

The SHORT WAVE Magazine

VOL. XLI

APRIL 1983

NUMBER 2

the new **R 2000** general coverage receiver from Trio.

Now from Trio, the R2000 general coverage receiver. By taking all the superb features of the R1000 and combining them with the latest in micro-processor control Trio have, in one step, completely revised the standard by which short wave receivers are judged. Among the many features provided for the discerning listener are programmable scan, memory scan, memory retention of the mode set for a particular frequency and last, but not least, Trio have included an FM mode — why FM after all this time and our repeated comment that for a short wave broadcast receiver FM is not really necessary. Take a look at the rear panel of the R2000: a socket marked VHF converter. Wouldn't it be superb if Trio produced a VHF converter covering from 118 to 174 MHz — then you would require FM, you would also require AM. Study the features and I am sure you will agree the Trio R2000 is the receiver for you.

Continuous Coverage from 150 KHz to 30 MHz. Use of an innovative up conversion digitally controlled PLL circuit provides maximum ease of operation and superb receiver performance. Front panel up/down band switches allow easy selection within the full coverage of the receiver. The VFO is continually tunable throughout the full 150 KHz — 30 MHz range.

All modes SSB, CW, AM and FM. To give full listening potential USB, LSB, CW, AM, and FM are provided for easy selection by push buttons having adjacent led indicators.

Adjustable Tuning Rate. Tuning speed switches enable the tuning rate to be in either 50 Hz, 500 Hz or 5 KHz. A frequency lock switch is included to guard against accidental shift.

Ten Memories Store Frequency, Band and Mode Data. Each of the ten memories can be tuned by the VFO, thus operating as ten built in digital VFO's. The original memory frequency can be recalled by simply pressing the appropriate memory channel key. All information on frequency, band, and mode is stored in the selection memory. The "auto M" switch allows two types of memory storage: when the "auto M" switch is off, data is memorized by pressing the "M in" switch; when the "auto M" switch is on the frequency being used at that time is automatically memorized.

Memory Scan. Scans all memory channels or may be user programmed to scan specific channels. Frequency, band and mode are

automatically selected in accordance with the memory channel being scanned.

Programmable Band Scan. Scans automatically within the programmed bandwidth. Memory channels 9 and 0 establish the scan limit frequencies. The hold switch interrupts the scanning process. However, the frequency may be adjusted using the tuning knob whilst in the scan hold position.

Lithium Battery Memory Back Up. Memory and VFO information is maintained by an internal lithium battery (estimated life, five years), a most important feature when moving the receiver from location to location.

Clock Display with Integral Timer. Two 24-hour quartz clocks are built in to allow for programming two different time zones. An integral timer is provided for on and off switching of the receiver.

Three Built In Filters with Narrow/Wide Selector. In the AM mode 6 KHz wide or 2.7 KHz narrow may be selected. In the SSB mode 2.7 KHz is automatically selected. In the CW mode 2.7 KHz is again chosen and if the optional YG455C filter is installed then 500 Hz in the narrow position. In the FM mode 15 KHz bandwidth is automatically selected. Other important features are: squelch on all modes, noise blanker, a large 4-inch front mounted speaker, tone control, RF attenuator, AGC switch, high and low impedance antenna terminals, optional 13.8V DC operation, record jack and, of course, provision for a VHF converter.

All in all, a truly remarkable receiver.

R2000 £398.00 inc. VAT. Carr. £5.00



“memorable”

LOWE ELECTRONICS

Chesterfield Road, Matlock, Derbyshire. DE4 5LE.
Telephone 0629 2817, 2430, 4057, 4995. Telex 377482.

remember the **KX2** now available the **KX3**

The KX3 is a wide range general coverage tuning unit specially developed for the short wave listener. Using high Q coils, and air spaced variable capacitors, the KX3 is designed to give additional front end selectivity as well as wide range impedance matching.

As a further feature, the range from 10KHz to 500KHz is provided with a low pass filter so as to allow listening below 500 KHz whilst rejecting strong medium wave stations in the 500 KHz to 1.5 MHz band.

Provision is made for using the tuning capacitors in the KX3 to resonate an external loop type aerial for medium wave directional reception.

- Frequency range 10 KHz-30 MHz
- Functions 10 KHz-500 KHz L.P.F.
500 KHz-30 MHz Pi match
- Number of bands 8
- Input and output impedance 50-600 ohms
- Size 220 x 66 x 154 mm

Both coaxial and wire aerials can be connected to the KX3.

KX3 RECEIVER ANTENNA TUNING UNIT £42.50 inc. VAT.



AF 606K

AUDIO FILTER £63.25 carr. £2.00

From Daiwa yet another aid to operating. In addition to the notch, SSB and CW filters, the AF606K is equipped with a PLL tone decoder; when the tone frequency of the CW signal and the free running frequency of the PLL tone decoder are the same a locked signal is generated. This locked signal keys an audio oscillator which then reproduces the received CW signal. However, there is a tremendous difference between the produced signal and the received one — no noise and, of course, no fading. **ANOTHER PIECE OF EQUIPMENT TO ENHANCE YOUR LISTENING.**



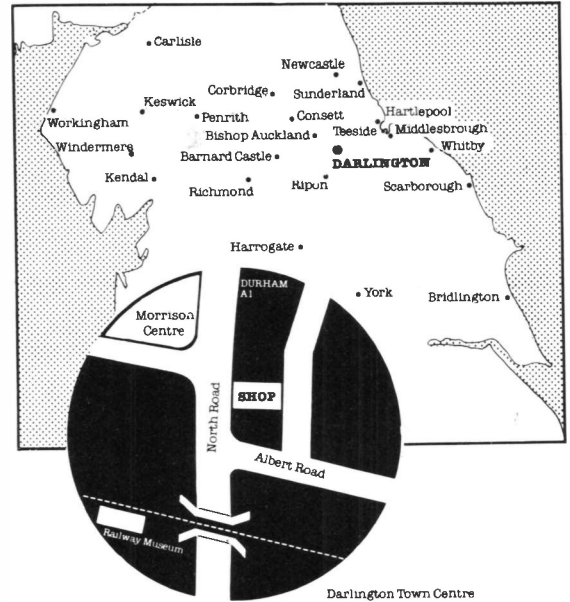
DK 210

**ELECTRONIC KEYSER
£47.00 inc. VAT carr. £2.25**

With so many electronic keys and keyers on the market, it's hard to describe one that is better than the rest. Inevitably it is a matter of "feel", and the feel of the New Daiwa DK210 is superb. Being Daiwa, the quality of design and construction has to be of the best, but it's in use that the DK210 is so impressive. Designed to be used with an external paddle, to give greater personal choice, the DK210 is otherwise self contained, even to being battery powered (PP3). It offers a speed range of 10 to 50 w.p.m., built in sidetone, facilities for semi auto, or fully auto keying, and a tune position for adjusting your transmitter, but the outstanding feature is the adjustable "weight" control. This control gives an amazing improvement in the character of the sending, and completely removes that mechanical sounding "electronic morse" characteristic. Those experienced CW users who have tried out the DK210 have all said how good it sounds — and have usually purchased one. So will you if you try it out.

DK210 from DAIWA — A truly nice keyer.

LOWE ELECTRONICS IN THE NORTH EAST



A huge free car park, a shopping complex which has within it a large supermarket, a wine and spirits shop, a bistro restaurant and convenient banking facilities has nothing at all to do with amateur radio.

However, as all these facilities are to be found across the road from our new amateur radio shop in the North East of England, then you will appreciate that we take great care in positioning the Lowe Electronic shops to help both you and other members of your family. The shop is in Darlington, 66 North Road, that is on the A167 road to Durham, only a few minutes from the town centre. Darlington is a delightful market town with extremely good links to the A1 north or south and to the west and east. Indeed, Darlington is easy to get to from towns such as Scarborough, Bridlington, York, Harrogate, Penrith and Carlisle. To the fortunate Radio Amateurs of the North East, then you have Lowe Electronics in your own backyard.

A Lowe Electronics' shop means the opportunity to browse, to try out, without sales pressure, a new or second hand piece of equipment before you buy it. And not only that, the shop will stock all the usual accessories, aerials, swr meters, cables, rotators, tuning units, plugs, sockets, etc. All equipment bought from the Darlington shop will carry the now well-known Lowe after sales service. It is a fact that today's equipment, although very reliable, is extremely complex and although not beyond the amateur, the expensive test equipment required for the repair leave most of us in the hands of the person who sold us the rig.

With Lowe Electronics not only are the hands helpful but technically able.

RING FOR OPENING DETAILS

LOWE IN LONDON, Open monday to saturday, six days a week
lower sales floor, Hepworths, Pentonville Rd, London. telephone 01.837.6702
LOWE IN GLASGOW, Open tuesday to saturday
4,5 Queen Margarets Rd, Glasgow. telephone 041.945.2626



**TR3500****COMPACT SIZE AND LIGHT WEIGHT**

Measures only 66W x 168H x 40D mm with a weight of 540grams including Ni-Cd battery pack.

LCD DIGITAL FREQUENCY READOUT

Easy to read in direct sunlight, or in the dark. Virtually no current drain (much less than LED's). Displays transmit and receive frequencies and memory channels. Display includes four "Arrow" indicators: "F. LOCK" (Frequency Lock), "REV" (Repeater Reverse), "PROG. S" (Programmed Scan), "MS" (Memory Scan).

TEN CHANNEL MEMORY

Nine memories may be operated in simplex mode, or with transmit frequency offset permitting access to repeaters.

LITHIUM BATTERY MEMORY BACK-UP

No loss of memory in case of complete discharge (or removal of the Ni-Cd batteries). Current (approximately 1 microampere) to maintain memory supplied by built-in separate lithium battery, with estimated life of more than 5 years.

MEMORY SCAN

Scans only those channels (maximum 10) in which frequency data is stored. Stops on "Busy" channel, resumes scan automatically approximately 2 seconds after signal goes off, or when "MS" key is pressed. The "STOP" key or the PTT switch may be used to cancel the scan function. LCD displays memory channel number and "MS" arrow while memory scan is in use.

PROGRAMMABLE BAND SCAN

Scan bandwidth (lower and upper frequency limits) and scan steps of 5kHz and larger (5, 10, 15, 20, 25 kHz, etc.) may be programmed. Scan automatically locks up on busy channel and resumes approximately 2 seconds after signal goes off or when "PROG. S" key is pressed. "STOP" key or PTT switch cancels scan function.

UP/DOWN MANUAL SCAN

UP/DOWN manual scan in 5 kHz steps.

FREQUENCY COVERAGE

Covers 430.00 – 439.995 MHz in 5 kHz steps.

TONE BURST SWITCH

The TONE BURST switch activates the 1,750 Hz repeater access tone oscillator.

TX OFFSET SWITCH

Selects simplex or repeater operation (operator pre-programmes repeater OFFSET MAX ± 9.995 MHz).

HI/LOW POWER SELECTION

HI/LOW power output switch allows operation at 1.5W or, for extended battery life, 300 mW.

REVERSE OPERATION

"REV" switch shifts the receiver to the transmit frequency, and the transmitter to the receive frequency. Useful for checking signals on the input of a repeater, to determine if you are within simplex range.

AUTO/MANUAL SQUELCH

Selector switch on threshold control allows selection of automatic or manual squelch operation.

BATTERY INDICATOR

LED battery condition indicator flashes when battery charge level approaches nominal discharged battery potential.

TWO "LOCK" SWITCHES

"F. LOCK" switch prevents accidental loss of chosen frequency when in "LOCK" position. "TX. STOP" switch prevents accidental transmission if PTT switch is accidentally pressed in handling.

BNC ANTENNA TERMINAL

Allows antenna changeover to be quick and easy.

ACCESSORIES INCLUDED

- Flexible rubberised antenna with BNC connector.
- 400 mA Ni-Cd battery pack.
- AC charger.
- Plug for external microphone and speaker.
- Hand strap.

“compatible”

the two metre &
seventy centimetre
handhelds from
Trio.

TR2500 £232.53 inc. VAT, carr. £5.00

TR3500 £250.70 inc. VAT, carr. £5.00

PRICES AND SPECIFICATION SUBJECT TO CHANGE WITHOUT NOTICE.

LOWE ELECTRONICS

Chesterfield Road, Matlock, Derbyshire. DE4 5LE.

Telephone 0629 2817, 2430, 4057, 4995. Telex 377482.



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 TO ORDER ANY OF THE ITEMS LISTED BELOW
 SIMPLY WRITE ENCLOSING A CHEQUE OR PHONE
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WE DO THE REST!

