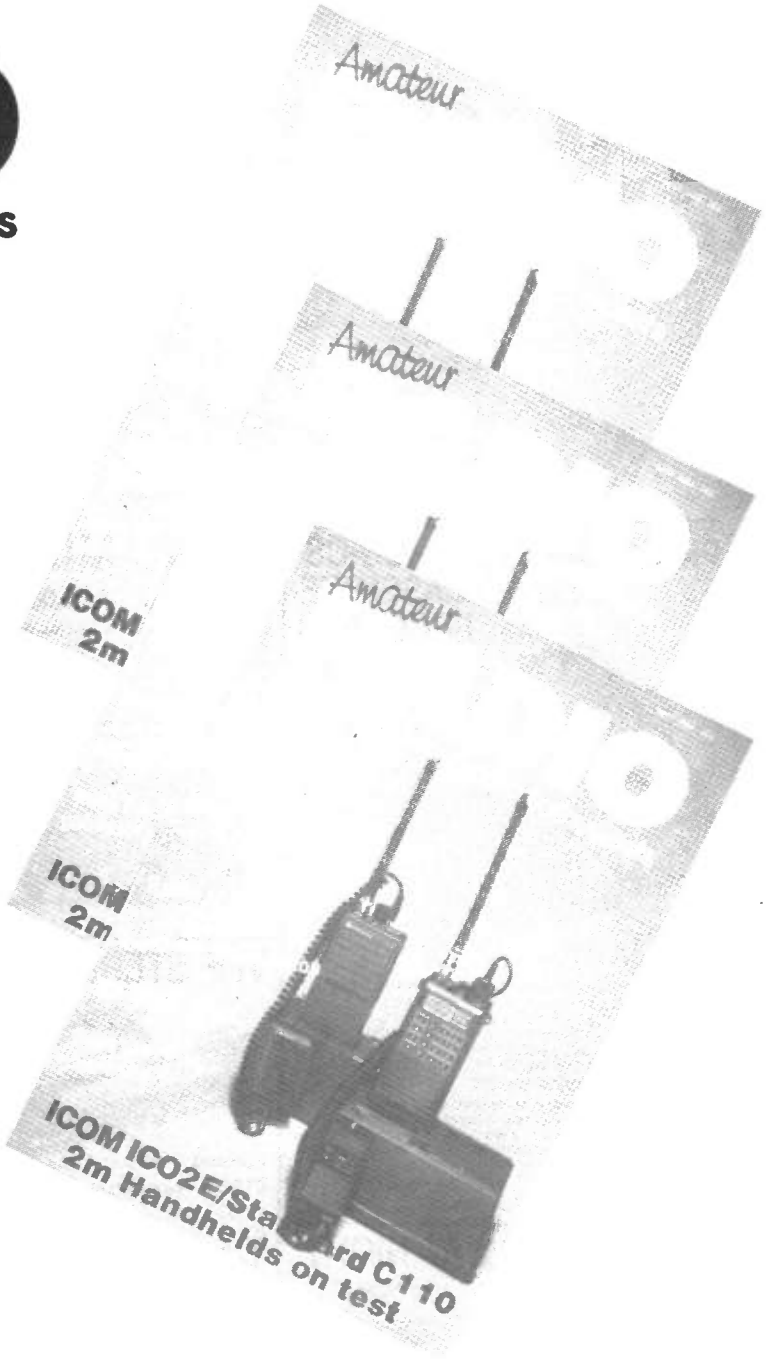

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LATEST LITERATURE

Clubs, manufacturers, publishers and agents are invited to send details of new books, catalogues, data sheets, etc for inclusion on this page

NEW FROM GRANADA

WORKING WITH dBASE II (price £7.95).

This book is for beginners as well as those already familiar with this popular database package. It not only provides new users with all they need to know to get this complex software package working as a comprehensive information processing system, but also sets out more sophisticated methods and introduces ways of exercising greater control and getting even more value from the databases that have been created. In addition, the book shows in detail how to write programs in the language which is supplied as part of the dBase II package.

Readers are also introduced to methods of setting up screen menus, writing enquiry facilities, producing pre-formatted printed documents such as invoices and providing personal computing power for a wide range of business and domestic processing requirements.

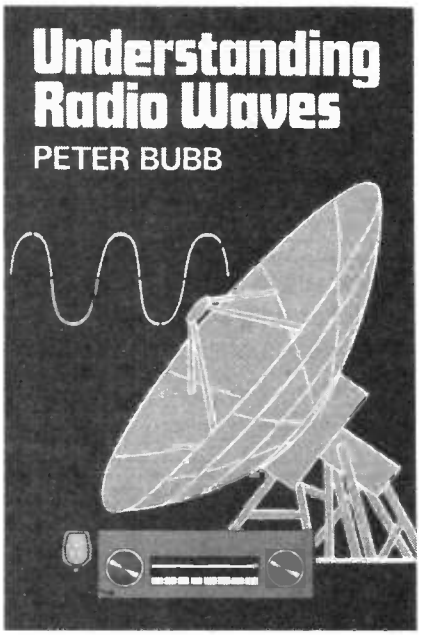
The author, M de Pace, has been using computers for nineteen years, and specialises in applying technology to the needs of the modern business or office environment. He is a member of the British Computer Society, Institute of Management Consultants, and Institute of Data Processing Managers.

Granada Publishing Ltd, 8 Grafton Street, London W1X 3LA. Tel: 01 493 7070.

RADIO WAVES

UNDERSTANDING RADIO WAVES by Peter Bubb (Price £6.95).

This book takes the reader through, at a general level, a wide variety of aspects of radio waves, from first principles through communications receivers and aerial systems, to such diverse topics as navigation, model control and microwave cooking.



The book is very clearly written and supported throughout by clear, informative diagrams and also has a selection of very interesting and topical photographs. There are eighteen chapters, each of approximately half a dozen pages, so one does not get bogged down in theory. This might, however, leave a more technical reader wanting to know more and it might be a little frustrating to find that the chapter finishes just as you are getting your teeth into the subject concerned! However, for those who simply want a good, up-to-date, sound introduction to a fascinating subject, this book can be thoroughly recommended.

Lutterworth Press, Farnham Road, Guildford, Surrey.

GUIDE TO RADIO

BEGINNER'S GUIDE TO RADIO (Ninth edition).

This new edition continues the work of its predecessors, which have given many readers a sound basic knowledge of radio principles and practice. The author, Gordon King, has again updated the text to keep up with the changes in radio technology.

The book takes you in logical steps from the theory of electricity and magnetism to the sound you hear from the loudspeaker. It describes the nature of the radio signal, what is involved in transmitting and receiving it (including stereo broadcasting) and what kinds of equipment are needed. Then it examines the components of a receiver, and how they are built up into circuits that will do the various jobs required.

This edition includes a new chapter on Citizen's Band radio and information on CB aerials. Other sections have been re-written to help those readers studying for the Radio Amateurs' Examination (RAE).

Written in a non-technical, highly readable style, with a minimum of mathematics, this guide provides the newcomer to radio with an enjoyable introduction to the subject. It will open the door to further reading and to greater skill in handling radio equipment, whether for work or leisure.

The Butterworth Group, Borough Green, Sevenoaks, Kent, TN15 8PH.

1984 POWER SUPPLY CATALOGUE

Powerline Electronics have announced their new 1984 catalogue of power supplies, dc/dc converters and power instrumentation. Comprising over 100 pages this new catalogue describes ranges of linear supplies, switched mode supplies from 30 to 1500 watts output, dc to dc converters, laboratory units, high voltage supplies, constant voltage transformers and power supply test equipment.

Powerline Electronics Ltd, 5 Nimrod Way, Elgar Road, Reading RG2 OEB. Tel: (0734) 868567.

NEW PROJECTS

30 SOLDERLESS BREADBOARD PROJECTS – BOOK 2 (price £2.25).

Written and produced in a similar style to Book 1, this volume contains thirty new projects based on CMOS logic ICs, that can easily be built upon 'Verobloc' breadboard, the projects in Book 1 all being designed around linear devices.

Wherever possible the components used are common to several projects, hence with only a small number of reasonably inexpensive components it is possible to build, in turn, every project shown.

Each project is presented with a brief circuit description, circuit diagram, component layout diagram and components list.

Also included, if necessary, are any special notes on constructing the designs as permanent units.

Bernard Babani (Publishing) Ltd, The Grampians, Shepherds Bush Road, London W6 7NF. Tel: 01 603 2581/7296.

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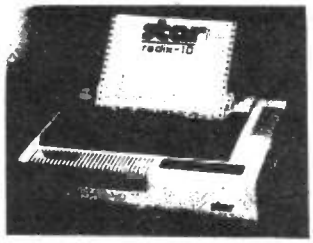

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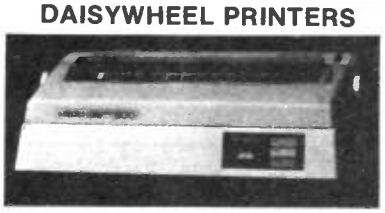

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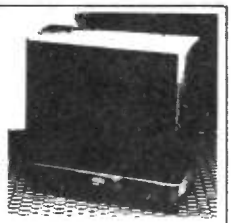

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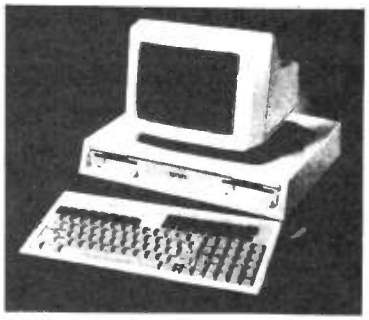

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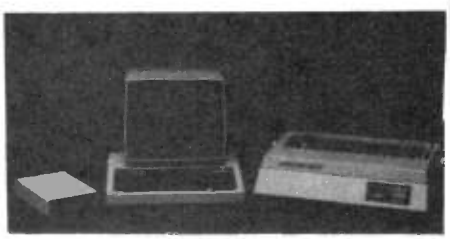

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CONNECTIONS

by Dr C J D Catto

Introduction

Let us start with wires and broken lines of communication. There is an old saw that it is not the telephone but the connections between them that go wrong. How often has a serviceman been called out, merely to find a wire loose or a plug half out?

Flexible cables eventually break, often near one end, and hence it is wise to have a 'strain-relief' moulding, as shown in *Figure 1.* Wires are occasionally cut through by doors or by sharp edges on cabinets, but this form of carelessness should be obvious and therefore more easily avoided.

More subtle are the problems with interconnections that gradually go 'soft' or become intermittent. A good sprung contact, if possible with some wiping action to cut through oxide layers, is advisable. Connector blocks should have leaves or captive bushes under their screws *(Figure 2),* so that wires are not severed. It is often forgotton, however, that the metals tin and lead suffer from 'creep', and so wires should not be solder-tinned prior to securing under any form of screw terminal: with time, the pressure becomes relieved, the connection worsens, and I^2R heating speeds up the decline.

Moisture and corrosion

Turning now to the insidious faults caused by moisture and corrosion. Where dissimilar metals are in contact, and some damp is present, an electrical cell is formed.

In relays, even where contact materials are consistent, a corrosive atmosphere can fuse closed contacts together, or encourage the growth of 'fur' that keeps open contacts forever open *(Figure 3.)* Gasket-sealed connectors are effective only if it is certain that moisture will not be trapped on the inside, eg during mating.

If high voltages are present the problems are worse, and tracking lengths on insulators must be improved, eg with 'sheds' or re-entrant sections *(Figure 4).*

Leak proof

Batteries are a frequent source of trouble, and leak-proof types are most desirable. Fine wires from relay and transformer windings can corrode and break at their terminations. More surprising is the brittle fracture that can occur at the spot-welded ends of potentiometer wires, despite being dry.

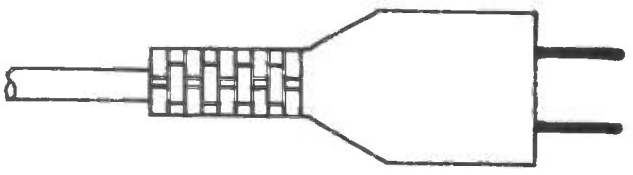

Figure 1 *Strain-relief moulding*

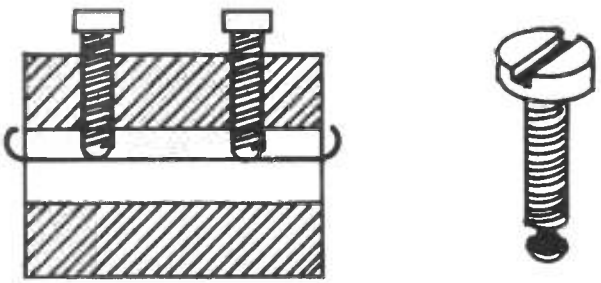

Figure 2 *Leaf or bush*

Figure 3 *Relay contacts*

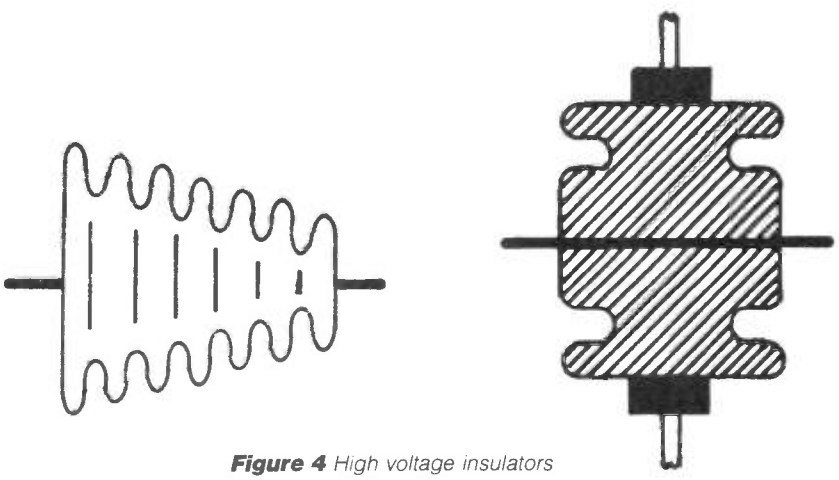

Figure 4 *High voltage insulators*

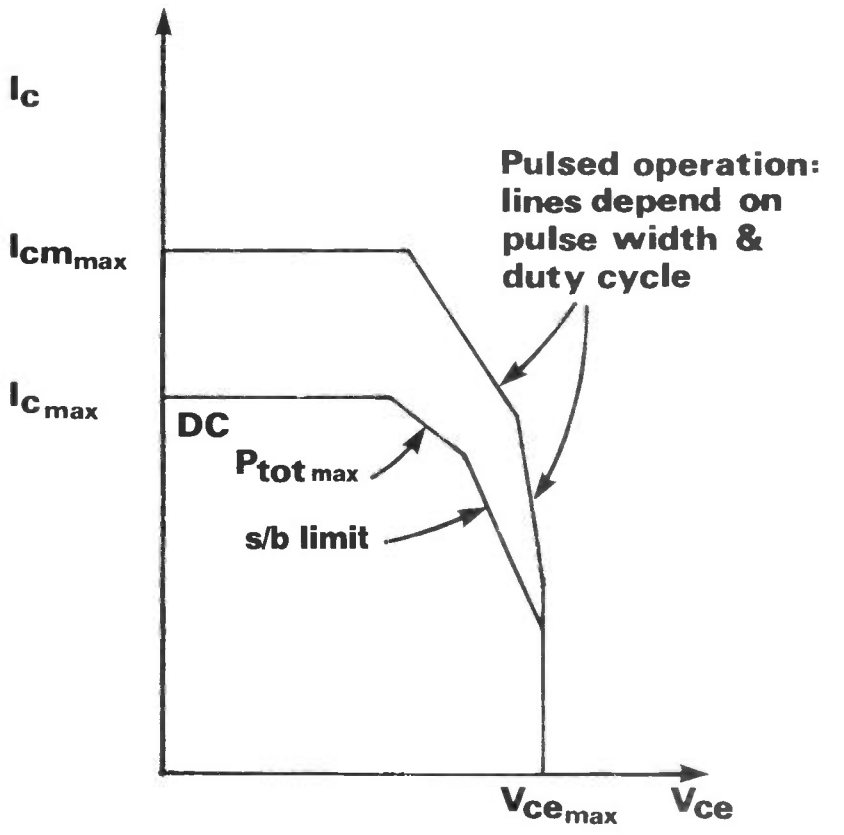

Figure 5 *Safe operating area*

Deliberate

Some connections, of course are deliberately breakable; a fuse is intended to blow on overload, but remember that it will also eventually break if run near its limit for a long time. In some cases, thermally or magnetically tripped circuit-breakers are preferable.