Bredhurst electronics

WELZ SP 15M £35.00



WELZ		£	C&P
SP15M	SWR-PWR Meter H.F./2M 200W	35.00	(1.00)
SP45M	SWR-PWR Meter 2M/70cm 100W	51.00	(1.00)
SP200	SWR-PWR Meter H.F./2M 1KW	69.95	(1.50)
SP300	SWR-PWR Meter H.F./2M/70cm	97.00	(1.50)
SP400	SWR-PWR Meter 2M/70cm 150W	69.95	(1.50)
SP10X	SWR-PWR Meter H.F./2M compact	74.45	(0.75)
SP380	SWR-PWR Meter H.F./2M/70cm compact	49.00	(1.00)
AC38	A.T.U. 3.5 to 30MHz 400W PEP	65.00	(1.00)
CT115A	15/50W Dummy Load (PL259)	7.95	(0.75)
CT115N	15/50W Dummy Load (N type plug)	13.95	(0.75)
CT300	300/1kW Dummy Load 250MHz (SO239)	49.50	(2.00)

SWR - POWER METERS		£	C&P
Model 110	H.F./2M Calibrated Power Reading	11.50	(0.50)
YW-3	H.F./2M Twin Meter	11.50	(0.50)
UH74	2M/70	14.30	(0.50)
T435N	2M/70CM Twin Meter 120W	37.00	(0.75)
DAIWA CN620A	H.F./2M Cross Pointers	57.00	(-)
DAIWA CN630	2M/70 Cross Pointers	85.00	(-)

DUMMY LOADS		£	C&P
DL30	PL259 30W MAX	5.00	(0.50)
WELZ CT15A	50W MAX PL259	7.95	(0.75)
WELZ CT15N	50W MAX N type	13.95	(0.75)
T100	100W MAX 450MHz	22.95	(0.75)
T200	200W MAX 450MHz	34.00	(0.75)
DL600	600W MAX 350MHz	34.00	(1.50)
WELZ CT300	1000W MAX 250MHz	49.50	(2.00)

YAESU		£	C&P
FT1	Superb H.F. Transceiver	1349.00	(-)
FT980	H.F. Transceiver	1115.00	(-)
FC902	All Band A.T.U.	135.00	(1.50)
SP901	External Speaker	31.00	(1.50)
FT102	160/10M 9 Band Transceiver	785.00	(-)
FT707	8 Band Transceiver 200W PEP	509.00	(-)
FP707	Matching Power Supply	112.00	(5.00)
FC707	Matching A.T.U. Power Meter	85.00	(1.00)
MMB2	Mobile Mounting Bracket for FT707	16.10	(1.00)
FRG7	General Coverage Receiver	199.00	(-)
FRG7700	200KHz - 30MHz Gen. Coverage Receiver	335.00	(-)
FRG7700M	As above but with Memories	399.00	(-)
FRA7700	Antenna Tuning Unit	37.95	(1.00)
FRA7700	Active Antenna Unit	36.40	(1.00)
FT208R	2M F.M. Synthesised Handheld	199.00	(-)
FT208R	70cm F.M. Synthesised Handheld	229.00	(-)
NC7	Base Trickle Charger	26.90	(1.30)
NC8	Base Fast-Trickle Charger	44.10	(1.50)
NC9C	Compact Trickle Charger	8.00	(0.75)
FBA2	Batt. Sleeve for use with NC7/8	3.05	(0.50)
FN2	Spare Battery Pack	17.25	(0.75)
PA3	12V DC Adaptor	13.40	(0.75)
FT480R	2M Synthesised Multimode	369.00	(-)
FT780R	70cm Synthesised Multimode (1.6MHz Shift)	409.00	(-)
FT290R	2m Portable Multimode	265.00	(-)
FT790R	70cm Portable Multimode	325.00	(-)
MMB11	Mobile Mounting Bracket	22.25	(1.00)
CSC1	Soft Carrying Case	3.45	(0.75)
NC11C	240V AC Trickle Charger	8.00	(0.75)
FL2010	Matching 10W Linear	54.00	(1.20)
Nicads	2.2 AMP-HR Nicads	2.50	(-)
FF501DX	H.F. Low Pass Filter 1kW	23.00	(1.00)
FSP1	Mobile, External Speaker 8 ohm 6W	9.95	(0.75)
YH55	Headphones 8 ohm	9.90	(0.75)
YH77	Lightweight Headphones 8 ohm	9.90	(0.75)
QTR24D	World Clock (Quartz)	28.00	(1.00)
YM24A	Speaker/Mic 207/208/708	16.85	(0.75)
YD148Z	Stand Mic. Dual IMP 4 Pin Plug	21.10	(1.50)
YM38	As 34 but up/down Scan Buttons	24.90	(1.50)

FDK VHF/UHF EQUIPMENT		£	C&P
Multi 750X	2M Multimode Mobile	315.00	(-)
Expander	70cm Transverter for M750E	199.00	(-)

DRAE		£	C&P
Power Supplies			
4 AMP		30.75	(1.50)
6 AMP		49.00	(2.00)
12 AMP		74.00	(2.00)
24 AMP		105.00	(3.00)
VHF Wavemeter	130-450MHz	27.50	(-)

TELEREADERS (CW & RTTY)		£	C&P
TASCO CWR 610		189.00	(-)
TONO 500		299.00	(-)
TONO 9000		699.00	(-)

MORSE EQUIPMENT		£	C&P
MK 704	Squeeze Paddle	11.95	(0.75)
HK 708	Up/Down Key	10.50	(0.75)
	Practise Oscillator	87.75	(0.50)
EK 121	Elbug	33.00	(0.75)
EKM12A	Matching Side Tone Monitor	10.95	(0.75)
EK150	Electronic Keyer	88.00	(-)

ICOM		£	C&P
IC 740	H.F. 9 band transceiver	725.00	(-)
IC 720A	H.F. Tx + Gen. Cov. Rx	949.00	(-)
IC-PS20	P.S.U. for above with Speaker	139.00	(-)
IC-PS15	P.S.U.	119.00	(-)
IC 2KL	H.F. Linear 500 Watts O/P	915.00	(-)
IC 2KLPS	P.S.U. for above	234.00	(-)
IC AT500	1.8-30MHz auto A.T.U.	339.00	(-)
IC AT100	3.5-30MHz auto A.T.U.	249.00	(-)
IC 251E	2M Multimode Base Station	559.00	(-)
IC 290E	2M Multimode Mobile	379.00	(-)
IC 25E	2M FM Mobile 25W	269.00	(-)
IC 2E	2M Handheld	169.00	(-)
IC 4E	70cm Handheld	199.00	(-)
IC BC30	Base Charger	49.00	(1.50)
IC HM9	Speaker - Microphone	12.00	(1.00)
IC ML1	10 Watt 2B Booster IC 2E	59.00	(1.00)
IC SM5	Desk Mic. (8 pin for Icom only)	29.00	(1.00)
IC R70	General Cov. Receiver	499.00	(-)

TV INTERFERENCE AIDS		£	C&P
Ferrite Rings 1 1/2" dia. per pair		0.80	(0.20)
Toroid Filter TV Down Lead		2.50	(0.50)
Tro Low Pass Filter LF30A 1kW		21.00	(1.00)
Yaesu Low Pass Filter FF501DX 1kW		23.00	(1.00)
HP4A High Pass Filter TV Down Lead		5.95	(-)

ANTENNA BITS		£	C&P
H1-Q Balun 1:1 5kW pep (PL259 Fitting)		9.95	(0.75)
7.1 MHz Traps		7.95	(0.75)
T Piece Polyprop Dipole Centre		1.20	(0.30)
Polyprop Strain Insulators		0.40	(0.10)
Small Egg Insulators		0.40	(0.10)
Large Egg Insulators		0.50	(0.10)
4mm Polyester Guy Rope			
15 strength 400kg per metre		0.18	(0.04)
75 ohm Twin Feeder - Light Duty - Per Metre		0.16	(0.04)
300 ohm Twin Feeder - Per Metre		0.14	(0.04)
URM67 Low Loss 50 ohm Coax - Per Metre		0.60	(0.20)
UR76 50 ohm Coax - Per Metre		0.25	(0.05)

Please send total postage indicated. Any excess will be refunded.

TRIO TS 430 £736.00



Amateur band transceiver/General coverage receiver

TRIO		£	C&P
TS930S	New Transceiver	1216.00	(-)
TS830S	160/10M Transceiver 9 Bands	697.00	(-)
VFO230	Digital V.F.O. with Memories	243.00	(2.00)
AT230	All Band ATU/Power Meter	135.00	(2.00)
SP230	External Speaker Unit	41.00	(1.50)
TS430S	160/10M Transceiver	736.00	(-)
TS130S	8 Band 200W Pep Transceiver	559.00	(-)
TS130V	8 Band 200W Pep Transceiver	456.00	(-)
VFO120	External V.F.O.	98.00	(1.50)
TL120	200W Pep Linear for TS120V	167.00	(1.50)
MB100	Mobile Mount for TS130-120	18.60	(1.50)
SP120	Base Station External Speaker	26.45	(1.50)
AT130	100W Antenna Tuner	93.15	(1.50)
PS20	AC Power Supply - TS130V	57.95	(2.50)
PS30	AC Power Supply - TS130S	101.00	(5.00)
MC50	Dual Impedance Desk Microphone	30.00	(1.50)
MC35S	First Microphone 50K ohm IMP	14.70	(0.75)
MC30S	First Microphone 500 ohm IMP	14.70	(0.75)
LF30A	H.F. Low Pass Filter 1kW	21.00	(1.00)
TR9130	2M Synthesised Multimode	433.00	(-)
BO9A	Base Plinth for TR9130	39.00	(1.50)
TR7730	2M Synthesised F.M. Compact Mobile. 25W	199.00	(-)
TR2300	2M Synthesised F.M. Portable	152.00	(-)
VS2300	10W Amplifier for TR2300	65.75	(1.50)
MB2	Mobile Mount for TR2300	21.00	(1.50)
TR3500	70cm Handheld	250.00	(-)
TR2500	2M F.M. Synthesised Handheld Base Stand	232.00	(-)
ST2	Soft Case	51.90	(1.50)
SC4	Soft Case	13.80	(0.50)
MS1	Mobile Stand	31.90	(1.00)
SMC25	Speaker Mike	16.10	(1.00)
PB25	Spare Battery Pack	25.00	(1.00)
TR8400	70cm F.M. Synthesised Mobile Transceiver inc. PS10	299.00	(-)
PS10	Base Station Power Supp. for 8400	64.00	(2.00)
TR9500	70cm Synthesised Multimode	450.00	(-)
R2000	200KHz - 30MHz Receiver	398.00	(-)
R600	Gen. Cov. Receiver	257.00	(-)
HC10	Digital Station World Time Clock	67.60	(1.50)
H55	Deluxe Headphones	23.00	(1.00)
HS4	Economy Headphones	11.27	(1.00)
SP40	Mobile External Speaker	14.26	(1.00)

ROTATORS		£	C&P
Hirschman	RO250 VHF Rotor	45.00	(2.00)
9502B	Colorator (Med. VHF)	56.95	(2.00)
KR400RC	Kenpro - inc. lower clamps	125.00	(2.50)
KR600RC	Kenpro - inc. lower clamps	175.00	(3.00)

DESK MICROPHONES		£	C&P
SHURE	444D Dual Impedance	39.00	(1.50)
SHURE	526T MK II Power Microphone	53.00	(1.50)
ADONIS	AM 303 Preamp Mic. Wide Imp.	29.00	(-)
ADONIS	AM 503 Compression Mic. T	39.00	(-)
ADONIS	AM 802 Compression Mic. Meter 30P	59.00	(-)

MOBILE SAFETY MICROPHONES		£	C&P
ADONIS	AM 202S Clip-on	24.50	(-)
ADONIS	AM 202H Head Band + Up/Down Buttons	34.50	(-)
ADONIS	AM 202F Swan Neck + Up/Down Buttons	37.00	(-)

TEST EQUIPMENT		£	C&P
Drax	VHF Wavemeter 130-450MHz	27.50	(-)
DM81	Trio Dip Meter	71.00	(0.75)
MMD50/500	Dig. Frequency meter (500MHz)	75.00	(-)

Co-AXIAL SWITCH		£	C&P
2 Way Decast (V.H.F.) SA450		10.00	(0.75)
2 Way Decast with N sockets		12.95	(0.75)
2 Way Toggle (V.H.F.)		6.00	(0.50)
WESTERN	5 Way 1KW Switch	13.95	(1.00)

HELICAL ANTENNAS		£	C&P
2M BNC or PL259 (state which required)		4.50	(0.50)
2M Thread for TR2300 or FT290R (state which)		4.50	(0.50)
70cm BNC		4.50	(0.50)

MICROWAVE MODULES		£	C&P
MMT144 28	2M Transverter for HF Rig	109.95	(-)
MMT432-28S	70cm Transverter for HF Rig	159.95	(-)
MMT432-144R	70cm Transverter for 2M Rig	184.00	(-)
MMT70-28	4M Transverter for HF Rig	119.95	(-)
MMT70-144	4M Transverter for 2M Rig	119.95	(-)
MMT1296-144	23cm Transverter for 2M Rig	184.00	(-)
MML144-30	2M 30W Linear Amp	69.95	(-)
MML144-100S	2M 100W Linear Amp (10W I/P)	139.00	(-)
MML144/100LS	2M 100W Linear Amp (3W I/P)	159.00	(-)
MML432-30	70cm 30W Lin. Amp (3W I/P)	99.00	(-)
MML432-50	70cm 50W Linear Amp	109.95	(-)
MML432-100	70cm 100W Linear Amp	228.64	(-)

MM2001	RTTY to TV Converter	169.00	(-)
MM4000	RTTY Transceiver	269.00	(-)
MMC50-28	5M Converter to HF Rig	29.90	(-)
MMT70-28	4M Converter to HF Rig	29.90	(-)
MMC144-28	2M Converter to HF Rig	29.90	(-)
MMC432-28S	70cm Converter to HF Rig	37.90	(-)
MMC432-144S	70cm Converter to 2M Rig	37.90	(-)
MMC435-600	70cm ATV Converter		

AMATEUR ELECTRONICS UK



Your number one source for YAESU MUSEN

KEEP AHEAD WITH THE YAESU FT-102!

Better Dynamic Range

The extra high-level receiver front end uses 24 VDC for both RF amplifier and mixer circuits, allowing an extremely wide dynamic range for solid copy of the weak signals even in the weekend crowds. For ultra clear quality on strong signals or noisy bands the high voltage JFET RF amplifier can be simply bypassed via a front panel switch, boosting dynamic range beyond 100dB. A PLL system using six narrow band VCOs provides exceptionally clean local signals on all bands for both transmit and receive.

Total IF Flexibility

An extremely versatile IF Shift/Width system, using a totally unique circuit design, gives an infinite choice of bandwidths between 2.7kHz and 500Hz, which can then be tuned across the signal to the portion that provides the best copy sans QRM, even in a crowded band. A wide variety of crystal filters for fixed IF bandwidths are also available as options for both parallel and cascaded configurations. But that's not all; the 455kHz third IF also allows an extremely effective IF notch tunable across the selected passband to remove interfering carriers, while an independent audio peak filter can also be activated for single-signal CW reception.

New Noise Blanker

The new noise blanker design in the FT-102 enables front panel control of the blanking pulse width, substantially increasing the number of types of noise interference that can be blanked, and vastly improving versatility.