Even with 'solid state' devices, ie semiconductors, a built-in fuse exists (the bonding wire), but it is not easily repairable!

With rugged devices such as diodes and thyristors, protection against excessive current can be provided by a separate fuse, but if transistors are to be made safe from second breakdown *(Figure 5),* fast electronic protection is needed.

There is much to be said in favour of simplicity of design. With a little extra thought, a piece of equipment may sometimes be simplified, for example with wiring harnesses lessened and interconnections generally reduced. This may mean having most of the back-wiring on a printed-circuit mother-board (See *Figure 6).* The fewer the hand-routed and hand-soldered joints the better, resulting in a simpler, more reliable and lower-cost product.

With modern flow-soldering machinery, the dry joint should be a thing of the past. Unfortunately, some components must of necessity be testable or field-replaceable, and here sockets of some kind are desirable. However, beware the 'dicky' socket, that merely adds to cost and unreliability. It is worth paying a little extra for dual-in-line sockets that have good lead-ins and contacts for the IC's pins.

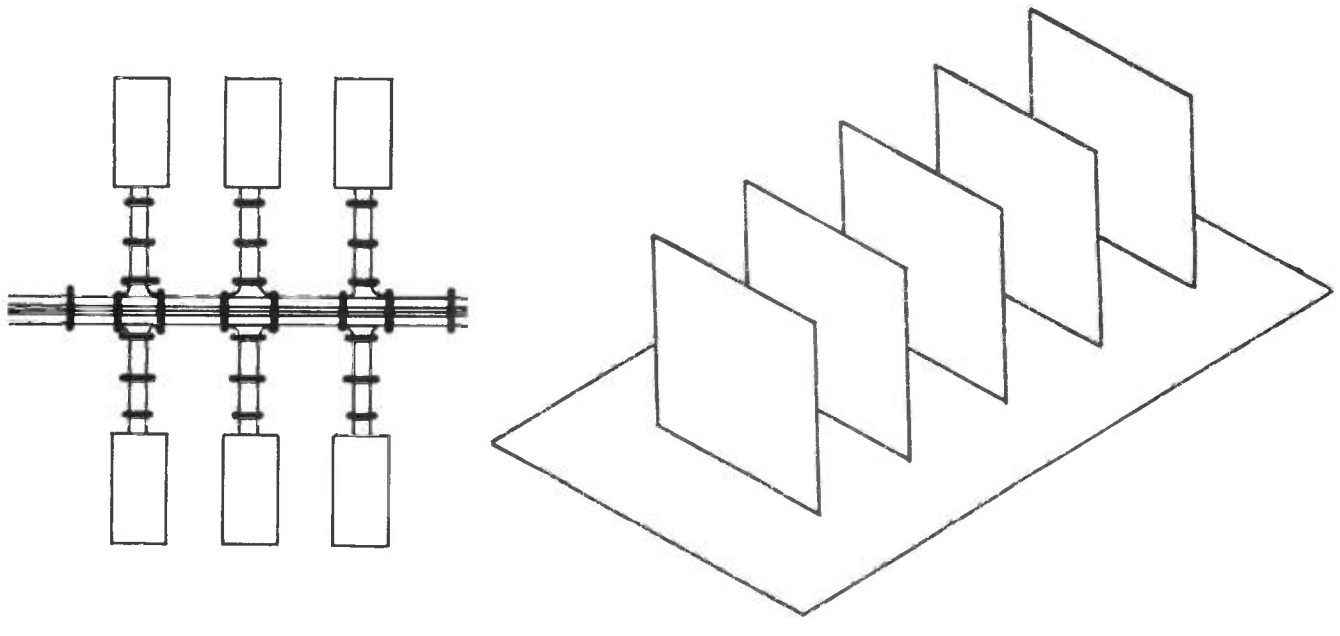

Figure 6 *Loom or motherboard*

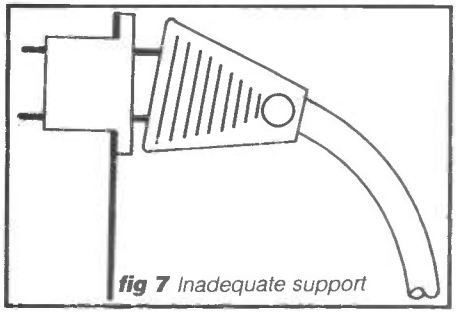

fig 7 *Inadequate support*

Mechanical considerations

Often, purely mechanical considerations are important. For example, in a multiway connector, how good is the locking arrangement, and will it hold the weight of a heavy cable? (See *Figure 7*). Also, are contacts accessible or replaceable without special tools? Do shells and clamps cut into the wires? There is a trend now to insulation-displacement connectors, where sharp tines cut through the insulation and bite into the conductors. They typically take lightweight ribbon cables. Clamping arrangements and mechanical robustness are worth investigation, especially if connection is to be made outside (rather than merely within) some equipment.

Fault-finding tips

Only a supreme optimist would expect equipment never to go wrong. Nowadays, with products incorporating microprocessors and memory devices, specialised test-gear is often required for fault finding. However, it can be extremely difficult to trace intermittent faults, and poor contacts that show up only now and then.

The traditional method is to bang the equipment. Dry joints or cracks in tracks on printed circuit boards can often be located by flexing and tapping the board. Other useful dodges are to apply heat with a blower, or maybe squirt selected areas with a freezer-aerosol. Devices prone to breakdown may be found by raising the supply voltage, and vulnerable ICs by aiming some form of spark-generator (eg a gas-lighter) at them; unfortunately, these are destructive tests.

Case-histories

Now here are some case histories. A certain make of popular home computer was found to give much trouble in loading programs from the cassette player. Signal levels and various other electronic parameters were checked, but in fact the problem was traced to the miniature jack-plugs provided, which were a very loose fit. Curiously, there is no such thing as a 'standard' 3.5mm jack-plug or socket, and hard plating or irregular insulators and mouldings do not help. In another, somewhat different, instance, a problem arose with connectors of the soft, moulded-on variety: the three-pin plug *(Figure 8)* which connected a twin electric blanket to two thermostatic controllers could (with sufficient force!) be reversed in the socket, with the result that one partner's heater was controlled by the other's knob, and vice-versa. The result was a classic case of positive feedback, where one person froze and the other boiled.

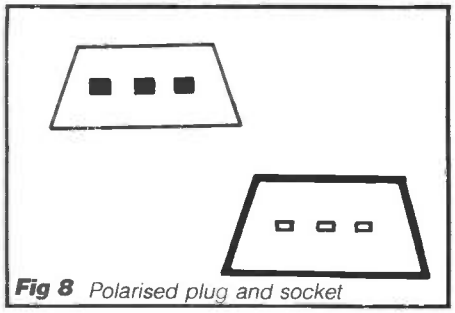

Fig 8 *Polarised plug and socket*

In another case involving jack-plugs, the quarter-inch variety were used on a large piece of studio equipment for cables linking various units; on one occasion, a somewhat short technician, who needed to reach the top chassis, was observed climbing up these cross links as if on a rope-ladder!

As so often is the case, best results are obtained with a blend of expertise and common sense, but few systems are foolproof. The trouble with fools is that they are so damnably ingenious.

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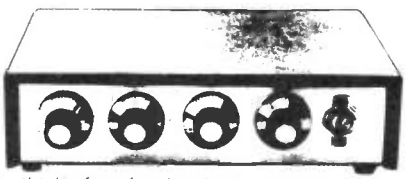

Complete kit of parts for a three channel sound to light unit controlling over 2000 watts of lighting. Use this at home if you wish but it is plenty rugged enough for disco work. The unit is housed in an attractive two-tone metal case and has controls for each channel, and a master on/off. The audio input and output are by 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 or £25.00 assembled and tested.

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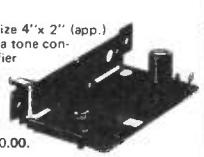

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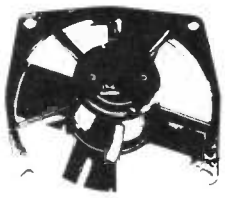

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The communications, electronics & computers magazine

VLF CONVERTER

This project by LIONEL SEAR introduces the subject of very low frequency reception. The unit costs little to construct but provides a wealth of interest.

FAST RESPONSE LOGIC PROBE

This probe, designed by C. ODDY, responds to full CMOS speeds and will catch pulses to 300 nanosecs. It has references for CMOS and TTL thresholds and will indicate the true logic state for either group.

REVIEWS

Two reviews by TERRY WEATHERLEY. The first describes a low-cost readymade printer from AMPLICON. The second describes an interesting reference addition to your bookshelf.

DATA FILE

In this latest report, the first of a special two-part feature, RAY MARSTON presents a wide selection of practical IC audio power amplifier circuits.

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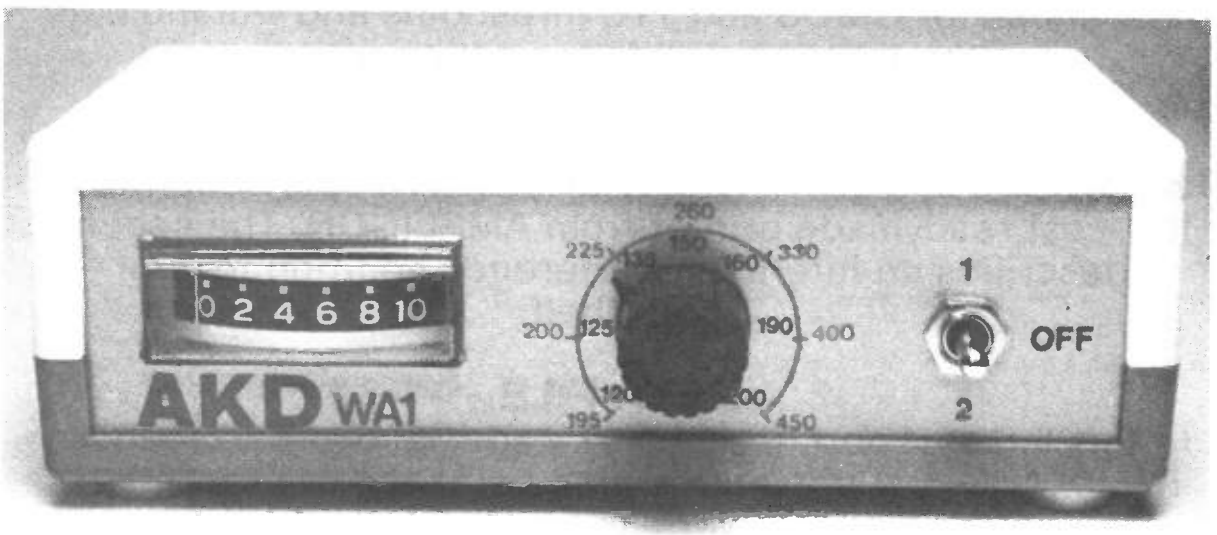

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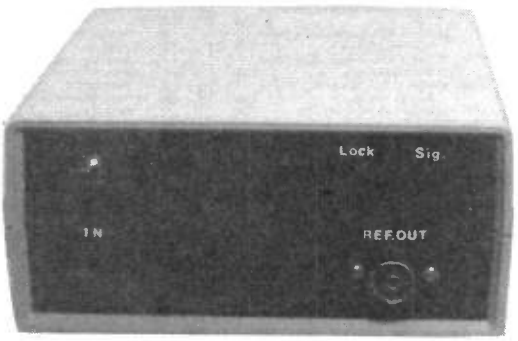
A LOW COST FREQUENCY STANDARD

by Brian Adkinson



A straightforward project utilising an unmodified television receiver to generate the reference pulse.