Commercial Quality Transmitter

Introducing to amateur radio design concepts that have previously been restricted to top-of-the-line commercial transmitters; far above and beyond government standards in both freedom from distortion and purity of emissions.

Transmitter Audio Tailoring

The microphone amplifier circuit incorporates a tunable audio network which can be adjusted by the operator to tailor the transmitter response to individual voice characteristics before the signal is applied to the superb internal RF speech processor.

IF Transmit Monitor

An extra product detector allows audio monitoring of the transmitter IF signal, which, along with the dual meters on the front panel, enables precise setting of the speech processor and transmit audio. A new "peak hold" system is incorporated into the ALC metering circuit to further take the guesswork out of transmitter adjustment.

New Purity Standard

Three 6146B final tubes in a specifically configured circuit provide a freedom from IMD products and an overall purity of emission unattainable in two-tube and transistor designs.

New VFO Design

Using a new IC module developed especially for Yaesu, the VFO in the FT-102 exhibits exceptional stability under all operating conditions.

ANCILLARY EQUIPMENT

SP-102 EXTERNAL SPEAKER/AUDIO FILTER
The SP-102 features a large high-fidelity speaker



with selectable low- and high-cut audio filters allowing twelve possible response curves. Headphones may also be connected to the SP-102 to take advantage of the filtering feature.

FC-102 1.2 KW ANTENNA COUPLER
1.2KW band-switched L-C pi-network antenna

FV-102DM SYNTHESIZED, SCANNING EXTERNAL VFO

FRG-7700 High Performance Communications Receiver



YAESU's top of the range receiver. All-mode capability, USB, LSB, CW, AM and FM 12 memory channels with back-up. Digital quartz clock feature with timer. Pictured here with matching FRT-7700 Antenna tuner and FRV-7700 VHF converter.

FT-708R/208R Synthesized UHF/VHF Transceivers

- NC-7 - Standard charger
- NC-8 - Standard/quick charger/DC Power supply
- NC-9C - Compact charger (220-234V)
- PA-3 - Car adapter
- YM-24A - Speaker/microphone
- FL-2010 - 10 watt power amplifier for FT-208R
- FL-7010 - 10 watt power amplifier for FT-708R



FT-290R/790R 2m & 70cm PORTABLES

10 memories, 2 VFO's, LCD display, C size battery, easy car mounting tray, FT-290R 0.5 low/2.5 high watts out FT-790R 0.2 low/1.0 high watts out (incorporates speech compressor).



FT-230R/730R 2m & 70cm FM MOBILES

- Two independent VFO's ● 10 memories
- Priority function ● Memory and band scan
- 12.5/25KHz steps (25/100KHz FT-730R)
- Large LCD readout.



FT-480R/780R 2m & 70cm MOBILES

The most advanced 2 metre and 70 cm mobiles available today — USB, LSB, FM, CW full scanning with priority channel, 4 memory channel, dual synthesized VFO system.





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EXCELLENCE

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FT-980 ALL MODE HF CAT *

This incredible new transceiver incorporates the highest level of microprocessor control ever offered in an HF all solid-state radio. Including a general coverage (0.15-30MHz) receiver with its own, separate front end, this amateur transceiver offers a new dimension in frequency control; whereby frequencies can be entered by either front panel keypad or tuning dial, and then scanned in selectable steps either freely or between any two programmable limits. Twelve memories include four with special protection, and two large digital displays allow full flexibility and control for split frequency operation while two meters allow full transmitter information.

Additional controls include IF Width and Shift on concentric controls, AMGC (Automatic Mic Gain Control) to set microphone input threshold, RF Speech Processor, ALC Meter Hold function, IF Notch and Audio Peak filters, Transmit Monitor, Noise Blanker and CW Full Break-in. Controls



NEW!

* Computer-Aided Transceiver

are also provided for FM Squelch and CW Keyer Speed when the optional FM and Keyer Units are installed.

The most important feature of the FT-980 is that practically all of the above features can be controlled by the user's separate personal computer, when connected through an optional Interface, also available from Yaesu. Where up to now the

few amateur transceivers that offered any kind of computer interfacing at all permitted only frequency control, the FT-980 permits almost total control of all functions from a separate micro-computer, including Mode; IF Width and Shift; Scanner Step, Speed and Limits; and switching of most other functions. (Microcomputers are not available from Yaesu.)

FT-77 THRIFTY HF TRANSCEIVER



UTILIZING THE NEW CAD/CAM* MANUFACTURING TECHNIQUES, YAESU PRESENTS THE FT-77 AS A NEW MILESTONE IN RELIABILITY, SIMPLICITY AND ECONOMY IN HF COMMUNICATIONS.

Thrifty

Featuring efficient, all solid-state, no-tune circuitry, the FT-77 offers a nominal 100 watts of RF output on all amateur bands between 3.5 and 30 MHz, including the WARC bands. New CAD/CAM techniques plus the simple design of the FT-77 add up to one of the smallest, lightest HF transceivers ever; both in your hands, and on your wallet.

Simple

The front panel control layout and operation are actually simpler than some VHF FM transceivers, with only essential operating controls; while the simple circuit design leaves fewer parts that could cause problems. Nevertheless, all of the essential modern operating features for HF SSB and CW are included, along with extras such as dual selectable noise blanker pulse widths (designed to blank woodpecker or common impulse noise), full SWR metering, and capabilities for an optional internal fixed-frequency channel crystal, narrow CW filter and FM Unit.

Reliable

Computer-aided design of the circuit boards in the FT-77 ensures the most efficient component layout possible in the smallest space, while automatic parts insertion and soldering greatly diminish the chance for human error. Reliability and quality control are thus improved and simplified beyond the degree previously attainable in amateur equipment. This means longer equipment life with less chance of breakdown.

Expandable

The extremely compact size and simple control layout make the FT-77 ideal for mobile operation, or as the heart of a complete base station with the optional FP-700 AC Power Supply, FV-700DM Digital Scanning VFO and Memory System, FTV-700 V/UHF Transverter and the FC-700 Antenna Tuner. The competitive price of the FT-77, coupled with the expansion capabilities presented by these accessories, make this transceiver the perfect choice for those new to amateur HF communication, or as a practical second rig for old-timers.

*Computer Aided Design/Computer Aided Manufacture

FT-726R VHF/UHF Multi- bander



Combining all of the best features from Yaesu HF and V/UHF transceivers, the FT-726R opens a new world of operating ease and flexibility for FM, SSB and CW on the 50*, 144 and 430/440 MHz amateur bands. The design of the FT-726R integrates the individual operating requirements of each of the three operating modes into one unit, and the user can then select which of the optional plug-in band modules he desires.

The VFO-A/B scheme has ten programmable memories, and can be tuned in 20Hz steps for CW and SSB operation, or in selectable steps for FM. FM tuning is accomplished by an indented tuning knob. IF Width and Shift controls are provided for CW and SSB operation, while both preset standard and user programmable repeater offsets can be selected for all modes. An optional Satellite Unit makes the FT-726R into a full duplex cross-band satellite transceiver.

*144 MHz Unit installed, other Units available as options according to local regulations.

AGENTS

North West - Thanet Electronics Ltd, Gordon, G3LEQ, Knutsford (0565) 4040
Wales & West - Ross Clare, GW3NWS, Gwent (0633) 880 146
East Anglia - Amateur Electronics UK, East Anglia, Dr. T. Thirst (TIM) G4CTT
Norwich 0603 667189
North East - North East Amateur Radio, Darlington 0325 55969
Shropshire - Syd Poole G3IMP, Newport, Salop 0952 814275

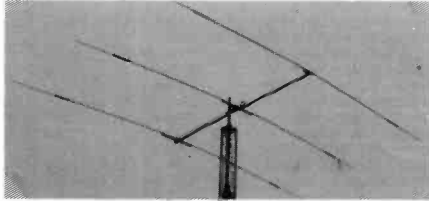
For full details of these new and exciting models, send today for our latest SHORT FORM CATALOGUE. All you need do to obtain the latest information about these exciting developments from the World's No.1 manufacturer of amateur radio equipment is to send 36p in stamps and as an added bonus you will get our credit voucher value £3.60 - a 10 to 1 winner!

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TET ANTENNA SYSTEMS



AX210N	10 ele. yagi for 2m crossed	74.95	(n/c)
H810F2T	2 ele. 10m mono band beam	51.50	(n/c)
H810F3T	3 ele. 10m mono band beam	74.95	(n/c)
H815F2T	2 ele. 15m mono band beam	60.66	(n/c)
H815F3T	3 ele. 15m mono band beam	93.45	(n/c)
H815M25P	VP mini size 15m 2 ele.	69.50	(n/c)
H815M35P	VP mini size 15m 3 ele.	102.30	(n/c)
H834D	4 ele. tri band beam 10/15/20m	222.90	(n/c)
H8335P	3 ele. tri band beam 10/15/20m	192.50	(n/c)
H835C	Tri band array 10/15/20m	283.95	(n/c)
H835T	5 ele. 10/15/20m	278.50	(n/c)
MV38H	Vertical for 10/15/20m	37.99	(n/c)
MV48H	Vertical for 10/15/20/40m	48.90	(n/c)
MV58H	Vertical for 10/15/20/40/80m	63.95	(n/c)
MLA4	Loop antenna 10/15/40/80	105.60	(n/c)
SQ22	Phased 2 ele. swiss quad 2m	58.95	(n/c)
SQ0Y6	6 ele. quagi 2m	45.75	(n/c)
SQ0Y8	8 ele. quagi 2m	52.75	(n/c)
H8210S	10 ele. dual driven yagi 2m	47.99	(n/c)
TE214	14 ele. long yagi 2m	74.40	(n/c)
SSL270	9 x 2 ele. (13) slot fed 70cm	77.20	(n/c)
H8235P	2 ele. tri band beam 10/15/20m	135.60	(n/c)
SSL218	9 x 2 ele. (18) slot fed 2m	144.79	(n/c)
HPH2	Phasing harness 2m	17.25	(n/c)
QYU10	10 ele. quagi 70cm	67.90	(n/c)
SQ007	70cm 2 ele. phased swiss quad	66.99	(n/c)
SQ10	Swiss quad 10m	97.50	(n/c)
SQ15	Swiss quad 15m	106.90	(n/c)

YAESU ANTENNAS

Base			
RSL145GP	1/2 wave base ant. 2m	21.20	(1.50)
RSL435GP	1/2 wave co-linear 70cm	31.60	(1.17)
HF Mobile			
RSL3.5	3.5MHz resonator & whip	12.21	(0.50)
RSL7.0	7.0MHz resonator & whip	11.80	(0.50)
RSL14.0	14.0MHz resonator & whip	11.45	(0.50)
RSL21.0	21.0MHz resonator & whip	11.20	(0.50)
RSL28.0	28.0MHz resonator & whip	11.00	(0.50)
RSL2A	Mast to suit above	5.00	(0.50)
RSM2	Gutter mount/Feeder/PL259 suit above	10.94	(0.75)

VHF Mobile			
RSL145	2m 1/2 wave fiberglass whip	12.10	(0.50)
RSL145S	2m 1/2 wave steel whip foldover	9.25	(0.50)
RSL150SS	2m 1/2 wave PL259 shock spring	3.90	(0.50)
RSM2	Gutter mount/Feeder/PL259 (RSL145)	10.94	(0.75)
RSM4M	Heavy duty mag/Feeder/PL259	13.25	(1.00)
UHF Mobile			
RSL453S	1/2 wave antenna	15.50	(0.50)

ANTIFERENCE ANTENNAS

VHF Mobile			
TAP3009	1/2 wave 3db snap-in hinged whip	11.42	(3.00)
TAP3677	1/2 wave 3db snap-in shock coil	15.64	(3.00)
TAP3002	1/2 wave unity gain snap-in hinged whip	8.81	(3.00)
UHF Mobile			
TAP3462	1/2 wave over 1/2 wave 3db	9.89	(3.00)
TAP3697	1/2 wave over 1/2 wave 5db	18.40	(3.00)
K220	Mag mount/Feeder to suit above	10.73	(2.00)

Simply phone or write and leave the rest to us

Antennas Various/Accessories

HQ1	Mini beam 10/15/20m 2 ele. 1kW	TBA	(4.00)
C4	Vertical 10/15/20m	48.50	(3.00)
G4MH	Mini beam 10/15/20	85.00	(4.00)
KTLM-4	Gutter mount/Cable assy. SO239	6.90	(0.50)

DATONG PRODUCTS

PC1	50KHz to 30MHz receive converter	137.42	(0.50)
VLF	Very low freq. converter	29.90	(0.50)
FL1	Frequency agile audio filter	79.35	(0.50)
FL2	Multimode audio filter	89.70	(0.50)
ASP/A	Auto RF speech clipper (YAESU)	82.80	(0.50)
ASP/B	Auto RF speech clipper (TRIO)	89.70	(0.50)
D75	Manual RF speech clipper	56.35	(0.50)
RFC/M	RF speech clipper module	29.90	(0.50)
D70	Morse tutor	56.35	(0.50)
AD270	Active dipole RX ant. (indoor)	47.15	(0.50)
AD370	Active dipole RX ant. (outdoor)	64.40	(0.50)
MK	Morse keyboard	137.42	(0.50)
DC144/28	2m converter	39.67	(0.50)
RFA	Broadband preamplifier	33.92	(0.50)
MPU	Mains power unit	6.90	(0.50)

MICROWAVE MODULES

Transverters			
MMT28/144	10m transverter	109.95	(2.50)
MMT70/144	4m transverter	119.95	(2.50)
MMT432/144R	70cm transverter	184.00	(3.00)
MMT1296/144	23cm transverter	184.00	(3.00)
MMT70/28	4m transverter	119.95	(2.50)
MMT144/28	2m transverter	109.95	(2.50)
MMT432/28S	70cm transverter	159.95	(2.50)

Linear Amplifiers

MML28/100S	10m 100W linear amp.	129.95	(3.00)
MML70/50S	4m 50W linear amp.	85.00	(2.50)
MML70/100S	4m 100W linear amp.	139.95	(3.00)
MML144/30LS	2m 30W linear amp. 1-3W in	69.95	(2.50)
MML144/50S	2m 50W linear amp.	85.00	(2.50)
MML144/100LS	2m 100W linear 1-3W in	159.95	(3.00)
MML144/100S	2m 100W linear 10W in	139.95	(3.00)
MML432/50	70cm 50W linear amp.	109.95	(3.00)
MML432/100	70cm 100W linear amp.	228.65	(4.00)
MML1296/10	23cm 10W linear amp.	199.00	(2.50)
MML432/30	70cm 30W linear amp. 1-3W in	99.00	(3.00)

Converters

MM1000KB	ASC11 morse converter with keyboard	99.95	(3.00)
MM4001	RTTY to TV converter	189.00	(2.50)
MM4001KB	RTTY transceiver	269.00	(2.50)
MM4000KB	RTTY transceiver with keyboard	299.00	(4.00)

Morse Talkers

MMS1	Morse tutor 2-20WPM Side tone	115.00	(2.50)
MMS2	Morse tutor (advanced) 6-32WPM + speak back	169.00	(2.50)
Amateur TV			
MTV435	70cm 20W (PSP) transmitter	149.00	(2.50)
MMC435/600	Converter ATV UHF output	27.90	(1.00)
Preamplifiers			
MMA144V	2m preamp RF switched	34.90	(1.00)
MMA28	10m preamp	16.95	(1.00)
MMA1296	23cm preamp	34.90	(1.00)
Frequency Converters			
MMD650/500	500MHz digital meter	75.00	(1.00)
MMD600P	600MHz pre scaler	29.90	(1.00)
MMDP-1	Probe	14.90	(0.50)
Filters			
MMF144	2m band pass 40W max.	11.90	(1.00)
MMF452	70cm band pass 40W max.	11.90	(1.00)
Various			
MMS384	384MHz signal source	29.90	(1.00)
MMR15/10	15db 10W attenuator	11.90	(1.00)

HI-MOUNT MORSE KEYS

HK702	Up down keyer marble base	24.50	(0.50)
HK704	Up down keyer	16.68	(0.50)
HK705	Up down keyer	12.50	(0.50)
HK706	Up down keyer	13.75	(0.50)
HK708	Up down keyer	11.96	(0.50)
HK808	Up down keyer marble base	39.57	(0.50)
MK704	Twin paddle keyer	10.95	(0.50)
MK705	Twin paddle keyer marble base	22.00	(0.50)

MOULDINGS

IK	lambic keyer	19.95	(0.50)
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TOKYO HY POWER

HC150	HF ATU SWR/Power meter	62.50	(n/c)
HC2000	200W PEP		
	HF 2kW ATU SWR/Power meter		
	6 POS ant. switch. 6 to 1 vernier high O coils 2kW peak 1kW continuous	276.55	(n/c)

Antenna Rotators & Accessories

9502	Channel master med duty up to 8 ele.	57.00	(3.50)
9523	Alignment bearing for 9502	15.81	(1.25)
KR400	Med/Heavy duty 180° meter (inc. lower casting)	90.85	(3.50)
KR400RC	Med/Heavy duty 360° meter		
	Load 200Kg 1 1/2"-2" masts	114.94	(3.50)
CASTING	Lower casting set (400RC)	15.00	(1.25)
KR600RC	Heavy duty 360° meter		
	Load 200Kg Rot600Kg/cm Brake 400Kg/cm 1 1/2"-2" masts	163.30	(3.50)

Antenna Switches

SA450	SO239 connectors 1 in 2 out	9.75	(0.50)
SA450N	"N" type connectors 1 in 2 out	12.75	(0.50)

Baluns

BL50A	RAK 50 ohm ferrite BALUN 1:1 1.8-38MHz 1kW	12.88	(1.50)
BL-40X	Balun 2K PEP 1.1	11.52	(1.50)

Dummy Loads

T30	30W DC 500MHz PL259	6.61	(0.50)
T100	100W DC 500MHz SO239	20.12	(1.00)
T200	200W DC 500MHz SO239	31.36	(1.50)
T210	Wide band 10W 1.2G-2.4G	24.50	(0.75)
AW05	Pocket RF wattmeter 5W up to 500MHz BNC	19.75	(1.00)

Filters

AKD	Hi-pass blocks 0-200MHz RF interference to UHF above 400MHz	5.50	(0.50)
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Linear Amplifiers

YAESU			
FL110	HF 160/80/40/20/15/10m 100W (10W drive)	155.25	(n/c)
FL2100Z	HF warc 1200W PEP. SS8 1kW CW, 400W AM/FM/FSK	449.00	(n/c)
FL2010	2m VHF 10W linear	54.00	(n/c)
FL2050	2m VHF 50W linear 10W drive	115.00	(n/c)
FL7010	70cm UHF 10W linear	91.00	(n/c)

TOKYO HY POWER

HL32V	VHF 30W linear 1-5W drive HI-LOW output	53.50	(n/c)
HL82V	VHF linear preamp output meter 2-12W in 35-85+ out	144.50	(n/c)
HL160V	VHF linear preamp output meter 1-10W in 160W+ out	242.40	(n/c)
HL45U	UHF linear preamp 2-15W in 10-45W out	119.75	(n/c)

ADONIS MICROPHONES Mobile/Base

MM202S	Mobile safety mic. (non scanning)	23.00	(1.00)
MM202HD	Mobile safety mic. (scanning)	30.00	(1.00)
AM502	Desk mic. (compressor selectable)	45.94	(1.00)

Miscellaneous

Mute			
SNL144S	2m preamp RF switched	33.90	(1.00)
RPCB	144UB FT221/225 front end board	64.50	(1.25)
Ni-cads			
AA	AA size Ni-cad	1.00	(0.20)
C	C size Ni-cad	2.40	(0.30)
NC1850	Ni-cad charger (4 x C or 4 x AA)	9.50	(1.00)

DRAE PRODUCTS

DRAE4	4 amp PSU	30.75	(2.00)
DRAE6	6 amp PSU	48.00	(2.50)
DRAE12	12 amp PSU	74.00	(3.00)
DRAE24	24 amp PSU	105.00	(4.00)
DRAE VM	135-450MHz wavemeter	27.50	(1.00)

"N" Connectors (Silver Plated)

N58	"N" Male connector RG58	2.25	(0.25)
N8	"N" Male connector RG8	2.40	(0.25)
N308	"N" T adaptor (three female)	2.40	(0.25)
N307	"N" T adaptor (1 male 1 female)	2.40	(0.25)
N306	"N" Double female adaptor	1.90	(0.25)
N310	"N" Double male adaptor	2.50	(0.25)
NB304	"N" Female to BNC male adaptor	2.10	(0.25)
N402	"N" Plug to SO239	2.05	(0.25)
N403	"N" Socket to PL259	2.00	(0.25)
N404	"N" Socket to SO239	1.80	(0.25)

Speakers/Headphones

Various			
RT650	4 ohm, 8 ohm 3W nom 6W max	6.50	(0.50)
MS60	3W nom 5W max	7.50	(0.50)
S2	Headphones (cobalt magnets)	5.75	(0.50)
YAESU			
YH55	Headphones Low Z	10.00	(0.50)
YH77	Lightweight headphones Low Z	10.00	(0.50)

SWR/Power Meters

YAESU			
YS200		52.90	(n/c)
YS2000		69.79	(n/c)

Other Makes

RF2000	Twinn meter 3.5-150MHz F/Scale 200/2000W	18.25	(1.00)
YM1X	Twinn meter 3.5-150MHz F/Scale 12 or 120W	14.99	(1.00)
Sensor 500	1.8-160MHz 5/50/500W	37.08	(1.00)
T430	Twinn meter 144-430MHz	34.85	(1.00)
T435	Twinn meter 144-435MHz	39.10	(1.00)

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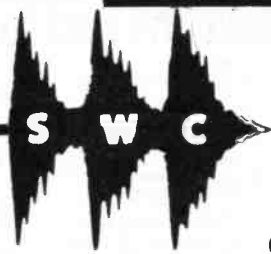
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GW4SWC

YAESU

	Price	Deposit	12/mont's
FT ONE	£1349.00	£675.00	£56.00
FT980	£1115.00	£557.00	£46.50
FT902DM	£885.00	£400.00	£41.00
FT102	£785.00	£392.00	£32.75
FT101ZDFM	£665.00	£325.00	£28.40
FT101Z	£559.00	£279.00	£23.44
FT707FM	£549.00	£273.00	£23.00
FT707	£509.00	£254.00	£21.25
FT77	£475.00	£241.00	£19.50
FL2100Z	£449.00	£200.00	£20.75
FT208R	£199.00	£103.00	£8.00
FT708R	£229.00	£109.00	£10.00
FT290R	£265.00	£130.00	£11.25
FT690R	£239.00	£119.00	£10.00
FT790R	£325.00	£175.00	£12.50
FT480R	£369.00	£189.00	£15.00
FT680R	£339.00	£165.00	£14.50
FT780R	£339.00	£201.00	£16.50
FRG7700	£335.00	£167.00	£14.00
FRG7700M	£399.00	£201.00	£16.50

ICOM

IC720A	£949.00	£469.00	£40.00
IC740	£725.00	£365.00	£30.00
IC730	£629.00	£329.00	£25.00
IC251	£559.00	£271.00	£24.00
IC290E	£379.00	£199.00	£15.00
IC290H	£399.00	£201.00	£16.50
IC2E	£169.00	£85.00	£7.00
IC4E	£199.00	£97.00	£8.50
ICAT500	£339.00	£171.00	£14.00
ICAT100	£249.00	£129.00	£10.00

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ACCESSORIES

A.T.U.S.		
FC102	10-160mtr	£209.99
FC902	10-160mtr	£135.00
FC707	10-80mtr	£85.10
FRT7700		£37.85

ROTATORS

KR500	elevation rotator 180	£116.42
RLD3	lightweight	£41.80
AR30	lightweight	£58.50
AR40	med-weight	£94.35
9508	med-weight	£83.40
9502B	lightweight	£59.40
CD45	armature brake	£142.00
HAM IV	solenoid brake	£225.00

CONTROL CABLE

4 way 25p/mtr	£20.00/100mtr	1000ft reel £58.00
5 way 33p/mtr	£26.40/100mtr	1000ft reel £73.00
6 way 45p/mtr	£30.00/100mtr	1000ft reel £104.27
8 way 48p/mtr	£38.40/100mtr	1000ft reel £110.00

MORSE KEYS

HK703	£25.00	£1.10 p&p
HK704	£17.65	£1.10 p&p
HK706	£14.60	£1.00 p&p
HK707	£13.75	£1.00 p&p
HK710	£36.40	£1.76 p&p
HK808	£45.60	£1.76 p&p
HK711	£29.50	£1.20 p&p
BK100	£22.25	£1.76 p&p
MK707	£25.25	£1.65 p&p
MK702	£26.45	£1.10 p&p
MK703	£25.95	£1.65 p&p
MK705	£22.60	£1.54 p&p
MK706	£19.50	£1.54 p&p

All goods normally despatched within 3days subject to availability.

Price correct at going to print.

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This amazing British made RTTY + C/W Terminal, represent incredible value for money, all you need in one unit, eliminating the clutter on those contest expeditions. Full details on request.

Basic model **£482.90**



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IC 740 Icoms latest thoroughbred at S.W.C.



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Continuing a tradition of excellence from the Yaesu Musen stable.

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Learning Morse? Here's the answer: facilities include repeat last letter, continuous morse, group of five random letters, speed & space control, practice oscillator, built-in P.S.U.

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£265.00 inc



NEW IC290H

25 WATTS RF OUTPUT On SSB CW and FM, standard and non-standard repeater shifts 5 memories and P/ch two VFO's 25Khz & 1Khz on FM 1Khz & 100hz on SSB
£339.00 inc



FRG7700 150Khz to 30Mhz inc FM SSB (LSB/USB) CW AM 1Khz digital, plus analogue display c/w clock
FRG7700 £339.00 inc
FRT7700 £37.85 inc
FRA7700 £36.40 inc

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70cm 1/4 co/lin 6.8db base	£29.90	£2.20 p&p
70cm + 2mtr co/lin 5.7 2.7db	£29.90	£2.20 p&p
70cm 3x 1/4 6.8db mobile	£16.85	£1.80 p&p
70cm + 2mtr co/lin mobile	£16.40	£1.80 p&p
2mtr 3x 1/4 co/lin base 6db	£39.50	£3.00 p&p
2mtr co/lin base 6.5db	£27.60	£2.20 p&p
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2mtr 1/4 f/over ball joint	£13.80	£1.80 p&p
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12mtr fold over 1/4 wave	£14.20	£1.80 p&p
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Tower's Available soon	Prices from £120.00 APR.	

PAN ANTENNA PRODUCTS

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Tube and Rod suitable for your Home Brew Antenna's Quad's, Yagi's, etc.

		P/per mtr	Post Max
Q/DIA	I/DIA		1.5 mtr's
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10mm Solid Rod		£1.15	£0.22 p&p
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Large Quantities are cheaper in 5mtr lenth's

Quant	Deduct	Carriage
20mtr	10%	£5.00
25mtr	12.5%	£5.00
30mtr	17.5%	£6.50
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Pan spiders are used to mount fibre spreaders to your boom up to 2" diameter, the 8 pole angled, two elements no boom is required, further elements may be added with the 4 pole spider.