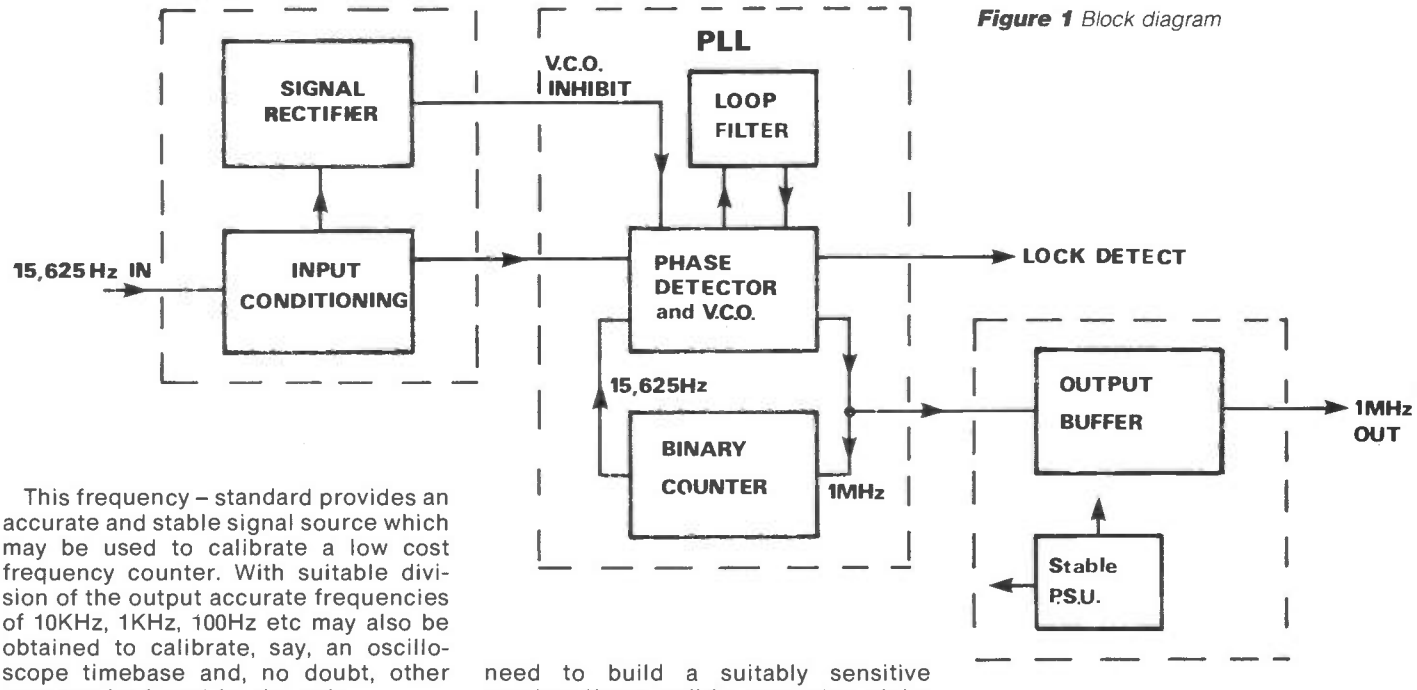


Figure 1 *Block diagram*

This frequency – standard provides an accurate and stable signal source which may be used to calibrate a low cost frequency counter. With suitable division of the output accurate frequencies of 10KHz, 1KHz, 100Hz etc may also be obtained to calibrate, say, an oscilloscope timebase and, no doubt, other uses can be found for the unit.

Many frequency–standard designs are based on the principle of using a very accurate off-air carrier such as the BBC 200KHz long wave transmission from Droitwich. The carrier is used to phase lock an internal oscillator, often running at 10MHz, and thereby produces a reference output at a much higher multiple of the input carrier frequency but with the same basic accuracy.

Many electronics engineers and hobbyists probably have only occasional need for a frequency – standard and the purchase of a commercially-made unit is not justified. A fair commitment in time and effort is needed to construct a reference of the type outlined. The reasons for this are due, in part, to the need to build a suitably sensitive receiver 'front end' for reception of the off-air signal, so that reception in any chosen location will be reliable. Also the inevitable modulation of the carrier (Radio 4) must be well filtered out to prevent phase jitter from entering the PLL system. These two factors add considerably to the complexity of the design and, bearing these points in mind, a far simpler approach was decided upon, whilst still retaining the basic PLL principle of operation.

This project is cheap and easy to build, utilises standard 'off the shelf' parts and requires no setting up or alignment. The trade off for this simplicity is a maximum output frequency of 1MHz instead of 10MHz (because of a CMOS PLL IC with a maximum VCO operating frequency of 1.5MHz), and the need for a domestic television receiver (colour or monochrome) to provide the reference signal. No direct connection or modification to the TV is necessary.

The frequency source

The high voltage 15,625Hz line pulse generated by the television receiver EHT section during the line flyback period is used as a frequency source. A strong field of positive-going pulses is present in close proximity to the receiver timebase section and this field is of sufficient amplitude to turn on the base

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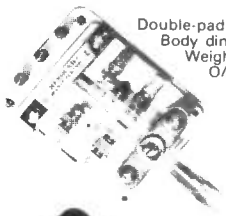

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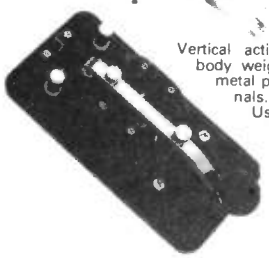

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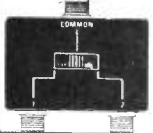

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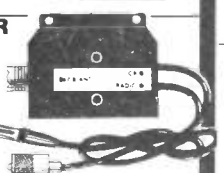

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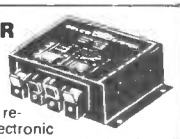

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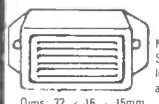

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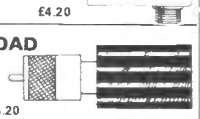

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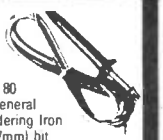

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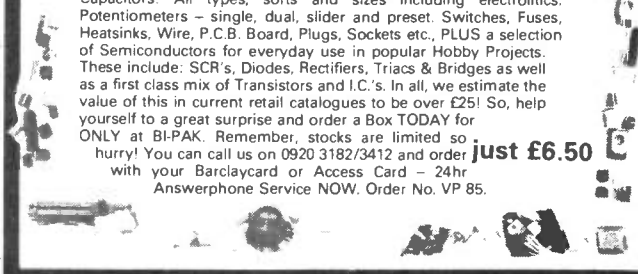

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LOW COST FREQUENCY STANDARD

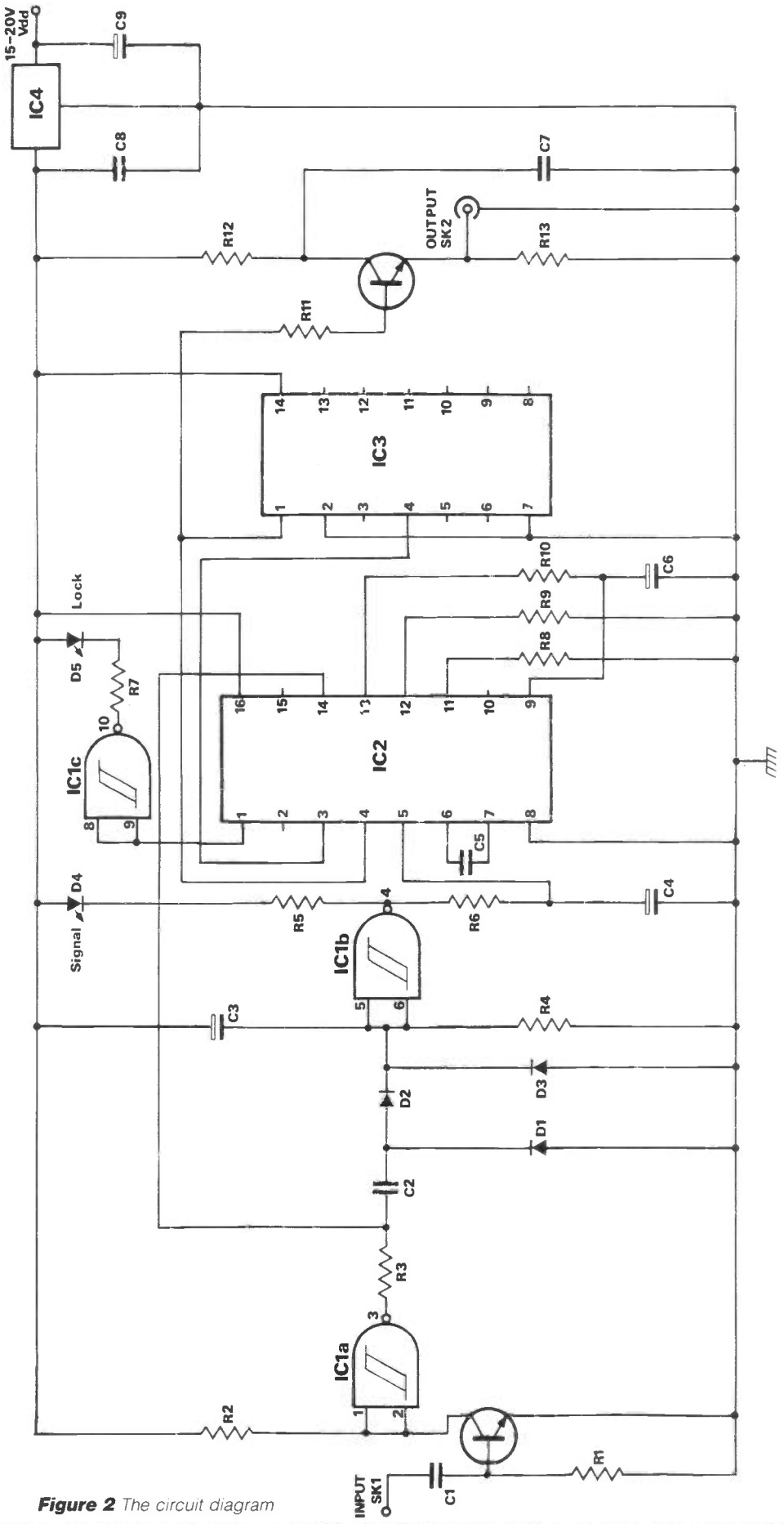

Figure 2 *The circuit diagram*

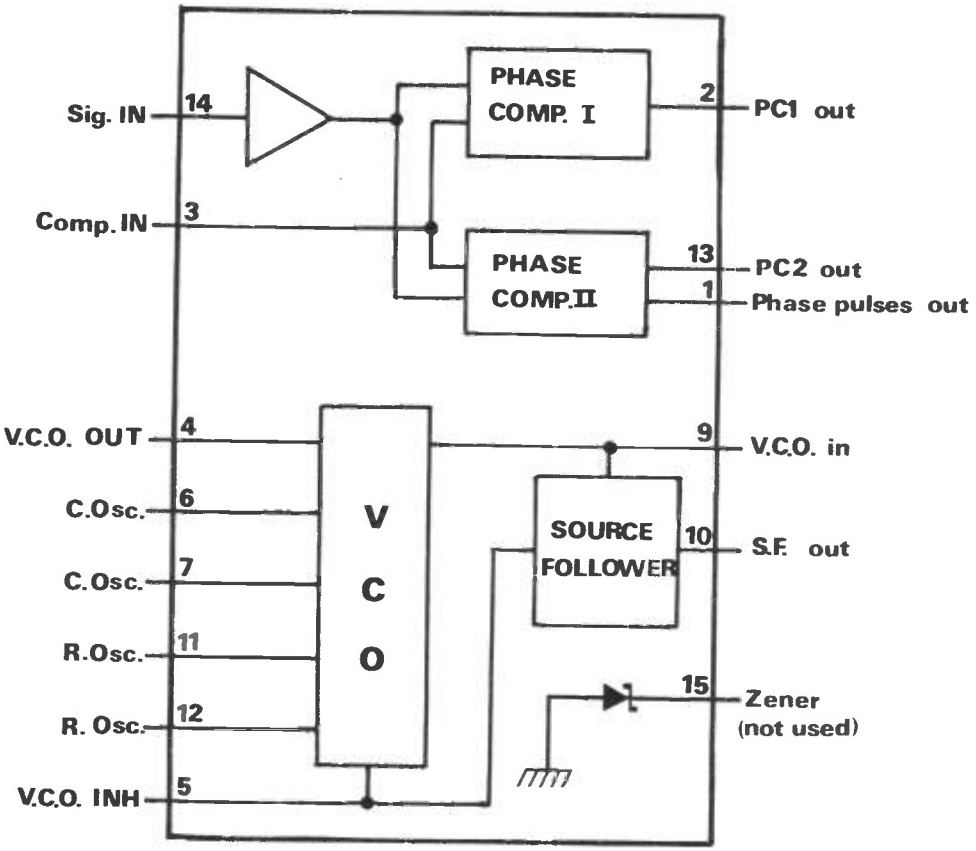

Figure 3 *The 4046 PLL*

emitter junction of an NPN transistor. The timing of the flyback pulse is initiated by the line synchronising pulse which is transmitted with the vertical sync pulses and video information.

The line sync pulse occurs during the transmitted line period of 64μS which is very accurately controlled and this, together with the vertical sync pulse, provides the master timing for the complete 625 line transmission system.

Circuit description

A block diagram of the frequency – standard is shown in *Figure 1.* This illustrates the connections between the three main parts of the circuit, namely input conditioning and signal detect circuitry, the PLL system output buffer and power supply.

Input conditioning

Referring to the circuit diagram *Figure 2,* flyback pulses are coupled to the input socket SK1 via a 'pick-up' lead. C1 together with the input impedance of T1 form a simple high pass filter to reduce the effect of 50Hz vertical pulses from the TV receiver. T1 is unbiased and will turn on when a pulse with an amplitude greater than 0.6V is present. This further reduces pickup of unwanted low-level signals. IC1a, an inverting Schmitt trigger, ensures a clean logic switching input for the SIG pin of IC2 (pin 14).

D1, D2, R4 and C3 rectify and filter the incoming signal and via Schmitt inverter IC1b, drive the SIGNAL LED (D4) to give clear indication of an incoming pulse train. As there is no 'power on' indication, except when an input signal is present, R4 and C3 also serve the purpose of momentarily taking IC1b input high during power up of the unit and SIGNAL LED D4, therefore, pulses momentarily at switch on, but if an input signal is present D4 will remain on. D3 protects the input of IC1b from the negative voltage present at the 'earthy' end of C3 after switch off.

Signal inhibit

The output of IC1b (pin 4) is also taken, via R6, to the VCO inhibit pin of IC2 (pin 5). In the absence of an incoming signal IC1b output is high and the VCO inhibited, hence preventing spurious output from the unit.

Phase lock loop system

The heart of the PLL system is IC2 *(Figure 3),* a low power CMOS device incorporating a choice of two phase comparators, a linear voltage controlled oscillator and a 5.2V zener diode. (Not used in this application). The VCO free running frequency is determined by the valves of R8, R9 and C5 which, with the values specified, will be approximately 850KHz. Phase comparator II (pin 13) was used in this design because with the PLL in a locked condition, a clear indication of phase lock (namely a logic high), is present at the PHASE PULSES output (pin 1).

This output via IC1c lights the lock LED (D5) and thus gives reassurance that the loop is locked. At phase lock, using comparator II, there is a 0° phase shift between the SIG IN (pin 14) and COMP IN (pin 3).

Early experiments with phase comparator 1 (pin 2) proved that, whilst providing better noise immunity than phase comparator II, misleading 'lock' indications were evident, due to the mode of operation of comparator I. Here, in a locked condition, the phase angle between SIG and COMP can be between 0° and 180°, depending upon the initial free running frequency of the VCO. Due to the phase shift, this type of locked condition is difficult to detect.