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You will need copper wire, 14swg per 33mtr roll hard drawn £6.00 £2.20 p&p
14swg per 100mtr roll hard drawn £17.00 £3.50 p&p
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PTS-1 £39.99 with VAT £45.99

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MODELS FL2, FL3, FL2/A
Model FL3 represents the ultimate in audio filters for SSB and CW. Connected in series with the loudspeaker, it gives variable extra selectivity better than a whole bank of expensive crystal filters. In addition it contains an automatic notch filter which can remove a "tuner-upper" all by itself. Model FL2 is exactly the same but without the auto-notch. Any existing or new FL2 can be up-graded to an FL3 by adding Model FL2/A conversion kit, which is a Fully tested auto-notch module in P.C.B. Form. Datong filters frequently allow continued copy when otherwise a QSO would have to be abandoned. Prices: FL2 £78.00 with VAT £89.70, FL3 £112.50 with VAT £129.37, FL2/A £34.00 with VAT £39.67



MORSE KEYBOARD

MODEL MK
As well as looking terrific, Model MK brings some very useful features to enhance your CW operating. Its four 64-character memories allow auto-repeat and any number of programmed pauses per message. It includes all normal characters (including accents) and the "merge" key lets you make up specials. The four colour key-board features individual click action switches beneath a tough wipe-clean surface and a buffer memory automatically converts indifferent typing to perfect morse. All this, and it runs for up to a year from four internal pen cells (not supplied).



MODEL MK £119.50 with VAT £137.42

COMPACT RECEIVING ANTENNAS

MODELS AD270/370
Datong Active Antennas solve the age-old problem of finding space for a "good" receiving aerial. Model AD370 mounted on a roof top or Model AD270 in a loft will give similar sensitivity to much larger conventional aerials yet are only 2 1/2 and 3 metres long respectively. Moreover they do not suffer from interference picked up by the feeder cable; such pick-up can be a problem with conventional dipoles because it is hard to maintain good balance over a band of frequencies. Although active antennas were introduced to the amateur market by Datong only a few years ago they have long been used by military and commercial receiving stations. The performance specifications achieved by the Datong AD270/370 are very close to those of "professional" active antennas selling for ten times the price - a point which is not lost on our many professional customers. The advanced design ensures two things: that you don't miss signals through inadequate sensitivity and that the antenna does not invent signals which are not there. Datong Active Antennas represent an advanced solution to a common problem and so far as we know have no serious competition in terms of performance at the price. (Reviewed in Rad. Com., June 1982) AD270 £41.00 with VAT £47.15 AD370 £56.00 with VAT £64.40



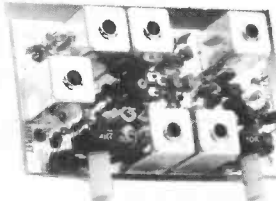
GENERAL COVERAGE RECEIVER CONVERTER MODEL PC1

Once upon a time it was the norm to use a ten metre receiver to receive the two metre band. Now, large numbers of special purpose two metre SSB rigs are in use and conversion the other way becomes a very attractive possibility. With the addition of Model PC1 each of these two metre SSB rigs becomes a really good general coverage receiver (from 50 kHz to 30MHz!). Two metre SSB rigs are not cheap and it makes good sense to get the most out of them. They also tend to have very good performance in terms of sensitivity, selectivity, and big signal handling. Each of these features is just as vital for short wave reception and Model PC1 is designed not to degrade them at all. The result, your two metre SSB rig receives below 30 MHz as well as it receives on two metres. And compared to many medium cost general coverage sets, that is saying a lot! Try this test. Listen on twenty metres after the band goes dead in the evening. With many general coverage receivers the band never dies. It remains populated with phantoms generated by the receiver from the many very strong signals on forty metres. This is the kind of effect that the higher quality receivers minimise, and that goes for PC1 plus a good two metre rig. Reviews: Rad. Com., April 1982. PC-1 £119.50 with VAT £137.42



HIGH PERFORMANCE 2 METRE CONVERTER MODEL DC 144/28

Again strong signal performance is the key to the design of Model DC144/28. Where conventional converters use a dual gate mosfet as a mixer, the Datong uses a balanced pair of Schottky diodes fed with nearly 10 mW of local oscillator at 116 MHz. Where other converters use open wound coils, the Datong coils are in screening cans on a plated through board. The result: an unusual freedom from spurious signals and overload effects together with a spurious-free dynamic range of 90 db. As the Rad. Com. reviewer wrote "With a 3db noise figure and 90 db dynamic range the Datong DC144/28 is one of the best 144 MHz converters currently available". Rad. Com., April 1982. Model DC144/28 is available either as a tested PCB module, as illustrated, or fully cased in a diecast aluminium box. DC 144/28 £34.50 with VAT £39.67



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

FL3	112.50	(129.37)	AD370	56.00	(64.40)	Codecall	
FL2/A	34.00	(39.67)	AD270+MPU	45.00	(51.75)	(Linked)	28.00 (32.20)
FL1	69.00	(79.35)	AD370+MPU	60.00	(69.00)	Codecall	
FL2	78.00	(89.70)	MPU	6.00	(6.90)	(Switched)	29.50 (33.92)
PC1	119.50	(137.42)	DC144/28	34.50	(39.67)	Basic DF System	149.00 (171.35)
ASP	72.00	(82.80)	DC144/28			Basic Mobile	
VLF	26.00	(29.90)	Module	28.00	(32.20)	DF System	159.00 (182.85)
D70	49.00	(56.35)	Keyboard Morse			Complete Mobile DF	
D75	49.00	(56.35)	Sender	119.50	(137.42)	System	214.00 (246.10)
RFC/M	26.00	(29.90)	RFA	29.50	(33.92)	PTS1	39.99 (45.99)
AD270	41.00	(47.15)					

See previous advertisement or price list for further details.

Data sheets on any products available free on request - write to Dept S.W.
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- ★ Up conversion, 48MHz first IF.
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- ★ Inbuilt quartz clock/timer.
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'7700 THE ONE WITH FM!
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JRC COMMUNICATION RECEIVER NRD515 £985 inc. VAT @ 15% SECURICOR

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- ★ No R.F. amplifier, balance U310 mixer.
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- ★ No tune design — inbuilt SWR meter.
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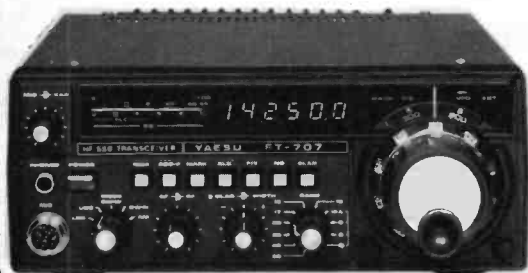
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*Limited Offer.

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FT101ZD ILLUSTRATED

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- ★ 1.8-3.5-7-10-14-18-21-24.5-28MHz.
- ★ All modes: — LSB, USB, CW, AM±, FM±, (±Option board).
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- ★ FV102: — VFO, 10Hz steps and readout, scanning, QSY.
- ★ FC102: — ATU, 1.2KW, 20/200/1200 W FSD PEP, wire.
- ★ FAS-1-4R: — 4 way remote waterproof antenna selector.

- ★ 160-10 metres including new allocations.
- ★ Variable IF bandwidth 2.4kHz down to 300Hz.
- ★ Audio Peak and independent notch controls.
- ★ AM, FSK, USB, LSB, CW, FM, (Tx and Rx).
- ★ Semi-break in, inbuilt Curtis IC Keyer.
- ★ Digital* plus analogue frequency displays.
- ★ VOX built-in and adjustable.
- ★ Instant write in memory channel.
- ★ Tune up button (10 sec. of full power).
- ★ Switchable AGC and RF attenuator.
- ★ 350 or 600 Hz CW, 6kHz, AM filters included!
- ★ Clarifier (RIT) switchable on Tx, Rx or both.
- ★ Plug in modular, computer style constructor.
- ★ Fully adjustable RF Speech processor.
- ★ Ergonomically designed with necessary LEDs.
- ★ Incredible range of matching accessories.
- ★ Universal power supply 110-234V AC and 12V DC.

"FREE" SECURICOR

FT902DM £885 inc. VAT @ 15% & SECURICOR



D & DE MODELS AVAILABLE

- ★ 150(W) x 50(H) x 176(D)mm.!!
- ★ Up/down, memory/band scanning.
- ★ Easy "write-in" memory channels.
- ★ Memory back-up "5 year" lithium cell.
- ★ Ten memories with priority functions.
- ★ Supplied with scanning microphone.
- ★ Illuminated "any angle" LCD display.
- ★ Display to 100's of Hz and functions.
- ★ Two completely independent VFO's.
- ★ Operation between memory and VFO.
- ★ Full reverse repeater function.
- ★ Manual and automatic tone burst.
- ★ Large "full sound" internal speaker.
- ★ Concentric volume and squelch.



2 or 70!

FT230R £239 inc. VAT @ 15% & SECURICOR

- ★ 144-146 MHz (extensions possible).
- ★ 25W RF output, 3W on low.
- ★ 25 and 12½ kHz steps provided.
- ★ ±600kHz repeater split, 1750Hz burst.
- ★ Tx; 5A. Rx 300mA (standby).
- ★ 430-434MHz (440-445MHz possible).
- ★ 10W RF output, 1W on low.
- ★ 25 and 100kHz steps provided.
- ★ ±1.6MHz repeater split, 1750Hz burst.
- ★ Tx 3A, Rx 300mA (standby).

- ★ Multimode USB, LSB, FM, CW
 - ★ 100Hz backlit LCD Frequency display
 - ★ 10 memory channels '5 year' backup
 - ★ Any Tx/Rx split with dual VFOs
 - ★ Up/down tuning from microphone
 - ★ AF output 1W @ 10% THD
 - ★ Bandwidth 2.4kHz and 14kHz @ -6dB
 - ★ LED's; 'On Air', 'Busy', m/c meter; S, PO.
 - ★ 58(H) x 150(W) x 195(D) (1.3kg)
- SMC2.0C** Nicad 2.0A/hr "C" £2.35
SMC8C Slow Charger (220mA) .. £8.80
MMB 11 Mobile Mount..... £22.25
CSC1A Soft carrying case £3.45
FL2010 Linear Amplifier 2m 10W. £59.00
FL7010 Linear Amplifier 70cms .. £91.00



6 or 2 or 70!

FT290R

£265
VAT @ 15% & CARRIAGE

- ★ 144-146MHz (144-148) possible
- ★ 2.5W PEP, 2.5W RMS/300mW out
- ★ FM: 25kHz and 12.5kHz steps
- ★ SSB: 1kHz and 100Hz steps
- ★ ±600 kHz repeater split 1750kHz burst
- ★ Integral telescopic antenna
- ★ Rx, 70mA, Tx; 800mA (FM maximum)

FT790R

£325
VAT @ 15% & CARRIAGE

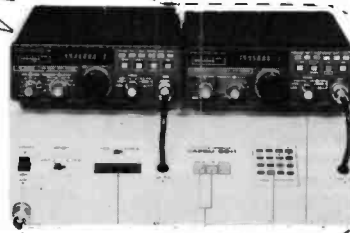
- ★ 430-440MHz (440-450 alternative)
- ★ 1W PEP, 1W/250mW FM/CW out
- ★ FM: 100kHz and 25kHz steps
- ★ SSB: 1kHz and 100Hz steps
- ★ 1.6MHz shift with input monitor, 1750Hz burst
- ★ Rx; 100mA/200mA. Tx: 750mA max
- ★ BNC Mounting ½ flexi antenna

SPECIAL OFFER

- ★ USB-LSB-CW-FM (A 3, A1, F3).
- ★ 30W PIP A 3, 10/1W out A1 F3.
- ★ Any Tx Rx split with dual VFO's.
- ★ Four easy write-in memory channels.
- ★ Memory scanning with slot display.
- ★ Up/down tuning/scanning from mic.
- ★ Priority channel on any memory slot.
- ★ Digital RIT. Advanced noise blanker.
- ★ Satellite mode allows tuning on Tx.
- ★ Semi break in with side tone.
- ★ Very bright blue 100Hz digital display.
- ★ Display shows Tx & Rx freq (inc RIT).
- ★ String LED display for "S" and PO.
- ★ LED's; "On Air" Clar, Hi/Low, FM mod.
- ★ Size (Case): 8.3" D, 2.3" H, 6.9" W.

*If you buy together a FT480 & 780 you get the SC1 Consol free.

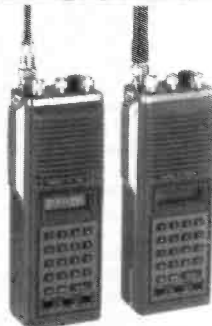
N.B. If you bought your 480 from SMC and you buy a 780 SC1 offer applies.



FT480R £369 inc. VAT @ 15% & SECURICOR

- ★ 144-146MHz (143.5-148.5 possible).
- ★ ±600kHz standard repeater split.
- ★ Excellent dynamic range and sensitivity.
- ★ FM; 25, 12½, 1kHz steps.
- ★ SSB; 1,000, 100, 10Hz steps.
- ★ 430-434MHz (440-445 possible).
- ★ GaAs Fet RF for incredible sensitivity.
- ★ FM; 100kHz, 25kHz, 1kHz, steps.
- ★ SSB; 1,000, 100, 10Hz steps.
- ★ FT780R 1.6 fitted 1.6MHz Shift £409 inc.

- ★ Keyboard entry of frequencies/splits
- ★ LCD digital display with backlight
- ★ Any split + or - programmable
- ★ Ten memory channels '5 year' back up
- ★ Up/down manual tuning. Memory scan
- ★ Manual or auto scan for busy/clear
- ★ Priority channel with search back
- ★ Scan between any two frequencies
- ★ Auto scan restart. 1.750Hz tone burst
- ★ Built in condenser microphone
- ★ 500mW to int/ext speaker
- ★ External speaker/mic. available
- ★ 168(H) x 61(W) x 39(D)mm
- ★ C/w Quick change NiCad pack, helical



2 or 70!

FT780R £399 inc. VAT @ 15% & SECURICOR

- ★ 144-146MHz (144-148 possible).
- ★ 12.5/25kHz synthesizer steps.
- ★ ±600kHz repeater split.
- ★ 2.5 or 0.3W RF output.
- ★ Rx: 20mA squelch 150mA max. AF.
- ★ Tx: 800mA at 2.5W RF.
- ★ 0.25µV for 12dB SINAD.

FT208R

£199
VAT @ 15% & CARRIAGE

FT708R

£229
VAT @ 15% & CARRIAGE

- ★ 430-440MHz (440-450 option).
- ★ 25kHz synthesizer steps.
- ★ ±7.6MHz EU split standard.
- ★ 1W or 100mW RF output.
- ★ Rx: 20mA squelch, 150mA (max AF).
- ★ Tx: 500mA at 1W RF.
- ★ 0.4µV for 12dB SINAD.

- ★ Four easy write-in memory channels
- ★ Rx priority channel (auto check)
- ★ Scanning band/memory empty/busy
- ★ Up/down tuning/scanning from mic.
- ★ Optically coupled tuning control
- ★ Manual and automatic tone burst
- ★ String LED's for "S" and PO, 7 status LEDs
- ★ 1½W of audio to internal/external speaker
- ★ **FT720** Control Head
- ★ 3.3 (4.3) " D x 6 " W x 2 (2.2) " H
- ★ **S72** Switching box
- ★ Pushbutton band change Auto steps/splits.
- ★ **E72S** Extension cable, 2m long
- ★ **E72L** Extension cable, 4m long
- ★ **MMB3** Mobile Mounting bracket for deck

Ills. c/w S72 and two E72S cables.



2 and/or 70!

FT720RV £199 inc. VAT @ 15% & CARRIAGE

- ★ 144-146MHz (144-148MHz possible).
- ★ 12½ kHz synthesizer, 600kHz shift.
- ★ 0.3µV for 20dB quieting.
- ★ Rx 0.5. Tx RV 3.5A, RVH 6.5A.
- ★ 5.8 (6.5) " D x 6 " W x 2 (2.2) " D.
- ★ 430-434MHz.
- ★ 25kHz synthesizer steps, 1.6MHz shift.
- ★ 0.5µV for 20dB quieting.
- ★ Rx 0.5A, Tx 4.5A.
- ★ 5.8 (6.5) " D x 6 " W x 2 (2.2) " D.

FT720RU £229 inc. VAT @ 15% & CARRIAGE

FT726R £ 649 inc. VAT @ 15% & SECURICOR



★ NEW ★
MULTI-BAND VHF/UHF
* Option

- ★ 3 Bands *! 2 metres. 70cms * (10MHz) & 6M * plug-ins.
- ★ Full Duplex *! Cross band Tx & Rx simultaneously.
- ★ SSB-CW-FM! All optimally catered for, clarifier all modes.
- ★ Variable bandwidth and IF shift! SSB & CW.
- ★ Processor! Front panel mic gain and variable power.
- ★ Two main VFO's! A & B with 20Hz/1KHz steps.
- ★ Separate channelised VFO! (for FM operation).
- ★ Scanning! band scan, memory scan, memory mode.
- ★ Repeater splits! programmable and preset.
- ★ Instant reverse! and + & - splits and A/B.
- ★ Twin meters; PO/DISC, S/ALC. Duplex switchable.
- ★ Switchable; AGC, CW bandwidth, * dial lock, noise blanker.
- ★ Priority channel operational split mode end split band.

FT726R(2) Transceiver c/w 144 MHz £649.00
430T 726 430-440 MHz module £208.90
50T 726 Six meter module £157.15
SAT 726 Full duplex unit £82.80

- ★ 160-10 Metres (inc WARC) plus standard service Rx.
 - ★ SSB, CW FSK, 100 Watts output (adjustable).
 - ★ Two 10Hz step digital variable frequency oscillators.
 - ★ Split frequency or cross mode single frequency operation.
 - ★ 3 PLL's (inc BFO) locked to 10MHz reference.
 - ★ 11 Channel memory retains operating freq. and mode.
 - ★ Listen on memory (fix Tx on VFO), microcomputer control.
 - ★ Display of memory contents during operation. Up/down/lock.
 - ★ Pass band tuning, tuneable notch, 10-20dB attenuator.
 - ★ Adjustable noise blanker, switchable AGC, calibrator.
 - ★ Adjustable RF output, RF speech processor, Vox.
 - ★ Comprehensive metering including compression level.
 - ★ Small 300(W), 327(D), 130(H), mm. 10Kg.
- NBD500 Mains PSU. NFG97 A.T.U.
NVA88 Ext. speaker. CFL260 600Hz filter.
CHG43 Desk Mic. CFL230 300Hz filter.
CHG44 Hand mic. KY3A Morse key.

JRC JST100 Price TBA

★ NEW ★



- ★ Rx 150kHz-30MHz.
- ★ Tx 160-10m. 9 bands x 3 x 500kHz Aux bands.
- ★ All modes AM, CW, LSB, USB, AFSK & FM (inc.)
- ★ IF shift & variable bandwidth 2.6 kHz-300Hz.
- ★ Inbuilt keyboard operation + scanning.
- ★ Switchable attenuator 10, 20, 30 dB.
- ★ Audio peak + notch filter - 40dB.
- ★ RF processor and Auto mic gain control.
- ★ 3rd order IMD - 40dB at 100W PEP.
- ★ AFSK shift 170, 425, 850 Hz selectable.
- ★ Multi channel memory + programmable scan limits.
- ★ Optional computer interface available.
- ★ Notch filter in IF (AGC immune to heterodynes).
- ★ Full break in keying. 500/600/700 Hz beat.
- ★ Unique analogue scale of digital type.
- ★ Comprehensive twin meter metering.
- ★ Memory retains mode information.

FT980 £ 1,115 inc. VAT @ 15% & SECURICOR



CREDIT COVER

- ★ Rx: 150kHz-30MHz. Continuous general coverage.
- ★ Tx: 160-10m (9 bands) or 1.5-30MHz commercial.
- ★ All Modes: AM, CW, FM*, FSK, LSB, USB.
- ★ 10 VFO's!!! Any Tx-Rx split within coverage.
- ★ Two frequency selection ways, no bandswitch.
- ★ Main dial, velvet smooth, 10Hz resolution.
- ★ Inbuilt keyboard with up/down scanning.
- ★ Dedicated digital display for RIT offset.
- ★ Receiver dynamic range up to 100dB!!!
- ★ SSB: Variable bandwidth and IF shift.
- ★ 300* or 600Hz*, 2,400 → 300Hz, 6kHz*, 12kHz*.
- ★ Audio peak and notch filter. FM squelch.
- ★ Advanced variable threshold noise blanker.
- ★ 100W RF, key down capability, solid state.
- ★ Mains and 12VDC. Switch mode PSU built in.
- ★ RF processor. Auto mic gain control. VOX.
- ★ Last but not least full break-in on CW.

FT ONE £ 1,349 inc. VAT @ 15% & SECURICOR

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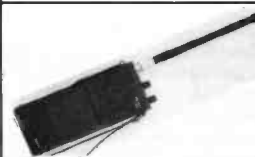
ICOM 251 E 2 mtr all mode base. We can't get enough - call now and try us for price and delivery.



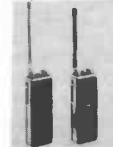
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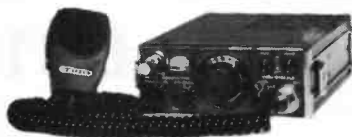
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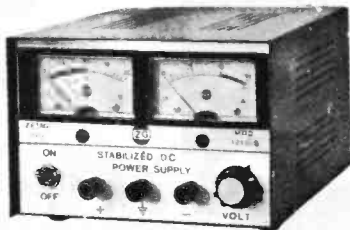


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SHORT WAVE MAGAZINE

(GB3SWM)

ISSN: 0037-4261

VOL. XLI

APRIL, 1983

No. 474

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Editor: PAUL ESSERY, G3KFE/G3SWM

Advertising: Charles Forsyth

Published at 34 High Street, Welwyn, Herts. AL6 9EQ, on the last Friday of the month, dated the month following.
Telephone: 04-3871 5206 & 5207

Annual Subscription:

Home: £9.00, 12 issues, post paid

Overseas: £9.00 (£17.00 U.S.), post paid surface mail

*Editorial Address: Short Wave Magazine,
34 High Street, Welwyn, Herts. AL6 9EQ, England.*

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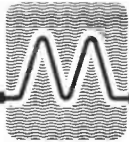
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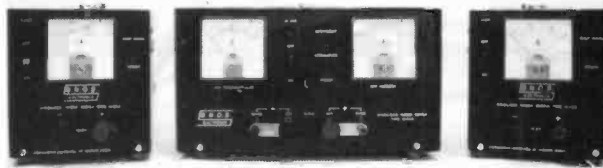
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BU 04	PL259 push on connector.....	0.81
BU 05	PL259 elbow plug for 0 0.2" cable.....	0.78
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BU 12	SO259 single hole, inside nut.....	0.47
BU 13	SO259 single hole, outside nut.....	0.47
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BU 22	back to back male.....	0.79
BU 23	male to female elbow.....	1.13
BU 24	1 male, 2 female 'T'.....	1.35
BU 25	3 female 'T'.....	1.46
BU 26	female to female lightning arrester.....	1.22
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The
SHORT-WAVE
Magazine

EDITORIAL

Of Good Manners and Sound Sense

Many holders of VHF licences complain that they are treated as second-class citizens by the Class-A types. Perhaps they forget that generally a man is judged on what he is and what he does. If he is a lousy operator, why does he get angry at being regarded as a bit of an idiot?

However, equally hard words could be aimed at the many holders of 'A' licences who indulge in the same sort of anti-social operating practices. Whether he holds an 'A' or a 'B' licence, anyone who sits on a repeater from the home station using it as a chat channel to the exclusion of mobiles, for whom it was originally installed, and who tells a mobile that he is an intruder on 'their' channel deserves all he gets. That is not to say that a base station should not use a repeater — far from it — but that mobile operators should always be given priority.

Band-plans are voluntary in this country, thank goodness; but too much of this particularly selfish behaviour will lead us headlong into enforced band-plans and barred frequencies on shared bands. The whole basis of our licensing is on self-policing, which in turn means self-discipline. The slogan "use or lose" should be altered to "use properly or lose" — and if a few hotheads had their licences revoked then sense would rapidly come to the others.

National Amateur Radio Convention

With an attendance of around 10,000 people over the two days, the first National Amateur Radio Convention to be held at the N.E.C. in Birmingham on March 5th and 6th, organised by the RSGB, must be judged a considerable success from every point of view. Facilities were excellent, as indeed they should be at a modern purpose-built exhibition centre, with many expressions of satisfaction from both visitors and traders; the lectures were all of high standard and well attended. The only general criticism being voiced was that it should have been held over three days rather than two. Without doubt the light and airy Hall 6, with its wide gangways between stands, created a pleasant and positive atmosphere; altogether a welcome change when compared to most of the other venues of which we have all had experience.

Perhaps we have reached a situation where just one national exhibition/convention should be held each year. It would certainly make a lot of sense.

"Magazine" Prizewinner

The prize of £85 for the best article in Volume 40 of *Short Wave Magazine* goes to — no surprise, perhaps — Rev. George Dobbs, G3RJV, for his really splendid series "Plug In Your Soldering Iron and Begin Here". This series introduced many a radio amateur to home-construction for the first time, as well as encouraging others to have another go at it; indeed, we know that it even brought some people back into amateur radio. The current trend of a return to home-building is due in no small measure to G3RJV's enthusiasm for his other 'gospel' of kitchen-table technology. As winner of this annual prize for the second time, congratulations, George, and thank you!

Deciding on a winner can often be a difficult task which only means, of course, that we greatly value the work of *all* our contributors. In other words, thank you to everyone who has written for us during the past year.

John
G3KFE

VHF BANDS

NORMAN FITCH, G3FPK

Award News

CONGRATULATIONS to Jim Rabbits, G8LFB, from Whetstone in north London, who is the 24th member of the 2m. QTH Squares Century Club, his certificate being issued on March 1. His 100 QSLs revealed 86 tropo contacts, 11 via *Aurora* and 3 via *E's*. The station consists of an Icom IC-202S, *Microwave Modules* 25 watts amplifier, *Datong* automatic speech processor and 16-ele. *Tonna Yagi* aerial at 10m. a.g.l. The site is 80m. a.s.l.

Another reminder concerning the Annual VHF/UHF Table that there are 104 counties in the British Isles. They comprise the 78 *administrative* ones in England, Scotland, Wales, Ulster, the Isle of Man and the Channel Isles, together with the 26 in the Irish Republic. The countries are the DXCC ones, plus Shetlands (GM) and Sicily (IT9). You can work them on any mode and by any "natural" propagation, which latter means repeater and satellite QSOs are not acceptable.

Contest Notes

Full details of the rules for the *9H Falcon Contest*, organised by the *9H VHF/UHF/SHF* Group in Malta have now been received from Henry Souchet, 9H1CD. The dates are from 0001 on June 1, through 2400 on June 15 and the single band is 144-146 MHz. All propagation modes are valid except satellites and repeaters. All competing stations must log a minimum of ten 9H stations, but the *same* station may be logged more than once, provided the *dates* are different. Contest exchanges to be RS(T) plus serial number starting at 001, and QTH locator. Only QSOs over 500 kms. in your own country count, but all contacts over borders can be included. (E.g. A QSO between a London "G" and a fellow in Land's End would not count; but one between a "G" in Bristol and a "GW" in Cardiff would.)

The entries go to:— The Contest Manager, 9H Falcon Contest, P.O. Box 144, Valletta, Malta, to reach there by July 1. Logs must show:— date, GMT, call sign of station worked, both reports and serial numbers, QTH locators and QRB points claimed, the latter at one point per kilometre. The winner will receive a trophy

and diploma, the runners up diplomas. So, work as much DX as possible in that fortnight and look for *Sporadic E* openings at the peak of the *E's* "season". Henry, 9H1CD, told your scribe there about 30 Maltese stations on 2m., so, given one or two good *E's* openings, some U.K. stations could well qualify to enter. If any reader would like a copy of the rules, please send an *s.a.e.* to the office address marked "9H Contest".