C6 and R10 form the low pass or loop filter for control of the VCO and a long time constant was chosen for two reasons. Firstly, as previously stated, phase comp II has relatively poor noise immunity (due to edge triggering of the SIG and COMP signals) and secondly, although the incoming 15,625Hz is a very accurate frequency, there is a degree of phase jitter present. This has presented no serious problems in the design and is believed to be caused by slight modulation of the line scanning circuitry by the vertical timebase. There is a phase jitter of less than 0.05Hz as measured at the 1MHz output when using the component values chosen for the filter. The phase lock loop is completed by IC3, a 7-stage binary counter. Output 0^5 (pin 4) is used here to give 2^6 division.

The VCO output (pin 4 IC2) of 1MHz is applied to the clock pulse input of IC3 (cp pin 1) which then divides it back down to 15,625Hz to provide the COMP input to IC2. T2 buffers the 1MHz output from IC2 and gives a 6V peak-to-peak output at low impedance on SK2 and IC4 is a 12V regulator which ensures reliable operation of IC2 at the required operating frequency.

LOW COST FREQUENCY STANDARD

Construction

The unit may be housed in any available case, metal or plastic, of suitable dimensions. Input and output sockets can be selected to suit individual requirements. Component layout is not critical, but use of printed circuit rather than strip board is advised. A mains power supply is not essential if only occasinal use is envisaged. Two alkaline PP3 batteries in series, will provide power for periods long enought to allow periodical calibration of test equipment. If a mains or external DC supply is used, the maximum dissipation of IC4 must not be exceeded, therefore, the input should lie within the range of 15 to 25 volts.

Initial testing

No setting up is required but, in the event of non operation, the following information may be helpful. With an input signal supplied from a TV receiver or signal generator, D4 will confirm operation of the complete input circuit. Should a fault be suspected in the PLL section, the VCO can be allowed to free run as an aid to diagnosis by earthing pin 5 of IC2 (VCO inhibit). The free running frequency is not critical and may lie within the range 750KHz to 950KHz.

Current drain with no input signal is approximately 3mA and, with loop lock, approximately 35mA. Investigate large deviations from these figures.

Operation

Virtually any TV receiver will generate a suitably strong field to trigger the reference. The author has found a single unscreened piece of wire, preferably not more than 1.5 metres in length, to be adequate although if problems are encountered with a particular TV receiver, a 'capacitor pickup plate' may be reuired. This can take the form of a 10 x 10cm piece of copper clad PCB or similar, with the pickup lead soldered to it.

The pickup lead or plate should be taped to the cabinet of the TV after first determining the area of strongest field srength. Reasonably noise-free reception is required.

When a suitable signal is received the SIGNAL LED should light, followed shortly by the LOCK LED. Observe the LOCK LED carefully as any flicker or dimming, indicates the input signal is noisy and, therefore, not allowing stable lockup of the PLL. Reposition the pickup lead until a stable lock is obtained, before using the standard.

Fire performance

The prototype unit has been extensively used with many receivers and over a long period of time. During this period it has operated reliably, the the author has been well satisfied with its performance.

PARTS LISTS

Resistors

R1, 4	1M
R2	15K
R3, 5, 7	1K
R6	100K
R8, 9	12K
R10	10K
R11	3K3
R12, 13	390R

All ¼W 5%

Capacitors

C1	47pF plate ceramic
C2	10nF disc ceramic
C3	0.47μF elect
C4	4.7μF elect
C6	1μF elect
C5	100pF polystyrene
C7, 8	100nF disc ceramic
C9	1000μF elect

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BC173	10p
BC174	10p
BC183	10p
BC184	10p
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BC213	10p
BC214	10p
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BF259	25p
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DATES FOR YOUR DIARY

Dates for your Diary is updated every month.
Club secretaries and organisers are requested to send information of forthcoming events as early as possible to ***Radio & Electronics World,*** Dates for your Diary, Sovereign House, Brentwood, Essex CM14 4SE

Date	Function	Location	Contact
11 May	TV Show repeat Japanese Morse: talk by Norman Kendrick G3CSG	Dunstable Downs Radio Club S Manchester Radio Club	P Seaford G8XTW G3FVA, G3UHF, G8SMR
13 May	First Sunday DF Contests	Wirral and District AR Club	G Scott G8TRY
15 May	Operating evening using club callsigns GARQT & G6TBH on HF & VHF	Biggin Hill AR Club	I Mitchell G4NSD
16 May	Foxhunt briefing	S Bristol AR Club	G8X1H/G40PQ
18 May	AGM AGM Amateur Satellites-talk by G3AAJ at Downs	S Manchester Radio Club Kent Repeater Group Sutton & Cheam Radio Society	GSFVA,G3UHF, G8SMR M W Stoneham G4RVV G3HSK
21 May	Model Engineering-Michael Kingston	Leighton Linslade Radio Club	P Brazier G6JFN
23 May	2 Metre SSB night Equipment Demonstration by Gordon Adams, G3LEQ Talk on Slow Scan TV HF Field Day Preview Basic Computing techniques	S Bristol AR Club Wirral and District AR Club The Home Counties Amateur Television Club Farnborough and District Radio Society Fareham & District AR Club	G6ZTX/G6ZTY G Scott G8TRY P W Andrews G6MNJ P Taylor G4MBZ B Davey G4IT6
25 May	Oscar 10 by G3VZV Talk by winners of Homebrew contest	Dunstable Downs Radio Club S Manchester Radio Club	P Seaford G8XTW G3FVA, G3UHF, G8SMR
27 May	Plymouth Rally	Devonport Secondary School, Park Ave, Devonport, Plymouth	–
30 May	ATV Night DF Practice, from Heswall lay-by	S Bristol AR Club Wirral and District AR Club	Peter G8WAX G Scott G8TRY
1 June	Modifications to the Club's FT221 by G4MYB	S Manchester Radio Club	G3FVA, G3UHF, G8SMR
2-9 June	HF National Field Day Operation Overload-a special event station	Leighton Linslade Radio Club Southampton Private AR Club – Royal British Legion premises	P Brazier G6JFN L Smith GAVNK
2-3 June	HF National Field Day	Leighton Linslade Radio Club	P Brazier G6JFN
3 June	70 MHz CW contest, 6 hours section	Wirral and District AR Club	G Scott G8TRY
4 June	Quiz; round two	Leighton Linslade Radio Club	P Brazier G6JFN
6 June	Lecture: Radio Interference Service	S Bristol AR Club	Len G4RZY
8 June	Summer Barbecue at Old Warden Club quiz	Dunstable Downs Radio Club S Manchester Radio Club	P Seaford G8XTW G3FVA, G3UHF, G8SMR

DATES FOR YOUR DIARY

10 June	Contest-425 MHz Trophy Contest-432 Trophy Elvaston Castle Mobile Radio Rally	Wirral and District AR Club Leighton Linslade Radio Club Nunsfield House Community Assoc - AR Group	G Scott G8TRY P Brazier G6JFN John Robson G4PZY
13 June	Longleat Preparations Talk on Racal Equipment G3VCX	S Bristol AR Club Farnborough and District Radio Society	G4KUQ/G4RZY P Taylor G4MBZ
14 June	'Electronic Music Demonstration'	Edgware & District Radio Society	G3MNO
15 June	Latest Developments on Top Band Direction Finding Techniques by Dave Holland G3WFT	Manchester Radio Club	G3FVA, G3UHF, G8SMR
17 June	Royal Navy ARS Mobile Rally D F Hunt	HMS Mercury nr Petersfield Wirral and District AR Club	A Walker G4DIU G Scott G8TRY
18 June	G8ELA on Packet Radio	Leighton Linslade Radio Club	P Brazier G6JFN
19 June	Spring sale of surplus equipment	Biggin Hill AR Club	I Mitchell G4NSD
20 June	Longleat Final Briefing	S Bristol AR Club	G4KUQ/G4RZY
22 June	VHF NFD Planning Mid Summer 1.8 MHz direction finding competition followed by barbecue	Dunstable Downs Radio Club S Manchester Radio Club	P Seaford G8XTW G3FVA, G3UHF, G8SMR
24 June	Car boot sale	Dunstable Downs Radio Club	P Seaford G8XTW
27 June	Rig Tweaking Night The Eileen Medley Challenge Cup DF Hunt Outside Activity Night on 70cm and 23cm TV VHF Field Day Preview	S Bristol AR Club Wirral and District AR Club The Home Counties Amateur Television Club Farnborough and District Radio Society	G4SDR Mark G Scott G8TRY P W Andrews G6MNJ P Taylor G4MBZ
29 June	An introduction to operational amplifiers by Chris Ward G4HON	S Manchester Radio Club	G3FVA, G3UHF, G8SMR
2 July	Electrical and Electronic Tool Aids for the Radio Enthusiast, by Mike Wells of AB Engineering Co Ltd	Leighton Linslade Radio Club	P Brazier G6JFN
4 July	Lecture-RSGB BBQ	S Bristol AR Club Wirral and District AR Club	G4FRG/G4ROX G Scott G8TRY
6 July	Preparation for VHF NFD contest at weekend	S Manchester Radio Club	G3FVA, G3UHF, G8SMR
7-8 July	VHF NFD 4 band club entry VHF National Field Day	Wirral and District AR Club Farnborough and District Radio Society	G Scott G8TRY P Taylor G4MBZ
8 July	Radio Rally	West Manchester Radio Club	Alan Nixon
9 July	Quiz, round three at MK and DRS in Newport Pagnell	Leighton Linslade Radio Club	P Brazier G6JFN
10 July	Visit IBA Transmitter Site at Emley Moor	Bury Radio Society	B Tyldsley G4TBT
11 July	70cms night	S Bristol AR Club	G4EIA Martin
13 July	The synthesis of the elements by Mike Ellis G4ROM	S Manchester Radio Club	G3FVA, G3UHF, G8SMR
15 July	D F Hunt	Wirral and District AR Club	G Scott G8TRY
17 July	QRP Operating Christopher Page G4BUE	Biggin Hill AR Club	I Mitchell G4NSD
18 July	Computer night	S Bristol AR Club	G1DBH Brian
21 July	Radio & Electronics Fair, Open 9.30am-5pm	Royal Victoria Hall, S'borough	W Kent AR Society

EAST CORNWALL COMPONENTS

Type	Price (£)
AC126	0.35
AC127	0.30
AC128	0.30
AC128K	0.34
AC132	0.55
AC141	0.26
AC141	0.26
AC141K	0.40
AC142	0.26
AC142K	0.48
AC151	0.45
AC152	0.45
AC176	0.28
AC176K	0.48
AC187	0.40
AC187K	0.40
AC188	0.28
AC188K	0.40
ACY40	0.88
AD142	1.10
AD143	1.10
AD149	0.96
AD161	0.42
AD162	0.42
AD161/AD162	0.98
AF106	0.48
AF114	2.10
AF115	2.10
AF116	2.10
AF117	2.10
AF118	0.85
AF121	0.62
AF124	0.48
AF125	0.48
AF127	0.48
AF139	0.68
AF178	0.68
AF239	0.68
AF279S	0.72
AL100	2.50
AL102	1.88
AL113	2.20
ASY80	1.75
AU110	1.40
AY102	4.32
BA102	0.34
BA110	0.67
BA121	0.40
BA129	0.38
BA148	0.16
BA154	0.08
BA155	0.10
BA156	0.08
BA157	0.28
BA164	0.14
BB104B	0.52
BB105B	0.30
BB105G	0.48
BB110B	0.42
BC107	0.10
AorB	0.12

Type	Price (£)
BC108	0.10
A B or C	0.12
BC113	0.14
BC114	0.12
BC115	0.12
BC116	0.15
BC117	0.22
BC118	0.17
BC119	0.30
BC125	0.12
BC140	0.28
BC141	0.42
BC142	0.30
BC143	0.30
BC147	0.08
A or B	0.10
BC148	0.08
A or B	0.10
BC149	0.09
BC157	0.10
BC158	0.10
BC159	0.10
BC160	0.30
BC161	0.30
BC168B	0.12
BC169C	0.10
BC170	0.14
BC170B	0.12
BC171	0.10
BC171	0.10
A or B	0.08
BC172	0.08
A or B	0.12
BC177	0.20
BC178A	0.22
BC182	0.08
A B or C	0.09
BC182L	0.09
A B or C	0.09
BC183	0.09
A B or C	0.10
BC183L	0.06
A B or C	0.12
BC184	0.10
A B or C	0.10
BC207	0.15
BC208	0.16
BC212	0.09
A B or C	0.10
BC212L	0.08
A B or C	0.10
BC213	0.09
A or B	0.10
BC213L	0.10
A or B	0.10
BC237	0.11
BC236	0.12
BC239	0.14
BC251	0.12
A B or C	0.14
BC301	0.30

Type	Price (£)
BC302	0.32
BC303	0.32
BC307	0.10
BC308A	0.10
BC323	0.99
BC327	0.14
BC328	0.14
BC337	0.12
BC338	0.12
BC350	0.14
BC440	0.30
BC441	0.32
BC461	0.32
BC547	0.12
BC548	0.12
BC549	0.12
BC550	0.18
BC550C	0.18
BC557	0.12
BC558	0.12
BCX34	0.27
BCY70	0.15
BCY71	0.17
BCY72	0.18
BCZ10	1.68
BCZ11	1.45
BD124P	0.80
BC130Y	0.68
BD131	0.34
BD132	0.34
BD131/BD132	0.95
BD135	0.32
BD136	0.36
BD137	0.36
BD138	0.38
BD139	0.38
BD140	0.38
BD144	1.60
BD145	1.82
BD150A	0.51
BD159	0.65
BD160	1.65
BD165	0.45
BD175	0.60
BD182	1.00
BD183	1.10
BD184	1.20
BD201	0.72
BD202	0.87
BD204	0.80
BD222	0.80
BD225	0.86
BD232	0.45
BD233	0.60
BD234	0.62
BD235	0.63
BD236	0.63
BD237	0.66
BD238	0.56
BD241	0.60
BD243A	0.80

Type	Price (£)
BD244A	0.65
BD375	0.32
BD410	0.76
BD434	0.68
BD436	0.68
BD437	0.76
BD438	0.75
BD439	0.68
BD507	0.48
BD508	0.53
BD509	0.54
BD510	0.48
BD517	0.56
BD520	0.66
BD699	1.25
BD707	0.88
BDX18	2.35
BDX32	2.10
BF115	0.32
BF117	0.54
BF119	0.82
BF120	0.38
BF123	0.40
BF125	0.42
BF127	0.38
BF152	0.16
BF154	0.23
BF157	0.40
BF158	0.22
BF159	0.24
BFR160	0.23
BFW10	0.30
BFW44	0.76
BFX29	0.28
BFX30	0.30
BFX80	0.32
BFX84	0.24
BFZ85	0.26
BFX86	0.26
BFX87	0.26
BFX89	0.65
BFY50	0.21
BFY51	0.21
BFY52	0.21
BFY57	0.40
BFY90	0.90
BFY90S	1.34
BR100	0.20
BR101	0.44
BR103	0.58
BRC443	1.76
BRY39	0.38
BRY56	0.42
BRY61	0.86
BSS17	0.56
BSS27	0.92
BSX19	0.34
BSX20	0.34
BSX59	0.62
BSX76	0.29
BT100A/02	0.94