Repeater News

After more than two years, the Home Office issued the first new VHF and UHF repeater licences in mid-February. These comprise 12 on VHF (Phase 5) and 10 on UHF (Phase 6). About half were operational when this was being edited. The full list, with channels where known, is:— 2m. GB3AE, Barnoldswick; GB3AM (R6) and GB3BX (R2) both local coverage relays in Birmingham; GB3ES (R7) Hastings; GB3EV (R4) Appleby; GB3HG, N. Yorks; GB3LM (R5) Lincoln; GB3MB, Manchester; GB3PW, Newtown, Powys; GB3RD (R3) Reading; GB3TY, Hexham and GB3WB on Dartmoor.

On 70cm, GB3FN (RB15) Farnham; GB3GC, Goole; GB3HA, Hornsea; GB3HB, St. Austell; GB3HD, Huddersfield; GB3PD, Peterhead; GB3UL (RB2) Belfast; GB3WP, Manchester; GB3WU (RB15) Wakefield and GB3XX (RB15) Daventry.

The *North Cambridgeshire 70cm. Repeater Group* has submitted a proposal to the *RWG* for a Fenland repeater to cover the Wisbech, March and Chatteris area. Further details from Mr. J. P. Arnold, G4NPH, 5 Princes Road, Wisbech, Cambs.

Beacon Notes

A change of frequency for the 70cm. Angus beacon is imminent due to a slight problem with the Perth repeater, according to a recent *GB2RS* news item. The new QRG will be 432.980 MHz, the frequency previously earmarked for GB3NEB.

Auroral Studies

As everyone knows, the *polar auroras* have both visual and radio effects and in this feature we are concerned only with the latter. The reports readers send in form part of the overall data eventually processed by Charlie Newton, G2FKZ, of the *RSGB's Propagation Studies Committee*. Similar work is being done by the *Auroral Observations Group* of the *British Astronomical Association*, the co-ordinator of which is Mr. R. J. Livesey, whose efforts were brought to your scribe's attention by George Grzebieniak, G6GGE.

The intention now is that we co-operate with Ron Livesey by exchanging

information for the mutual benefit of both groups. Accordingly, Ron would like to receive copies of readers' reports on radio events for comparison with solar, visual *aurora* and magnetic storm data. The required reporting format would be the same as for the radio reports, *i.e.* dates, times, locations of stations worked and any relevant comments on the events. All reports will be acknowledged and data would be included in the *B.A.A.'s* auroral analysis which is published annually in their *Journal*. Any reader wishing to correspond directly with Mr. Livesey can do so by writing to:— 46 Paidmyre Crescent, Newton Mearns, Glasgow, G77 5AQ.

VHF Down Under

Steve Mahony, VK5AIM, is a reader of the *Magazine*. He lives in South Australia and wrote after reading about the 6m. U.K. band. As there is Band 1 TV still in Australia, their band is 52-54 MHz which makes working DX very difficult. In the summer, there are *E's* contacts on SSB across the continent, the southern VKs work into New Zealand and the northern folk into Japan. During the winter, it is mostly local FM activity. Most stations run 10w. from transceivers or transverters with 4-ele. *Yagis* but some have 100w. amplifiers and 8-ele. long *Yagis*. However, the latter combination in a city area is "asking for trouble", due to the problem of RFI with home video equipment.

On 2m. there are repeaters in the 146-148 MHz part of the band which give continuous coverage from north Queensland, down the east coast, through Melbourne and across to Adelaide. Repeaters account for two-thirds of the 2m. activity and there are many local FM nets. SSB is confined to the first 200 kHz of the band with a "No-man's Land" up to the 145.8-146.0 MHz satellite part. The SSB calling QRG is 144.100 MHz and regular skeds are held over 150 mile paths.

70cm. activity seems rather sparse and *Microwave Modules* gear is popular and helped things get moving when the *Oscar 7* satellite was launched. Now there are the familiar oriental multi-modes to buy. There are UHF repeaters in most capital cities and UHF CB has boosted FM activity on 438 MHz using modified *Philips* transceivers. Most evenings, Steve, and another local, VK5QM, work VK5ZRG, 150 miles away, often with just 10w. and a 10-ele. beam. 2m./70cm. "duplex" is used when conditions permit and these experiments have shown that 70cm. often gives better results.

Four Metres

Syd Harden, G2AXI, (Hants.) was on for the second and third legs of the *Cumulatives* which provided four more counties for this year's score. Arthur Breese, GD2HDZ, was on for the Feb. 13

session and worked G3JXN in London and G3BPM in Surrey, for best DX. Other new ones for the 1983 Table were, G3NPI (Bucks.), G4FRO (Avon), G3UKV (Shropshire), and G3OIC (Herefordshire & Worcs.).

Dave Robinson, G4FRE, is now settled in Felixstowe and is QRV on several bands, including 4m., where he uses a *Trio* TS-120V, home built transverter and PA. The aerial is a 3-ele. *Yagi* at 10m. *a.g.l.* Best DX so far, during the *Cumulatives*, is G4APA (Cheshire) but Dave wonders, "Does anyone deliberately beam towards the east coast?" Dave Lewis, GW4HBK, (Gwent) heard GM3MOX at 2222 in the *Ar* of Feb. 4, but failed to work him. The next day's *Ar* brought QSOs with G4BAO at 1625 and GM3TAL at 1809, the latter again worked in a second phase at 0015 on the 6th.

Welcome to Denis Jones, G3UVR, from the Wirral (Merseyside) who leaps into first place in the Table. The Fixed Contest on the 16th of Jan. and the *Cumulatives* account for his 28 counties and six countries already. He has 50w. output and a 4-ele. *Yagi* on the band with 38 squares and nine countries since Jan. 1980. He transverts from 10m. with a home built unit.

Six Metres

Paul Turner, G4IJE, (Essex) has now worked 13 of the other 39 6m. licensees and has been busy with many tests. The converter he sent to DJ5MS arrived in Peter's letter box very quickly and they had a 6m./2m. cross-band MS QSO on Feb. 27, completed in one hour, with DJ5MS getting four bursts from Paul, using a 20m. dipole. OK1OA has built a 6m. converter and, using a dipole taped to a window, completed a cross-band MS QSO with G4IJE in 50 mins.! Just as this was being written, G4IJE reported another 6m./2m. test with CT1WW (WB) on Mar. 5 when confirmation from Tiago was still awaited.

GW4HBK put out his first call on 6m. at 0605 on Feb. 2, with no luck. G6XM (Dorset) was heard at 0733 on CW on Feb. 21, and Dave's only QSO up to Feb.25 was with G4GLT (Leics.) at 0037 on the 24th and which was a very difficult contact. His equipment includes a QQV06-40A PA at 10w. with a 5-ele. *Yagi*.

It seems that some Class B licensees feel they should have had equal opportunity to apply for 6m. licences and cite the *W.A.R.C.* 1979 Convention whereat it was decided that national administrations could waive the morse code requirement

ANNUAL VHF/UHF TABLE

January to December 1983

Station	FOUR METRES		TWO METRES		70 CENTIMETRES		23 CENTIMETRES		TOTAL Points
	Counties	Countries	Counties	Countries	Counties	Countries	Counties	Countries	
G3UVR	28	6	30	21	34	9	—	—	128
G4NBS	12	1	28	8	33	11	—	—	93
G4ARI	11	1	54	13	1	1	—	—	81
G2AXI	20	2	30	10	11	7	<i>1</i>	<i>1</i>	80
G3FPK	—	—	58	15	—	—	—	—	73
G8TF1	—	—	25	10	22	13	—	—	70
G4ROA	—	—	26	6	22	7	6	3	70
G8FMK	—	—	18	4	18	6	20	4	70
G6DER	—	—	37	8	20	5	—	—	70
G6HR1	—	—	37	8	18	6	—	—	69
G6ECM	—	—	47	19	—	—	—	—	66
G8ULU	—	—	23	9	22	8	—	—	62
G4DEZ	—	—	39	22	—	—	—	—	61
GD2HDZ	15	2	3	6	17	6	—	—	49
G4FRE	14	1	—	—	21	11	1	1	49
G3PBV	2	<i>1</i>	17	12	7	7	3	2	48
G4MUT	10	2	12	9	9	4	—	—	46
GW6JDK	—	—	29	11	—	—	—	—	40
G8PNN	—	—	3	6	14	8	3	4	38
G8KAX	—	—	17	8	5	7	—	—	37
GM4CXP	—	—	18	12	—	—	—	—	30
G3FIJ	14	1	5	6	—	—	—	—	26
GW4HBK	16	3	—	—	—	—	—	—	19
G8XTJ	—	—	13	5	—	—	—	—	18
G4NRG	4	1	3	4	—	—	—	—	12
G2DHV	4	1	2	1	3	1	—	—	12

Three bands only count for points. Non-scoring figures in italics.

above 30 MHz. However, it has to be pointed out that *no* amateur allocation in the 50-54 MHz region was made for Region 1 of the *I.T.U.* Nevertheless the Home Office *has* exercised its right to grant an amateur band to us in this region. The situation is the same as for the 4m. band, which few other countries have. Consequently, the Home Office is not under any *I.T.U.* obligation to licence either band for Class B licensees.

Fortunately, many Class B licensees are adopting a positive approach by doing a lot of listening on 6m. Their reception reports on various propagation modes will be just as useful as the QSOs reported by the lucky 40, during this trial period.

Two Metres

Dave Sellars, G3PBV, (Devon) reports generally poor tropo. conditions in February, but he did catch the *Auroras* on Feb. 4 and 5. The one on the 4th was found at 1715 and was still going on at 0010. Gs in AL square were quite loud, along with Ds and PAs. GM4ILS (YR) and GM6PZ (XQ) at 1945 and 2019, the former on the key, the latter on SSB, provided a couple of new squares. On the 5th, Dave noticed the *Ar* at 1305, but did not get on till 1515 when GD, GI and GM signals were heard. At 1530, GI4ONL (WO) was worked on CW and the event faded at 1900.

G3UVR is already up to 21 countries this year, even though Denis does not use

MS mode. He has 400w. output from a home built transverter and PA with an 8-ele. *Yagi*. Tim Raven, G4ARI, (Leics.) added 22 more counties for the year. The rarer ones listed on the 4th are obviously *Ar* QSOs and later in the month, there were tropo. contacts in with such as GW6DDB (Gwynedd) and GW8TBG (W. Glam.). Mar. 1 brought G6CGY in Co. Cleveland.

On Mar. 2 there was another *Ar* that started soon after lunch and lasted for some time. In the south, it was not very spectacular, but the DX was there for those with "good ears". G4IJE worked seven GMs, along with OZ and DL. Paul reported that GM3WCS worked a couple of OKs at a QTF of 80° which suggests it was a rather southerly event. Ian Parker, G6DFT, (Herts.) heard five new squares in this event but did not work any stations therein.

Jon Stow, G4MCU, (Essex) missed an hour of the Feb. 4 *Ar*, but did get RQ2GAG (MQ) for new square and country, and GM4FZH (YS) around the 1900 period. SM6AOQ (GR) and SM6CMU (FR) were worked around 2100, all at QTFs between 5 and 15 degrees. He missed the events on the 5th and 6th, but worked OZ1EYE (FQ) at 1524 and GM6PZ (XQ) at 1559 on the 7th. Feb. 18 saw good tropo. conditions, but Jon's aerial rotator decided to go on strike, so he did not work anything.

For anything radio you want to buy, sell, or exchange, use the Readers' Advertisement columns in "Short Wave Magazine"

Tony Collett, G4NBS, (Berks.) was a little more active on 2m. In February and mentions ON1BCG (BK) on the 22nd and GM6MJY/A (YR) on CW the next day Adrian Chamberlain, G4ROA, (Coventry) worked GM6PQE (Tayside) in the *Ar* on the 4th then decided to have a go on CW. He heard the GMs working ONs and PAs he could not copy. Mick Cuckoo, G6ECM, (Kent) operated in the Feb. *Ar* for three hours from 1800. He lists EI2BBB (VM) in Limerick, G8YWF (ZO), G16DCQ (XO), GM3JIJ (WS) in the Western Isles, GM4JCM (YQ) and GM6PBF (YQ) along with other Gs in YM and YN. The next day, between 1300 and 1600, Mick's best DX were:— G16AGB (XO), GM4NHI (YR), GM6PLE (YQ), GM8VRU (YP) and SM7LXV (GP). That is a good tally for SSB mode. On the 18th, GM8MBP (YR) was heard calling "CQ" at 0100 and a quick QSO resulted before he faded into the noise. Later that day, many D, ON and PAs were worked, the best being DD9QT (EL), DJ1SU (FM), DJ5KB (EL) and OZ1DPR (EP).

Russell Coward, G6HRI, (Blackpool) hopes to have two 10-ele. *Parabeams* at 34ft. *a.g.l.* by now. In the Feb. 5 *Ar*, G4RNL and G16DNP (XO) were worked at a QTF of 30° but no other stations were heard. On the 7th, in another *Ar* G16ATZ (XO) and G4RQG/A (Staffs.) were contacted. Ray Cox, G8FMK, (Oxon.) got several GM and GI stations in the Feb. 4 and 5 *Ar*'s, G14OUN (Tyrone) and GM3ZXE (Tayside) being new, all-time counties. In the Feb. 4 *Ar*, Martyn Jones, G8CXQ, (Warks.) added a new square, thanks to GM3JIJ in WS.

Derrick Dance, GM4CXP, (Borders) rarely misses an *Ar* and his lists show the difference in areas workable from YP square, compared with what can be heard from more southerly latitudes. At 2317 on the 4th, a visual *Ar* alerted Derrick to switch on the radio and between 2322 and fade-out at 0020, nine QSOs were made at QTFs 45° to 55° with DF1ZE (EJ), OZ1AZZ (FR), OZ1HWS (GQ), GM6PZ (XQ), EI4CL (WN), G14MXW (WO), GW3LDH (YN), LA7KK (FU) and LA9BM (EU). On the 5th, a 'phone call at 1330 from GW3LDH alerted him to another event, the first contact being with 'LDH (YN) at 1405. 23 stations were worked up to 1532 when he switched off including 10 Germans, mostly on the EJ and EM squares, PAs and ONs in BK, CK and CL, F5SE (CJ), LA8AK (DS) and SM7GEP (HR). QTFs were from 45° to 80°.