Type	Price (£)
BF258	0.30
BF259	0.32
BF262	0.30
BF263	0.30
BF270	0.30
BF271	0.26
BF273	0.18
BF274	0.32
BF323	0.92
BF336	0.26
BF337	0.26
BF338	0.26
BF355	0.42
BF363	0.82
BF367	0.24
BF371	0.27
BF422	0.38
BF450	0.38
BF457	0.33
BF458	0.36
BF459	0.44
BFR39	0.22
BFR40	0.22
BFR41	0.22
BFR51	0.30
BFR61	0.32
BFR62	0.28
BFR88	0.34
BFR90	1.72
BFT41	0.38
BFT43	0.36
BFW10	0.79
BFW44	0.76
BFX29	0.28
BFX30	0.30
BFX80	0.32
BFX84	0.24
BFZ85	0.26
BFX86	0.26
BFX87	0.26
BFX89	0.65
BFY50	0.21
BFY51	0.21
BFY52	0.21
BFY57	0.40
BFY90	0.90
BFY90S	1.34
BR100	0.20
BR101	0.44
BR103	0.58
BRC443	1.76
BRY39	0.38
BRY56	0.42
BRY61	0.86
BSS17	0.56
BSS27	0.92
BSX19	0.34
BSX20	0.34
BSX59	0.62
BSX76	0.29
BT100A/02	0.94

Type	Price (£)
BT101/300	1.15
BT101/500	1.25
BT102/300	1.35
BT102/500	1.65
BT106	1.50
BT108	1.30
BT109	1.18
BT116	1.25
BT119	3.82
BT120	3.60
BT121	3.02
BT138/600	1.30
BT151/560R	0.90
BT151/500R	1.15
BTY79/400R	2.80
BU100A	2.30
BU104	2.00
BU105	1.20
BU105/02	1.56
BU108	1.80
BU124	1.75
BU126	1.25
BU133	1.80
BU204	1.35
BU205	1.30
BU206	1.70
BU208	1.55
BU208A	1.63
BU208/02	2.05
BU326S	1.75
BU407	1.65
BU407D	1.80
BUX80	3.70
BUY20	1.75
BUY69A	2.60
BUY69B	1.98
DBY101	0.48
BY118	1.10
BY122	0.68
BY126	0.12
BY127	0.10
BY133	0.16
BY135	0.25
BY164	44
BY179	0.66
BY182	0.87
BY184	0.40
BY187	0.72
BY189	4.75
BY198	0.44
BY199	0.47
BY206	0.24
BY207	0.24
BY210/400	0.25
BY210/600	0.26
BY210/800	0.30
BY223	1.20
BY227	0.26
BY229	0.30
BY238	0.68
BYX10	0.24

Type	Price (£)
BYX36/150	0.22
BYX36/600	0.28
BYX48/300	0.72
BYX49/300	0.47
BYX55/350	0.29
BYX55/600	0.33
BYX71/600	1.18
BYZ12	0.42
C106D	0.80
E1222	0.40
E5024	0.30
GET872	0.48
ITT44	0.04
ITT2002	0.11
ME0402	0.20
ME0404/2	0.24
MEU21	0.60
MJ400	1.25
MJ2955	0.90
MJ3000	1.98
MJE240	0.60
MJE340	0.54
MJE370	0.88
MJE520	0.48
MJE2955	0.99
MJE3055	0.70
MPSLO1	0.28
OA47	0.10
OA90	0.08
OA91	0.09
OA95	0.18
OA200	0.06
OA202	0.15
OC25	2.10
OC26	1.70
OC28	1.50
OC29	2.47
OC35	1.75
OC36	1.75
OC42	0.72
OC42K	1.40
OC44	0.72
OC45	0.58
OC71	0.50
OC72	0.52
OC81	0.68
OC200	2.45
OC202	2.20
ORP12	0.85
R2008B	1.50
R2010B	1.52
SHG1.5	0.40
TAG1/100	1.40
TAG3/400	1.78
TIC44	0.40
TIC45	0.45
TIC46	0.48
TIC47	0.70
TIC106A	0.70
TIP30A	0.46
TIP31C	0.54

Type	Price (£)
TIP32	0.40
TIP32C	0.60
TIP33A	0.63
TIP34A	0.72
TIP41C	0.46
TIP42A	0.52
TIP47	0.60
TIP110	0.88
TIP2955	0.60
TIP3055	0.60
TIS43	0.32
TIS88	0.40
TIS90	0.25
TIS91	0.28
ZTX108	0.12
ZTX109	0.12
ZTX212	0.28
IN4001	0.05
IN4003	0.05
IN4004	0.06
IN4006	0.07
IN4007	0.07
IN4148	0.05
IN5400	0.12
IN5402	0.15
IN5405	.16
IN5406	0.18
IN5408	0.20
IS920	0.08
2N697	0.55
2N706A	0.33
2N2904	0.28
2N2906	0.24
2N2926G	0.10
2N3053	0.22
2N3054	0.56
2N3055	0.45
2N3702	0.10
2N3704	0.10
2N3708	0.10
2N3772	1.90
2N3773	2.70
2N3904	0.18
2N3906	0.18
2N5294	0.48
2N6107	0.71
2N6126	0.68
2SB337	1.60
2SC1172Y	2.90
2SC1173Y	0.82
2SC1302	1.40
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78M08	0.50
78M12	0.50
78M15	0.50
78M24	0.50
7805	0.55
7808	0.56
7812	0.55
7815	0.55
7818	0.55
7824	0.55
7905	0.65
7912	0.65
7915	0.65
7918	0.65
7924	0.65
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100nF 1000V DC	46p
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Type	Price (£)
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DY86/87	0.75
ECC81	0.85
ECC82	0.65
ECC83	0.75
ECC84	0.65
ECC85	0.90
ECC88	0.95
ECF80	0.90
ECH81	0.75
ECH84	0.75
ECL82	0.75
ECL86	0.98
EF80	0.65
EF86	1.65
EF183	0.75
EF184	0.75
EH90	0.54
EL34	2.50
EL84	0.69
EL509	5.50
EM87	2.55
EY86/87	0.67
EY500A	1.65
PCC84	0.50
PCC85	0.65
PCC89	0.74
PCC189	0.85
PCF80	0.75
PCF86	1.25
PCF200	1.55
PCF801	1.45
PCF802	0.85
PCF806	1.20
PCL82	0.90
PCL83	2.50
PCL84	0.90
PCL86	0.58
PCL805/85	1.35
PD500	3.75
PFL200	1.35
PL33	1.50
PL36	1.45
PL81	0.85
PL82	0.75
PL83	0.65
PL84	0.75
PL95	2.00
PL504	1.20
PL508	2.40
PL509/519	5.95
PY88	1.80
PY500A	2.40
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LM1303N	2.52	TA7176	2.50
HA1151P	3.12	TA7202P	4.18
MC1307P	1.85	TA7204P	1.86
MC1310P	1.85	TA7205AP	1.50
MC1312P	2.25	TA7208P	3.25
MC1327P	1.75	TA7210P	1.50
MC1330P	0.83	TA7222P	1.88
MC13449P	1.85	TA7223P	3.68
MC1350P	1.20	TA7227P	5.60
MC1351P	2.50	TA7310P	1.80
MC1352P	1.50	TA7609P	4.28
MC1357P	.88	TA7611AP	2.88
MC1358P	1.30	TAA263	2.46
MC1496L	1.15	TAA310A	2.68
ML231B	2.10	TAA550	0.50
ML232B	2.10	TAA570	1.99
ML237B	2.30	TAA611A12	3.50
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C-mos555	0.88	TAA630S	3.90
NE556	0.80	TAA661B	1.70
SAA1024	5.35	TAA700	2.80
SAA1025	6.40	TAA840	3.38
SAS560A	2.50	TAD100	2.80
SAS560S	1.85	FM FILTER	1.20
SAS570S	1.85	TBA120A	1.00
SAS580	2.85	AS,S,SA,SB	1.30
SAS590	2.82	Q,T,U,UQ	1.32
SC9503P	1.10	TBA120B	1.30
SL432A	4.00	TBA231	1.45
SL901B	5.20	TBA281	2.65
SL917B	6.25	TBA395	1.20
SL1327Q	1.10	TBA480Q	1.50
SN76003N	2.44	TBA400	2.30
SN76013N	1.90	TBA510	2.60
SN76023ND	2.90	TBA510Q	2.60
SN76033N	2.45	TBA520/Q	1.60
SN76110N	1.12	TBA530/Q	1.30
SN76115N	2.00	TBA540/Q	1.40
SN76131N	1.65	TBA550/Q	1.52
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SN76227N	1.10	TBA560CQ	1.60

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TBA673	2.40	UPC1181H	1.60
TBA700	2.85	UPC1185H2	3.75
TBA750	2.85	UPC1212C	1.30
TBA800	1.50	UPC1230H	3.90
TBA810P	1.10	UPC1350C	4.25
TBA810S	1.20	UPC1367C	3.40
TBA820	1.60	UPC1378H	4.40
TBA890	3.88	UPC2002H	2.80
TBA920/Q	3.00		
TBA950/2A	3.05	**BRIDGES**	
TBA970	4.05	1½A 50V	0.27
TBA990	1.88	100V	0.28
TCA160C	3.90	200V	0.32
TCA270S	4.00	400V	0.40
TCA270SA	4.02	600V	0.50
TCA800	3.10	800V	0.58
TCA940	1.90	3A 100V	0.52
TDA440	3.80	200V	0.55
TDA1002	1.90	400V	0.61
TDA1003A	5.50	600V	0.67
TDA1004A	2.90	800V	0.60
TDA1006A	2.40	6A 100V	0.66
TDA1035S	4.50	200V	0.68
TDA1044	4.30	400V	0.74
TDA1170S	3.00	600V	0.80
DA1190	3.50	800V	0.86
TDA1200	2.98	10A 50V	2.20
TDA1270Q	3.70	100V	2.24
TDA1327A	1.66	200V	2.35
TDA1352A/B	1.56	400V	2.50
TDA1412	1.20	600V	3.50
TDA2002	2.80	25A 50V	2.05
TDA2020	4.60	100V	2.25
TDA2030	2.78	200V	2.40
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/06	0.22
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Radio Frequency BRIDGE

RJ Harry describes an invaluable piece of equipment that can be built in just one night

Although simple in design and easy to construct, an RF bridge has many uses. It can measure unknown values of impedance, inductance, and capacitance. The circuit consists of a Wheatstone bridge (*Figure 2a*), but instead of a battery as a source of current a two-transistor multivibrator is used, and the conventional moving coil balance meter is replaced by a radio receiver (*Figure 2b*). The multivibrator operates at an audio frequency, but the square wave output contains many harmonics which can be detected by a radio receiver up to 30MHz and beyond.

The multivibrator acts as an RF signal generator, but unlike conventional generators it produces all its outputs at the same time. It is this combination of broadband signal generator and selective receiver that makes the bridge such a versatile measuring instrument.

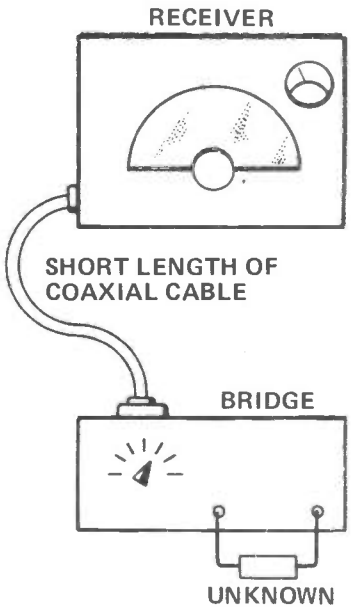


Figure 1 *The RF bridge and associated receiver*

Construction

The building of the bridge should present no problems, and it can be built in an evening. A small metal box is an ideal housing. The shaft of the variable potentiometer RV (*Figure 2*) should be fitted with a pointer and sufficient room left around the knob to mark a scale. The connection to the receiver should be by a short length of screened lead. Because the receiver earth is then connected to terminal B (see *Figure 2b*), no other part of the circuit should be electrically connected to the box.

Calibration

To calibrate the scale, the bridge is connected to a radio receiver which is tuned to any frequency between 500 KHz and 2 MHz. The receiver should have an intermediate frequency (IF) with a pass-band of at least 3 KHz, and it should preferably have an S-meter. If the IF is too narrow, the individual harmonics of the multivibrator will be detected, and balancing the bridge will be difficult. (This is the ideal application for an old receiver with an IF as wide as a barn door).

When the bridge is connected to the Rx (*Figure 1*) and switched on a tone should be heard, and the S-meter should read. As the tuning is altered the tone should remain at a constant sound level. Tuning should have no effect. If the tone rises and falls as the tuning is moved the receiver selectivity is sufficient to distinguish between the individual harmonics of the multivibrator. At this point, either use a wider IF, or double the value of the capacitors C_1 and C_2 in *Figure 3*. Changing these capacitors will lower the frequency, bring the harmonics closer in frequency and make

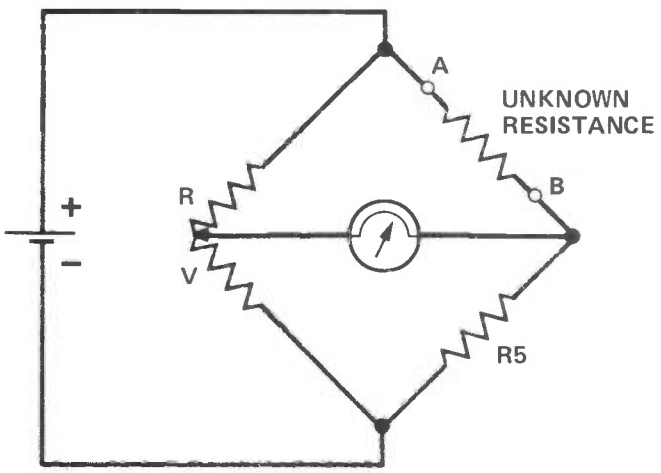
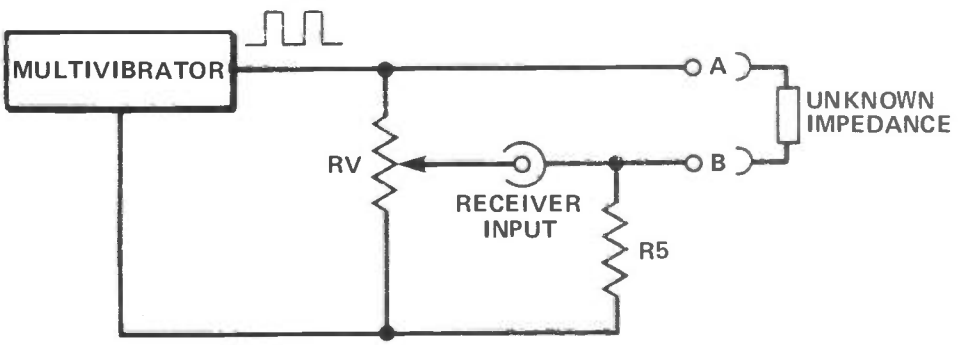


Figure 2a *Conventional Wheatstone bridge*

Figure 2b *The RF bridge*



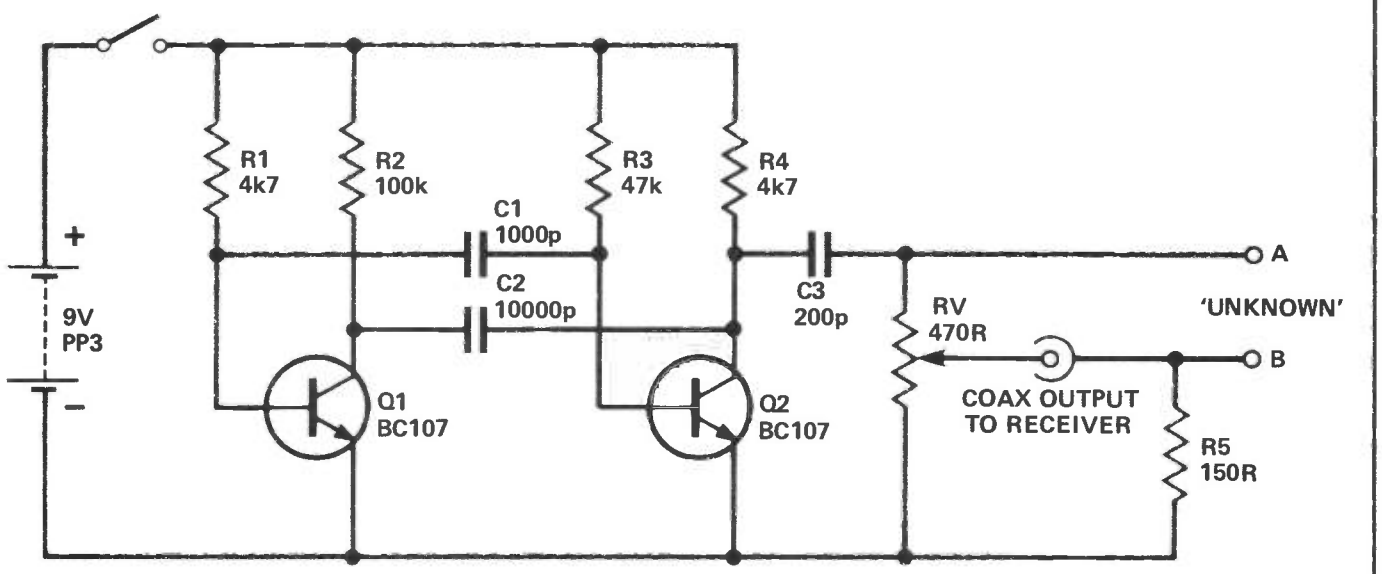


Figure 3 *The Multivibrator*

operation easier. However the harmonic energy at higher frequencies may be less and the highest working frequency may be reduced.

A selection of close tolerance resistors should be connected across the 'unknown' terminals and the bridge balanced by adjusting RV for a null (ie, a dip) in S meter reading, then the value should be marked on the scale.P

At this stage the frequency range and balance can be assessed with a resistor connected, null the bridge at 1MHz. The null should be sharp. Repeat at 10MHz, the null may be less precise. As the frequency is increased the null will become less deep, and may be at a slightly different position. The output of the multivibrator will also fall with increasing frequency, so that the S meter no longer reads. The null can still be detected by ear, and the bridge used at frequencies where the S meter reading is insufficient. The highest usable frequency depends on several factors, one being the receiver sensitivity. The bridge is now ready for a variety of tasks.

Inductance

If the receiver is tuned to 159KHz the scale can be read directly in microhenries. That is, 10 ohms may be read as 10uH, 47 ohms as 47uH, and so on.

If the receiver is tuned to 1.59MHz the range of inductance is altered so that 10 ohms equals 1uH, and 47 ohms equals 4.7uH, and so on in proportion.

This simple relationship is achieved by a little mathematical juggling of the formula $X_L = 2\pi fL$ (Symbols have the usual values).

Capacitance

This is harder to measure than inductance, and the easiest solution is to mark additional scales for the capacitance ranges required. Initial calibration should be done with a selection of close tolerance capacitors.

Using the formula: $x_C = 1/2\pi fC$ gives the reactance (in ohms) where f = frequency in Hz; C = capacitance in Farads.

At 1.59 MHz a capacitor of 100pf has a reactance of 1000 ohms, and another of 10,000pf (0.01 uF) has a reactance of 10 ohms. Other frequencies will give other ranges of capacitance.

Tuned circuits

The resonant frequency of a parallel tuned circuit can be found by connecting it to the bridge and setting RV to a high value and adjusting the receiver frequency until a dip in the S meter is found.

Baluns and RF transformers

The effective frequency response of aerial baluns and RF transformers can be easily checked with the bridge.

For a balun, the balanced connections should be terminated in the correct impedance, say 50 ohms. For a balun with a 1:1 turns ratio, the 50 ohms should be reflected to the unbalanced terminals which should be connected to the bridge. As the receiver is tuned over the designed frequency range of the balun the null should remain substantially in the same position but a fall in efficiency of the balun will show as a fall in impedance reading.

Inaccuracy of the bridge at higher frequencies can be checked by measuring the 50 ohm resistor on its own. Whatever variations in value the bridge indicates with the resistor alone should be the same as those when the balun is interposed between the bridge and resistor.

A balun or transformer with a turns ratio other than unity will behave in a different way. Impedance is proportional to the square of the turns ratio, so a 2:1 turns ratio will reflect an impedance of 200 ohms (50 x 4) into the primary when the secondary is connected to a 50 ohm resistor.

Conclusion

Sufficient has been said to illustrate the use of this simple instrument. Any work in electronics or radio requires test equipment, and I can think of no other aid to a workshop that can so quickly pay back the time spent in construction and calibration. Every radio shack should have one.

Modifying the RGB Interface for the Ferguson TX-90

by Martyn Dyer

This modification, compensates the varying brightness levels of displayed colours from a BBC micro when used with the RGB interface for the TX-90 (described in ***R&EW,*** January 84 issue).

The interface was built so that the Ferguson 37140 colour television could be used as a colour monitor for the BBC microcomputer. The television's controls were set up for the usual viewing conditions of a dark background and light text or graphics. Some programs create a display with a light background (eg yellow) and dark text (eg blue). This caused the displayed brightness to fall, but it can be compensated for by increasing the brightness control. Rather than adjusting the controls every time the display changes, a solution to the problem was sought and resulted in the following modification to the interface circuit.

Procedure

Looking at the circuit of the interface (***R&EW,*** Jan 84 issue, Page 47), the Red, Green & Blue signals are ac coupled into the transistor amplifiers by 10 uF capacitors C1, C2 & C3. Converting the amplifiers to dc coupling throughout will remove the problem. The conversion is much easier to perform than might be expected.

a) Remove C1, C2 & C3.
b) Remove R1, R10 & R18.
c) Remove R2, R11 & R19.

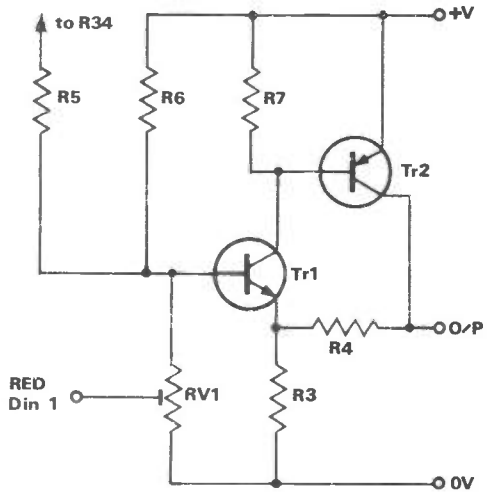


Figure 1: *Circuit diagram of the modified red channel input amplifier. Green and blue channels are similarly modified*

d) For each channel, connect the input signal to the slider of the preset potentiometer RV1, 2 or 3.
e) For each channel, connect the top of the preset potentiometer to the base of the input transistor TR1, 3 or 5.

Figure 1 shows the circuit diagram of the now dc coupled input stage. RV1, RV2 & RV3 are adjusted in a similar manner as described in the original article.

ATV on the Air

Presented by Andy Emmerson, G8PTH

High Resolution slow-scan picture by G3YCV

Time seems to fly: it's time to run down the activity report once more. So here it is: as ever, we start on 70cm and go progressively higher, finally returning to the lower frequencies for a bit of slow-scan.

We seem to have been well served with openings during the past winter season, and reading the Benelux DX Club magazine (kindly passed on by Arthur Milliken) I see that our signals have been making it over to the Netherlands.

Noted in despatches, so to speak, are: G3DFL, G4NPS, G4RNA, G4SRF, G8CTT, G8LES. G8SKO, G8VBS, G6LIC, G6YLG (29.9.83 & 26.10.83 at Beemster); G4NPS (23.10.83 in Texel); G3DFL, G4PSX, G6YLG, G8VBS (26.10.83 in Bergum); G4RNA & G6AVB (27.10.83 at Driebergen); G4RKP and GU8FBO (4.12.83 in Rotterdam).

Gordon Hunter GM3ULP is prompted to write from Motherwell to tell us about the large ATV net which operates every Monday. His setup is a MM transmitter and 48 element Multibeam at 35 feet in a less than perfect location. Licensed first in 1969 as GM6ADR/T, he used to work GM6AEG/T across the Clyde. Nowadays, his most regular contact is Norrie GM4BVU, also 'just across the Clyde'. Gordon is also QRV on slow-scan, but finds little activity; how about some skeds?

In downtown Newport Pagnell, Jon G4MDU and Andy G6LTZ recently gave an impressive talk and demonstration of ATV to members of the Milton Keynes radio club. Not content with the usual talk and slide show, the pair went on to mount a live outside broadcast from the pub across the road! A portable camera and backpack transmitter/aerial combination made this all possible, and the results made the audience extremely aware of the possibilities of ATV. We can confidently expect an increase of ATV activity in the district as a result!

The aforementioned openings which favoured 70cm gave equal or better possibilities on 24cm. On the 29th December, Rod G8VBC saw P5 pictures from F3LP on 24cm. Given that Rod is located near Derby and F3LP is in Le Havre (nearly 400 km), this is most encouraging. Rod was unable to get through on 2 metres, no doubt because lower bands were not so favoured.

From Southampton, Allan G8CMQ writes about 24cm activity in the Solent area. Two stations are on the air, himself and Sid G4JQU, with Mike G8LES in the role of visiting advisor and source of encouragement. Sid built the first Tx W&D oscillator on 429 MHz, home-made 70cm PA with 3-5W into a homebrew tripler and Tonna 21 element 1296 yagi. Operating frequency is 1285 MHz FM. Allan made the first Rx from an Ambit 23cm converter (modified), a TV tuner and BATC IF board. With a double 15 slot antenna, results were P3 over 2.5 miles.

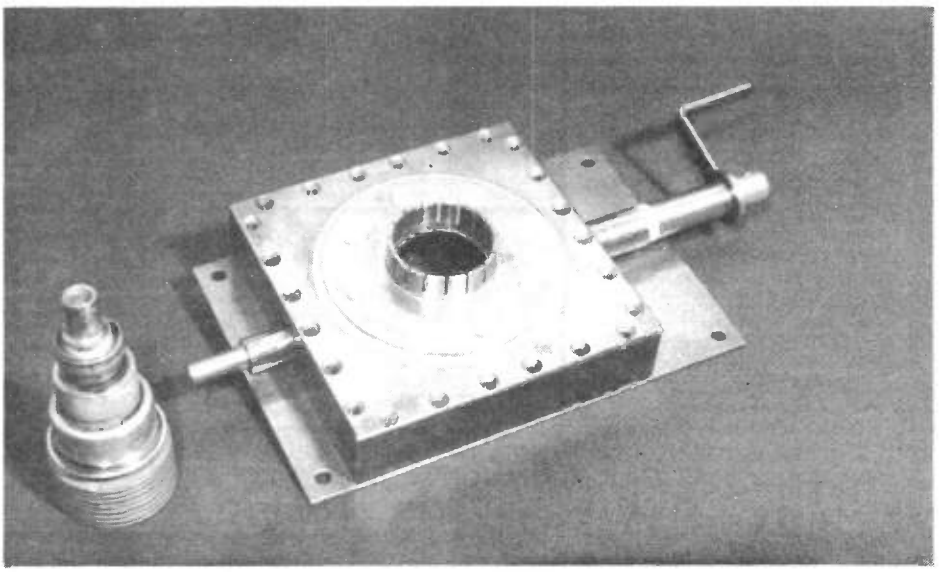
P5 every time

Mike suggested mods to the converter, retaining just the oscillator chain and results shot to P5. Further mods and a GaAsFet front end mean P5 every time now, and P3 even when Sid runs 10mW from the BATC free-running oscillator.

Sid has a W&D FM IF which works well, fed by the BATC converter but is plagued by UHF broadcast breakthrough. Allan's TX is now up to 10W input to the tripler. Allan is off the air but hopes for even better results from his new QTH.

Even over non line-of-sight paths they have been surprised with the capability of the 24cm band; best DX was over 25 miles when Allan took the Rx to Nick G8MCQ's place, giving P4 despite a long cable run and no preamp. Activity is expected to increase and Allan's new QTH has a clear takeoff for at least 10 miles in all directions. So point your beams towards ZK04g!

A letter from Cyril James G3VVB bemoans the price of varactor diodes, saying that Mullard quoted £36 each for BXY36s. I must say I am glad I bought a Microwave Modules unit while they were still available; if you are not the happy possessor of one of these, look out for



Power amplifier cavity for 23cm – an example of G3VVB's handiwork

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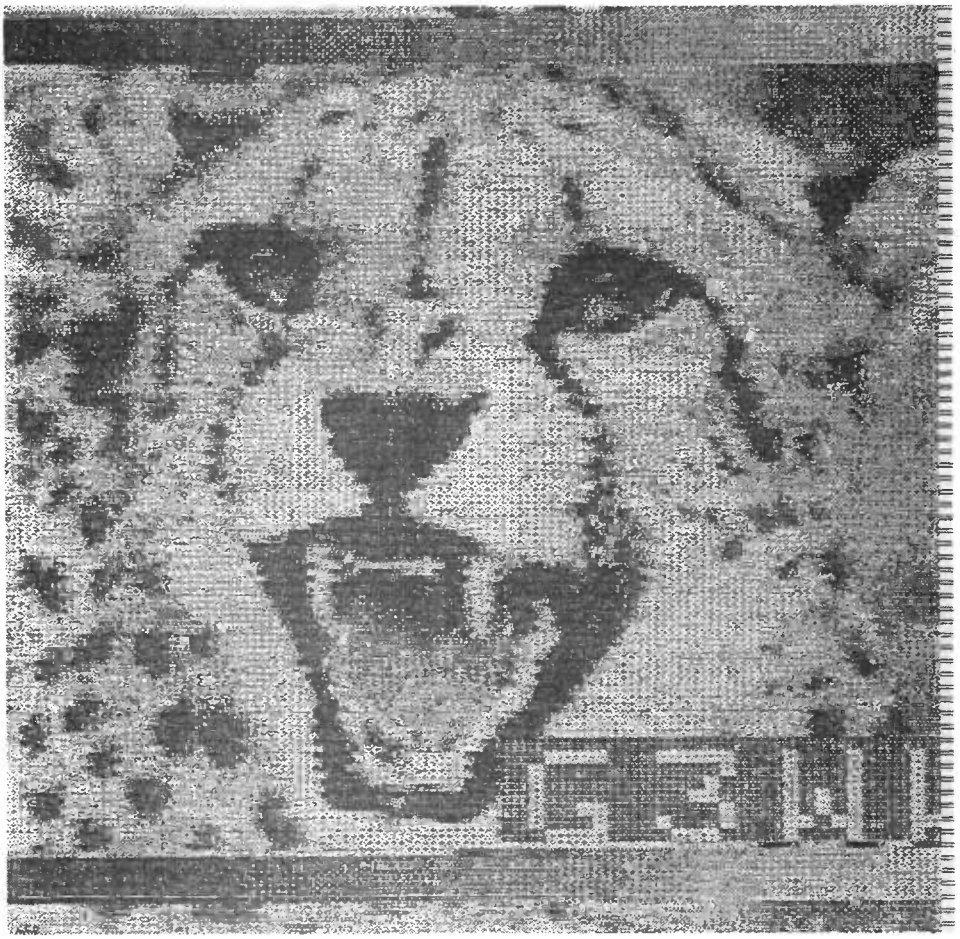
ATV ON THE AIR



One of several 32 seconds frame black and white pictures transmitted by slow-scan TV using a Wraase (German) converter. Date was 13 February 1984 and frequency 14230 KHz, sent by Peter I3XQW. Richard Thurlow G3WW received the signals and recorded them on audio cassette before printing them with his Seikosha GP-250X computer printer

them at bring and buy stalls or the Wood & Douglas substitute may well be available by the time you read this. Cyril does a very nice line in cavities, dish feeds and filters for 23 and 13cm (see photo) and if you have any special requirements, you could do worse than write to him QTHR. I bought one of his 23/24cm interdigital filters and it is a work of art.

Slow-scan news

This time we seem to have more SSTV letters – is there a slow-scan revival perhaps? Dick G3LUI from Hullbridge in Essex, counts at least 16 stations in the two metre net he organises on Wednesday evenings. Stations from London, Cambridge, Kent and Essex take part, and the old problem of shifting beam headings (and non-SSTV QRM) has been overcome by splitting into two or more QSOs and QSYing HF of the calling frequency.

Two stations, G3WW and G4GZN, are producing good quality colour with the new SC1 scan converter from Wraase. Roddy G3CDK has perfected his instant colour SSTV playback of commercial TV transmissions, while Dick has found it extremely bad luck to replace all the fixing screws on any piece of shack equipment!

Another regular correspondent, Richard G3WW tells of a two way SSTV contact with 16GK1 on 26th February. Frequency was 14227.4 KHz, with 5-9-5 signals; Richard received six pictures on his SC1 converter which were displayed on a normal Sony TV set. Richard has now added a GP-250X dot-matrix printer to his setup, enabling him to produce permanent pictures on paper; a sample was enclosed with his letter.

Exotic contacts

A lot of Richard's contacts have callsigns which look distinctly exotic to me, such as 5N8HEM (listen on 14230+5 at 17.45-18.00 GMT) and ZL2AUJ on 14229.7. G4NJI has a 'print out' board for the SC1 and with G4DYB can be found almost nightly on 144.5 FM or 144.23 SSB around 21.00 GMT. Apparently an FM voice net congregate on the SSTV calling frequency and refuse to move because their licences don't mention 144.5 as the SSTV calling frequency. Such crassness beggars belief; my response would be to run QRO (whoosh, over the top!) but that is not 'the ham spirit' either. I suppose the simplest idea is to have a pre-arranged fallback frequency and hope you don't upset some other special-mode users!

Our final SSTV letter is from John Hibbert G3YCV in Ramsgate. He too, is a member of the Essex net on Wednesdays, and has lately made contacts to South Africa, North & South America and Europe. He has replaced his Pye Lynx camera and got colour filters, so can now produce smart colour pictures.

John and a colleague have also devised a colour caption generator program for the Dragon computer, producing four lines of eight characters to the page. The computer's video output is fed to the SC-160 scan converter's camera input. If anyone else is interested they can send a SAE to John QTHR or to Aphros Software, Hawley Square, Margate, Kent. John also gave a talk to the Thanet club recently; the demo went well and seemed to impress those present, especially the way you can get colour pictures from a black and white camera! Look out for more SSTVers in Kent. . .

Finally, a plea from Bob Valder G4RRU in Peacehaven, Sussex. He has built the 'RadCom' SSTV receive converter and BATC character generator and is looking for ideas for a fast-to-slow scan converter. He will be pleased to hear from others in his area, so that he can try out the receive converter.

More news

So there we are: once again you have sent plenty of letters, and I apologise if I had to abbreviate your news just a little. I always enjoy reading your letters and printing your news, even if I don't get a chance to reply to each letter. Let me have more news for next time and send it to me at Brentwood, care of the Editor. Many thanks in advance.

DX-TV RECEPTION REPORTS

Compiled by Keith Hamer and Garry Smith

In retrospect, February wasn't anything to shout about as far as DX-TV was concerned compared with previous months. The Sporadic-E activity which continued throughout the winter appeared to fizzle out at the beginning of the month. Most days produced evidence of meteor-scatter activity which helped fill an otherwise empty log. A tropospheric opening appeared during the period between the 12th and 16th giving Scandinavian Band III and UHF reception on the 12th and the usual West German and Dutch transmitters for the remaining time.

A short-lived but intriguing Sporadic-E (SpE) opening occurred on February 5th during the late morning. Signals were observed on channels E2 and E4 consisting of programme material coming from south-east Europe. Tuning around the band produced colour bars between channels IA and E3. The pattern was finally swamped by RAI (Italy) programmes on channel IA. It is suspected that the colour bars originated from Nord Center Television, one of Italy's private stations situated close to Udine in the north-east of the country. This station is frequently received during the summer months when there are intense SpE openings. We haven't as yet seen them on programmes. Colour bars or similar electronic displays are often radiated by NCT for lengthy periods even during the early evening.

Eastern European signals were seen on R2 at 1136 GMT via SpE but they soon faded away. The highlight was the sighting of a test card not unlike the very old USA 'Bull's Eye' type via meteor-shower for just a second or so on channel E4. It was probably only a technical programme from a European service!

DX-TV Log for February

The following meagre log reflects the conditions during the month under review. But don't forget, as you read this the 1984 Sporadic-E season should be opening up.

1/2/84:
CST (Czechoslovakia) on channels R1 and R2 with the 'RS-KH' EZO electronic test card; ORF (Austria) on E2a radiating the Philips PM5544 test card plus the monochrome Telefunken T05 test card; DDR: F (East Germany) E4 on electronic test pattern; TVE (Spain) E3 on test card prior to programmes.

5/2/84:
Unidentified programmes via SpE during the late morning from south-east Europe; unidentified signal on channel R2; RAI (Italy) on IA; Colour-bar pattern probably from NCT Italy on a frequency between IA and E3; USA-type test card on E4 via meteor-shower propagation (MS).

6/2/84:
TSS (Russia) R1 transmitting the old 0249 monoscopic test card via SpE; co-channel reception of programme on R2 at times.

DR (Denmark) E3 on PM5544; CST R1 on EZO test card floating with TSS and co-channel programme; TSS R2 via SpE with programmes.

7/2/84:
TSS R1 on *'BPEMR'* News programme; MTV-1 (Hungary) R1 with the multi-burst pattern; CST R2 on EZO test card; unidentified programme via SpE on E4.

8/2/84:
DDR: F E4 on test card; CST R1 with the 'RS-KH' test card.

10/2/84:
CST R2 on test card.

12/2/84:
NOS (Netherlands) 1st network clock caption with programmes during the early evening on E4 from the Lopik transmitter via improved trops.

13/2/84:
NOS-1 E4 on 'PTT-NED.1' PM5544 test card; SR (Sweden) on E10 from the 60kW outlet at Naessjoe and E11 from Kisa (30kW); DR (Denmark) E5 and E10 with skiing followed by closedown sequence and 'DR DANMARK' PM5544; SR-2 channel E30 and SR-1 on E9 seen late evening on programmes from the Goeteburg outlet; NRK (Norway) E10 from Skien and E11 from Halden on programmes fo!-lowed by the closedown sequence at 2215 with a clock caption and programme schedule for TV and radio.

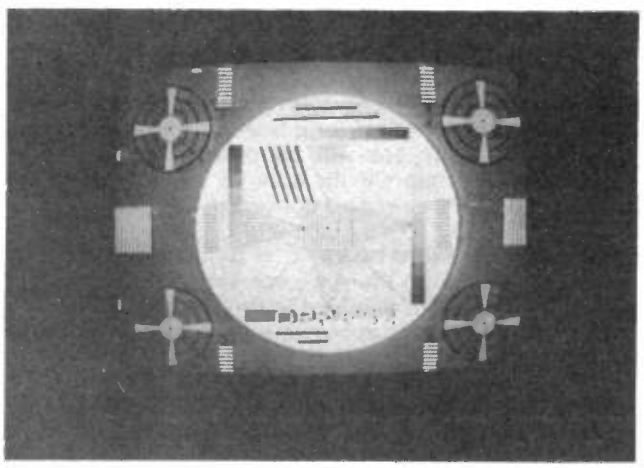
14/2/84:
NOS-1 E4 and E6 on 'PTT-NED.1' PM5544 plus NOS-2 with 'PTT-NED.2' test card on channel E45. NOS-1 was seen later on E5 with programmes; RTBF 1 (Belgian French-language network) on E8 from Wavre with the PM5544 following closedown; West Germany E9 and E11 from Westdeutscher Fernsehen (WDR) 1st Network with identification caption and programmes. All reception via improved tropospheric conditions.

16/2/84:
TSS R1 on clock caption and BPEMR News programme during a short SpE opening between 1759 and 1805.

20/2/84:
CST R2 on 'RS-KH' test card.

21/2/84:
TVP (Poland) R1 on PM5544 with a dark background; CST R1 and R2 on EZO pattern.

22/2/84:
NRK E3 with the identification 'NORGE GAMLEM' on the PM5544 from Gamlemsvetten.



Pic 1 *Telefunken T05 monoscopic test card radiated by ORF FS2 in Austria*

Pic 2 *Russian News programme relayed in East Germany for the Soviet Army stationed around Berlin*

DX-TV RECEPTION REPORTS

23/2/84:
DR E3 on PM5544; DDR:F on colour test pattern.

24/2/84:
CST R2 on 'RS-KH' test card.

25/2/84:
Unidentified signal on channel E4 via SpE.

Reception reports

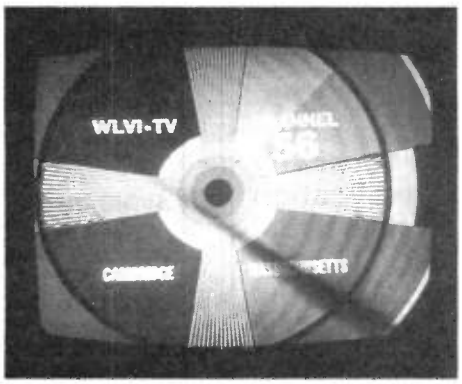
The Wrekin transmitter radiating the Belgian test card: that's what Andy Webster of Billinge near Wigan saw on the 16th. The test card carried the identification 'TV2' in the lower black rectangle and appeared co-channel to BBC-1 transmissions on channel 26. Since there isn't a Belgian 2nd network outlet on this channel we can only assume that the Wrekin takes BBC-1 programmes from Sutton Coldfield off-air on channel 46 and on this particular occasion was re-broadcasting the Belgian transmission from Egem, also on channel 46.

Andy is currently improving his DX installation. He's feeding a MOSFET VHF/UHF tuner via two Philips G8 IF selectivity modules into the normal IF's of a Philips 210 chassis. The filters are re-aligned to provide narrowband working and greater selectivity. Andy has also fitted a G8 filter to a Bush TV 161 receiver belonging to fellow DX-TV enthusiast Arthur Milliken. This enables Arthur to resolve the Dublin channel H broadcasts from RTE on a daily basis. The filter has been re-aligned to notch out offending splatter from the local BBC-1 Winter Hill transmitter on channel B12.

Bob Brooks (South Wirral) received Iceland on E3 from 2145 GMT on February 1st. This originated from Stykkisholmur in the north-west of the island. Incidentally, Rikisutvarpid is easy to identify during the summer – it is the only 625-line signal to come from the north-west. Programmes start as late as 2100 BST which means the test card carrying the identification 'RUV ISLAND' is radiated for generous periods. The PM5544 is even transmitted throughout the night, probably for DX-TV insomniacs!

Experienced French DX-er Pierre Godou (Rennes) has supplied details of his DX-TV set-up. His aerials are shown in *Picture 4* and comprise separate wideband Band III and UHF arrays both with masthead amplifiers. For Band I coverage two Fuba multi-element arrays are used. One is cut to channel E4, the other is cut to channel E2. Both are equipped with masthead amplifiers. The system is atop a lattice mast and is fully rotatable. A dual-standard (French 819 lines/CCIR 625 lines) Sony 112UM monochrome portable receiver is used which covers the CCIR system B channels. For FM radio DX a Sony CRF 230 receiver is employed which provides 64-108MHz coverage. Pierre's receivers are shown in *Picture 5*.

Alan Jardin has written from Kuwait informing us of possible Italian TV reception towards the end of the last Sporadic-E season. He has also received several Middie East TV services such as those operating in Bahrain and Dubai in Band I. Alan hopes to receive the ARAMCO TV service from Dhahran in Saudi Arabia but it may be very difficult. Dhahran uses channel E3 with only a few kilowatts effective radiated power (ERP) and it is too close for normal SpE reception. At the same time the transmitter seems too low-power for reliable tropospheric DX. Alan has now become interested in satellite TV. Only the Emir (or King) has a satellite dish, so far, and when our correspondent made enquiries about obtaining a system, the local suppliers were very suspicious!



Pic 3 *Typical American 'Bull's Eye test card used several years ago by WLVI-TV*

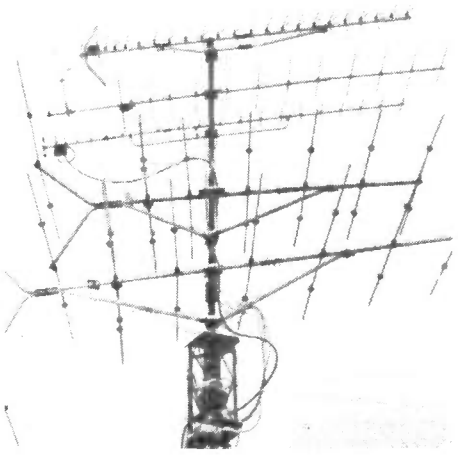
A few Swedish delicacies were sampled during the trops by Kevin Jackson in Leeds. On the night of the 12th, Sveriges Radio 2nd network programmes were coming in on channel E39. Kevin suggests that this may have been the 2.2KW outlet at Kungshamn on the west coast, just north of Goeteborg at a distance of some 937Km. There are two alternative outlets but at greater distances. These are Oernskoeldsvik with 400KW (120Km north-east of Sundsvall) and Sysslebaeck on 10KW situated north of Karlstad.

The 13th showed an improvement for Kevin with SR-1 on E9 (from Goeteborg) and E11 (possibly from Kisa with 30KW) together with SR-2 on channel E30 (Goeteborg) and E37 (from Västeraas on the east coast at 1265Km). The latter two signals were almost snow-free on test card and programmes. Danmarks Radio (Denmark) were also seen during the afternoon from both the E5 Aalborg 50KW and E10 Vestjylland 60KW transmitters. A few French (TDF) transmitters in Brittany were noted but the only West German signals to arrive at Kevin's location were from Harz West on E10 and Kiel on E35.

Gösta van der Linden (Netherlands) appears to have received the low-power (10KW) Belgian UHF transmitter located in the Brussels area on channel E25. The outlet, which radiates BRT TV2 programmes, is situated atop a tall building. Gösta has advised that following the collapse of the Wavre transmitter in Belgium, one of his most frequent signals on channel E28 has disappeared from his log. However he can receive RTBF TELE 2 programmes from a channel E49 outlet operating near Brussels. During the recent improved tropospheric conditions, Gösta noted a variety of British UHF stations and he even caught a glimpse of the famous BBC 2 Colour Test Card 'F'.

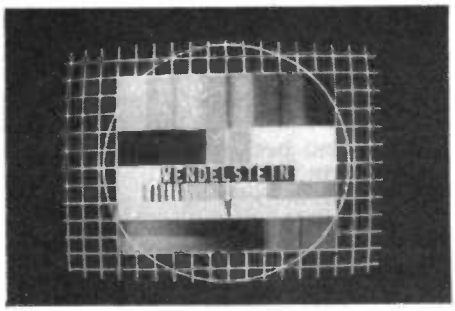
Service information

Eire:
Radio Telefis Eireann are to close the low-power channel C relay in Dublin



Pics 4 & 5 *The fully rotatable aerial system used by French TV-DXer Pierre Godou in Rennes, along with some of his shack equipment*

DX – TV RECEPTION REPORTS



FuBK test card with Tx identification used by Bayerischer Rundfunk,W Germany

since UHF coverage of RTE-1 in the area is considered to be adequate.

The RTE-2 network is to be radiated from the Kippure main transmitter on channel J (223.23MHz vision) on full power by mid-1984. It should be noted that channel I is often omitted from charts and listings and is usually incorrectly quoted as being channel J. Channel H is 207.25MHz, channel I is 215.25MHz and channel J is 223.25MHz. These frequencies correspond to vision carriers.

Spain:

Television Española appears to have altered their test transmissions. The GTE electronic test card, normally radiated for about 15 minutes prior to programme commencement, has been seen at various times of the day. Perhaps the familiar electronic bar patterns which carry transmitter location information has been discontinued – at least for the moment. We will keep a look out towards the south over the next few weeks.

Belgium:

According to the latest EBU station list the Brussels transmitter radiating TELE 2 programmes on channel E45 has increased its ERP from 500W to 1KW.

France:

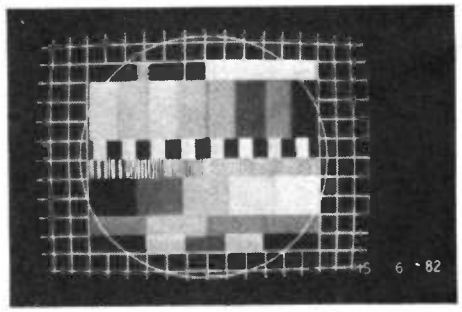
France Régions 3 are radiating a special colour test pattern during the afternoon. It consists of vertical bars with superimposed Antiope (French teletext service) information.

Syria:

The EBU now lists the SRT transmitters at Abou Kamal and Nabi-Saleh, both operating on channel E3, with ERP's of only 400W and not 400KW! Hassake on E4 is listed as 95W rather than 35KW.

Denmark:

The regional programme from Danmarks Radio known as 'TV SYD' is radiated on Sundays between 1300 and 1400 local time with repeats on Mondays from 0830 to 0930 and 1545 until 1645. The outlet at Sønderjylland operates on channel E7 with 60KW ERP.



Colour electronic test card used by NDR from the Harz outlet on E10 and E40

West Germany:

Programmes from Norddeutscher Rundfunk (NDR) are broadcast on channel E28 from Neumünster with 200KW. The ERP should soon increase to 500KW.

The Mölln/Tarkau transmitter is in service on channel E53 with an ERP of 20KW. Transmissions are also radiated from a 100W relay at Lauenburg on E46. The FuBK test card includes the identification 'SH'.

WDR-1 has started broadcasting from a 100KW outlet at Bonn on channel E43. The FuBK test card carries the identification 'WDR 1 BO 43'.

Service Information this month was kindly supplied by Andy Webster (Wigan), Gösta van der Linden (Rotterdam, Netherlands) and the European Broadcasting Union (Belgium).

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75450	85p
75451	50p
75452	50p
75453	72p
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LM381	170p
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MC1455	75p
MC1456	135p
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MC3242A	630p
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MC3401	65p
MC3403	70p
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MC3480	580p
MC34001	58p
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NE556	70p
NE565	155p
NE567	140p
SN76003	180p
SN76013	180p
SN76023	180p
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TBA920	190p
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TCA650	390p
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TL061	50p
TL062	70p
TL064	100p
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2.4576MHz	225p
3.0000MHz	240p
3.5795MHz	120p
3.6864MHz	240p
4.000MHz	150p
4.1943MHz	190p
5.0688MHz	240p
6.00MHz	190p
6.1440MHz	190p
6.880MHz	240p
8.000MHz	160p
10.000MHz	170p
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EC942 0.039" Lines
EC943 0.049" Lines
EC944 0.061" Lines
EC945 0.079" Lines
EC946 0.100" Lines
EC947 0.124" Lines
EC950/1 0.031" 90 Benos
EC951/2 0.061" 90 Bends
EC951/1 0.031" 30 45 60 Bends
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Squarewave 50Hz
Case (Maximum Dimensions)
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Case Material – Heavy Duty Steel

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26 Way Grey -do-	136p
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40 Way Grey -do-	209p
50 Way Grey -do-	262p

DIL HEADERS
(IDC TYPE)

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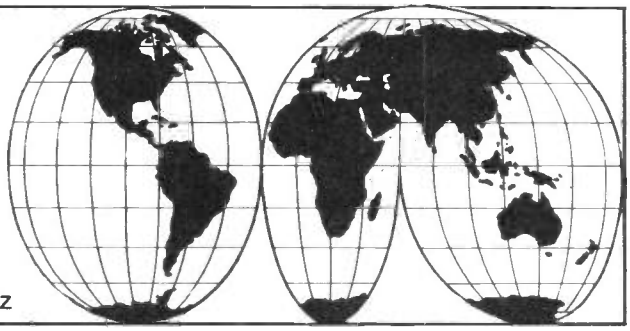
SHORT WAVE NEWS FOR DX LISTENERS



by Frank A Baldwin

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

Keeping the promise made in the December 1983 issue, here are some Latin American stations to be heard on the 90 metre band (3200 to 3400).

There is a station, Radio Riberao Preto in Brazil, on **3205** that has been logged here many times and which is on the air from 0800 to 0400 with a power of 1KW. If conditions are good for LA reception and the channel is relatively QRM free, then this one is a good 'marker' or indicator for the logging of other South American transmissions on this band.

Slightly higher up the band there is HCJB Quito in Ecuador on **3220** where it is scheduled from 0900 to 1300 and from 2130 to 0200 in Quecha – the local Indian language – and from 0200 to 0500 in Spanish, the power being 10KW.

Regularly reported in the short wave listener press is the Brazilian Lins Radio Clube, Lins on **3225** which operates in Portuguese and is on the air from 0730 to 0400 at 1KW. Sometimes the dominant transmission to be heard on this channel is the Venezuelan Radio Occidente in Tovar, on the air from 1000 to 0400 at 1KW (Saturday and Sunday until 0300) in Spanish.

The Ecuadorian La Voz del Triunfo, Santo de los Colorados may be heard on **3252** but reportedly varies from **3252** to **3253** on occasions, identifying as 'La Voz del Tigre'. It is on the air from 1000 to 0400 with a power of 1KW.

In Calceta, Ecuador is located La Voz del Rio Carrizal operating on **3260** at 2KW from 1300 to 0330 (Saturday until 0400) and on Sunday from 1200 to 0300, identifying as 'Radio Carrizal'. If, however, you would like to try for some real super DX, why not tune to **3262** where operates the Peruvian La Voz de Oxapampa located in Pasco and timed on the air from 1100 to 0330 at 1KW. Recently moved from **3260,** where it was rarely reported probably due to co-channel QRM, it should now be in the clear – we hope.

On **3275** there is a mix of two Brazilians and one Venezualan, the latter being Radio Mara, Maracaibo working from 1000 to 0400 at 1KW and the most often reported channel occupant, the Brazilians being Baura Radio Clube (0730 to 0400 at 1KW) and Radio Difusora, Caceres scheduled from 0900 to 0300 at 1KW. The latter mentioned is not very often featured in the SWL press.

More often brought to notice is the Ecuadorian La Voz del Napo located in Tena and radiating programmes in both Spanish and Quecha from 2200 to 0230 with a power of 1KW on **3280.** Quite recently a new occupant has appeared on this channel in the guise of Radio Chaco, Yacuiba in Bolivia, both the power and the schedule being unknown.

On nearby **3284** may be found the Peruvian Radio Esmeralda in Huanta, on the air from 2100 to 0300 at 1KW. Just alongside, on **3285**, you will find the often logged Radio Belize, Belmopan in Belize working to the schedule 1100 (Sunday from 1200) to 0510 at 1KW, always assuming of course that your listening session has coincided with a period of good conditions for reception of this area of the world.

Another DX gem for UK listeners would be the reception of the 0.36KW La Voz del Rio Tarqui in Cuenca, Ecuador, scheduled from 1000 to 0500. It is currently reported by USA DXers as operating on **3286,** a move from the previously occupied **3285** channel, but it has also been heard on **3869** so take your choice.

On **3290** there is the Peruvian Radio Tayabamba in La Libertad province with the schedule 1100 to 0315, power unknown; and Radio Panamericana with a 1KW signal from 2300 to 0300 operating from Quero in Ecuador.

A few KHz up the dial to **3300** where, sometimes, one can log Radio Cultural in Guatemala City, Guatemala, now working from 2245 to 0630 with a power of 10KW and being regularly mentioned in reports from DXers.

The Bolivian Radio San Miguel located in Riberalta occupies the **3310** channel from 1000 to a variable closing time around 0300. The power is 1KW and logged here in the UK several times a year.

In the above schedules I have included only that part applicable to possible reception here in the UK and omitted those times which prohibit any chance of success. The review continues next month.

AROUND THE DIAL

This information is provided to assist those interested to tune around their dials to the frequencies, and at the times stated, hopefully to log the stations we have listed here.

AFRICA

Egypt

Cairo on **15155** at 1529, an interval signal of local-style music then OM (old oam = male announcer) with station identification and recitations from the Holy Quran at the commencement of the Afar programme directed to East and Central Africa from 1530 to 1630.

Cairo on **17690** at 1433, OM with recitations from the Holy Quran during the Hindi transmission times from 1430 to 1530.

Libya

Tripoli on **15415** at 1100, OM with station identification in Arabic, drums, Arabic-type music then OM with songs in a relay of the Domestic Service on this channel from 1100 to 1745, thereafter radiating programmes as 'Voice of the Greater Arab Homeland'.

Morocco

Tangier on **17595** at 1435, OM's with songs in a vernacular, local-style music in a relay of the Home Service to the Middle East, West Africa, Europe, South Morocco and Mauritania, scheduled from 1100 to 0100 on this frequency.

Zambia

Lusaka on **4910** at 2017, OM's with a discussion in a vernacular – they use seven of them plus English in their broadcasts – but this channel is the Home Service entirely in vernaculars on the air from 0350 to 0530 and from 1530 to 2105 (Friday and Saturday until 2205). The power is 50KW.

THE AMERICAS

Columbia

Emisora Nuevo Mundo, Bogota on **4755** at 0654, OM with a programme of recorded local pop songs and music then OM with promos complete with echo-effect. The language is Spanish and this one is operating irregularly on a 24-hour basis, the power being 1KW.

Ondas del Meta, Villavicencio on **4885** at 0656, OM with a ballad in Spanish complete with local-style orchestral backing. OM with the station identification as 'Ondas del Meta, La Voz del Llano, Villavicencio, Colombiana' and frequencies. 1KW.

Costa Rica

Emisora Radio Reloj, San Jose on **4832** at 0553, OM announcer then pop songs and music in typical local style. This one is on the air around-the-clock and has a power of 1KW.

Guatemala

La Voz de Nahuala, Nahuala on **3360** at 0223, OM with announcements in Spanish, YL (young lady – female announcer or artiste) with a local folksong. LV de Nahuala operates from 2130 to 0230 at 1KW. The channel is a difficult one owing to the surrounding commercial QRM (man-made interference).