Another affair was in progress at switch-on on the 6th at 1520, which brought GM4IAO (YR), PA2VST (CM) and G8XVJ (YN) before switch-off at 1624. The QTF was 45° during this event. A holiday from work enabled Derrick to be QRV during a fine tropo. spell on Feb. 17 and 18, during which many Scandinavians and Germans were worked

Station	QTH LOCATOR SQUARES TABLE			Total
	23cm.	70cm.	2m.	
G3POI	—	—	393	393
G3IMV	—	39	324	363
G3VVF	—	117	307	424
DK3UZ	—	—	304	304
G4IJE	—	—	290	290
SP2DX	—	—	280	280
EA3LL	—	30	252	282
G4IGO	—	19	245	264
G4DEZ	—	—	236	236
G4ERG	—	16	235	251
GJ4ICD	1	103	225	329
G3CHN	—	—	225	225
G8VR	—	3	224	227
9H1BT	—	11	210	221
LA8AK	25	62	200	287
G3BW	3	35	198	239
GM4COK	—	26	194	220
G3FPK	—	—	193	193
GJ8KNV	12	76	191	279
GW4EAI	—	—	187	187
G3KEQ	—	—	186	186
GW3NY	—	48	185	233
G3UVR	—	38	178	216
G8KBQ	4	91	172	267
G4PCI	—	28	167	195
G4OAE	—	28	164	192
G3PBV	18	85	163	266
G4MCU	—	50	163	213
GM4CXP	—	26	163	189
GJ8SBT	3	—	161	164
G3JXN	57	98	155	310
G3COJ	36	87	150	273
G8LFB	—	—	150	150
G8RZO	—	75	148	223
G8RZP	—	76	147	223
G8CXQ	—	61	146	207
G6ECM	—	—	141	141
G4JZF	—	68	140	208
G4HMF	—	32	140	172
G8WPD	—	24	139	163
GM4IPK	—	—	139	139
G4NFD	—	36	138	174
G8HHI	12	70	133	215
G8TGM	—	—	133	133
G3XDY	30	86	131	247
G8ATK	15	81	129	225
G6ADH	—	27	129	156
G3NAQ	—	58	128	186
G6DDK	—	11	122	133
G4ERX	6	46	121	173
G2AXI	9	72	120	201
GM8OEG	—	—	115	115
G4MEJ	—	—	114	114
G4NQX	—	47	113	160
G8XIR	—	—	112	112
G4MJC	—	12	108	120
G8PNN	30	70	106	206
G4KUX	—	30	105	135
G4GHA	—	—	104	104
G4HFO	—	59	102	161
G8VRJ	16	38	101	155
G8ULU	—	66	97	163
G4MWD	—	—	95	95
G4NBS	13	75	92	180
G3FIJ	—	29	92	121
GD3HDZ	13	46	91	150
G6HKT	—	60	89	149
G8VVF	—	—	89	89
G8SRL	—	21	83	104
G8RWG	—	—	83	83
G8TFI	—	95	82	177
G8KAX	17	56	82	155
G4MUT	—	54	82	136
G8FUO	3	86	80	169
G8WPL	—	30	79	109
GW3CBY	5	16	79	100
G8ORP	—	37	76	113
G6DER	—	26	76	102
G8XQS	—	4	76	80
G6ABB	—	—	75	75
G8FMK	21	59	74	154
G4KLX	—	5	74	79
G8WUU	—	27	72	99
GW6JDK	—	2	72	74
G4RSN	2	19	71	92
G6ADE	—	64	70	134
G6ELO	—	—	69	69
G6HTJ	—	17	66	83
G6CNX	—	—	63	63
G8XMP	—	—	62	62
G4NRG	—	11	61	72
G4ROA	6	43	58	107
G4NWT	—	22	55	77
GM8BDX	—	33	53	86
G4PEM	—	—	50	50
G8XTJ	—	—	48	48
G8ZYL	—	—	46	46
G4LDY	—	3	41	44
G8LXY	—	20	34	54
G6HRI	—	12	32	44
G4BVY	9	72	—	81

Starting date January 1, 1975. No satellite or repeater QSOs.
 Band of the Month, 2m.

on SSB. OZ1CSI (HP) was a new square.

Andy Steven, GM4IPK, (Edinburgh) took full advantage of the Feb. 4, 5 and 6 *Ar*'s and worked no less than 233

stations, adding another nine squares. These were:— OY5NS (WW), F9LT (AI), LA1K (FX), G3DAO (AK), UP2BKH (KP) a new country, too, F5SE (CJ), SM1BSA (JR), OH1ZAA (KV) and EI8EV in UO70c. Andy also lists SM5DFF (IS), OH1ZP, OH1DP and OH1BS all in LU, and SM0BKZ (IT).

Welcome to yet another new contributor, Kelvin Weaver, GW6JDK, from Blackwood in Gwent, who passed the *R.A.E.* a couple of years ago when he was 15. His father, Phillip, is GW6JDJ and their licences arrived last June. The station comprises a *Kenwood* TS-770 and *Dressler* D-200 amplifier, a *Datong* Automatic Speech Processor, the aerials being two 9-ele. *Tonna Yagis* at 20ft. with a *Dressler* 0.7 dB masthead pre-amplifier. Planning permission for a 60ft. *Versatower* is awaited, upon which a couple of the new, 17-ele. *Tonna Yagis* will be placed. The QTH is 750ft. *a.s.l.* and Kelvin lists some very nice DX he has already worked.

Jan-Martin Nøding, LA8AK, (DS80b) in Vågsbygd, has now reached 200 QTH squares on the band and, in the Feb. 6 *Ar* found two new squares on CW, ZT and FY. At present, his PA is out of order so he is running 50w. to a 16-ele. *Yagi*, with a BFT66 type preamplifier.

The activity in the 144/432 MHz contest on the Mar. 5/6 weekend was high, although a number of club and other multi-operator stations did mention a lack of help due to the N.E.C. Exhibition creaming off some operators. As observed from G3FPK, stations on the east and south coasts were doing well with 700 and 800-plus QSOs at the end. Propagation to the north and northwest was flat, though, with only GM4CXM and G18EWM heard weakly in ZL60j. The only consistent Welsh portables were GW3OXD and GW4NFD, while GD4IOM was a good signal at times.

Seventy Centimetres

LA8AK is one of a growing number of operators carrying out 70cm. *Ar* work. On Feb. 6, Jan-Martin mentions working, "... a few SM4, SM5, OZ and DL stations on CW". Going back to the Jan. 23 fine tropo. opening, he reports contacts with 19 squares. His rig runs 50 w., but a 300w. PA is being built, with two 21-ele. *Yagis* and a 3SK97 preamp. John Tye, G4BYV, (Norfolk) reports that Simon Freeman, G3LQR (Suffolk) worked EA1KC and EA1NU during the Jan. 23 tropo. event.

G3UVR used the Feb. 6 contest to help his 1983 score along well. He uses a home built transverter and runs 20w. output to a 21-ele. *Yagi*. G4FRE (Suffolk) uses either a *Yaesu* FT-290 with *Elektor* 144/432 transverter, or a *Trio* TS-120V and home built transverter for 70cm. Dave has an MGF1401 preamp. and a 4CX250B amplifier in either case, the latter being

“. . . half a K2RIW to a design from *DUBUS Magazine* . . .” and which has proved a very easy one to build and get going. He also worked the two EA1s on Jan. 23, but the best DX was OE3OBC in 11 square, with several Ds in the F and G squares. In six days of putting up outdoor aerials, Dave notched up 11 countries and 40 squares!

G4MCU's reluctant rotator which was stuck to the east, enabled Jon to copy the beacon OK0EA (HK18d) at S9 on Feb. 18 at 2200, while OZ2ALS (EP79c) was S2 off the side to the beam. He and John Lemay, G8KAX, suggest that, just because distant beacons at great heights can be copied, it does not follow that QSOs between stations at lower altitudes are possible. For example, over the Feb. 18-20 period, GB3MLY — as it now is — was an enormous signal, whereas there was little increase in the strength of signals from northern amateur stations. This phenomenon has also been observed with HB9HB and DL0PR on 2m.

G4NBS took his gear down to G8FUO's QTH in Windsor for the Feb. 6 contest and they made 110 QSOs, working well to the north. Best DX was G8PNN in Northumberland and the total points was about 500. From home, Tony found conditions poor, but then mentions working DF9JS (DL), DL2KBB (DK), DL4OX (FM), DJ9BV (EN), DF6HT (FN) and ON and PA. However, activity seemed low. Other noteworthy contacts were GW8AAP/P (Clwyd) on the 22nd, and G3LQR and G6OUF (Chesterfield) on the 27th.

G6HRI now has a weekly sked. with GW3CCF in Clwyd. Russell intends to go out portable in YO square as soon as he has a suitable aerial. He has worked some reasonable GDx during February from the Blackpool home station. G8FMK also found OK0EA at S7 on Feb. 18, but little else from the east in the short lift which lasted but two hours in Thame. Pete Godfrey, G8ULU, (Kent) got DC7QH (GM) and GM4JLY (YR) for a couple of new squares on the 18th to make it 66 on 70cm.

A short note from Don Hughes, G8WPL, (Stockport) indicates he has a Yaesu FT-780R and MM 100w. amplifier with 23-ele. aerial on the band and this combination has brought QSOs with D, EI, F, G, GD, GI, GU and GW stations in 30 squares, so far. GD2HDZ worked 13 more counties and two more countries in the Feb. 6 contest, including G8ZHP (Lincs.), G4FUF (Essex) and G3SEK (Oxford).

“Contaminated coax” is keeping GM4CXP off the band at present. Derrick mentions all sorts of aerials to go up for 4m. and 6m. so it seems some “muscle” is needed at St. Boswells! GW6JDK has only 10w. to an 11-ele. *Yagi* at the moment, but a 4CX250B amplifier and *Gasfet* preamp. are envisaged, plus two 21-ele. *Tonna Yagis*. Kelvin mentions that GW8UCQ and GW8XMT, also in Blackwood, Gwent, are QRV on the band, each with 50w. and single 21-ele. beams. They are looking for skeds and both are *QTHR*.

For TV addicts, your scribe learned from Tim Stanley, G4DBL, who was operating G61BA at the time, that the latter club station will be transmitting FS/TV soon on 70cm.

Gigahertz Bands

From Norway, LA8AK is QRV on 23cm. with 15w. to a 23-ele. beam. A 150w. PA is being assembled. G4BYV has supplied some East Anglian microwave news. John is QRV on 13cm. and, on Jan. 22, made contacts with DJ9PC (DI), DB5KS (DL) and G8LMW (ZM). G3LQR also worked DJ9PC, plus OE3LFA (II) on Jan. 23, a QRB of 1,139 kms. Bob Hope, G3AUS, (Devon) is now on 13cm. with 6w. from an NE3005 device. His gear is all home designed and built and he has worked G4LRT in ZM square.

G4FRE plans to take down his 4m. beam later in the year and put up aerials for 13cm. and 23cm. On 23cm. at present, Dave has 10w. from a home built, solid state transverter with a 15-over-15 aerial on the side of the house, fixed to the east. Even so, GB3MLE, F1BUU (ZE), DL7QY (FJ), and HB9AMH/P (DH) have been heard. No QSOs were possible as his *Gasfet* preamp. and changeover relay had been left at work.

G4ROA is pleased to report very good activity on 23cm. in February, as heard from Coventry, the 19th bringing four more 1983 counties and G8TXG (YM) for a new square. In the brief tropo. event on the 18th, G8FMK closely monitored 23cm. and found beacon DB0JO peaking at S5 at 2130. This is in DL48a on a QRG of 1,296.854 MHz with 35w. *e.r.p.* from four, 15-over-15 *Yagis*, QTF 275°. The only station heard and worked was DF1EQ (DL76a) who was S9-plus 20dB.

G8ULU had hoped to be QRV on 23cm. by now but still awaited an MM transverter which has been on order from his local dealer since the end of October! Ken Willis, G8VR, (Kent) *does* have one of these, however, and is now on 23cm. He

plans to build a 2C39A amplifier and hopes, eventually, to install a 12ft. dish for *E-M-E* work.

Satellite News

G6HRI is the only reader to mention any satellite activity and has had a QSO with WA3YGQ in Pennsylvania, but did not state which satellite/mode. Russell has also worked numerous Europeans. The latest launch date for the *Phase 3B* “bird” is June 5 — it changes every month.

The recorded message from the University of Surrey on Mar. 8 said that UOSAT's gravity gradient boom was successfully deployed early on Mar. 7. However, after one metre extension, a cable fouled so the remaining three metres of deployment was stopped. Even so, this one metre extension was sufficient to stabilise the satellite for two days. Hopefully, the cable will be disentangled by the time this is read.

AMSAT-UK's A.G.M. takes place on April 9 at 1300 at London House in Mecklenburgh Square, off Guildford Street, London, W.C.1. Lunch facilities are available at this venue from midday.

Domestic Contests

The Barking Society's 2m. event is on Mar. 27, see details on p. 42, last month. The last three legs of the 4m. *Cumulatives* are on Mar. 27, Apr. 10 and 24, 0900-1100 GMT. The 23cm. Trophy Contest is on Apr. 2, 1600-2400 GMT, with the 70cm. version the next day from 0900 to 1700 GMT. Both are two section affairs, Single-op. and Multi-op. with one point *per* kilometre on 23cm. and the radial ring scoring system on 70cm.

The Stevenage and District A.R.S. is running an FM contest on 2m. on Apr. 10, 1300-1700 GMT in the 144.500-144.845 and 145.200-145.575 MHz parts of the band. Three sections, 1) up to 25w. output; 2) over 25w. *o/p*; 3) *S.w.l.* More information from G6NZC, 82 Lingfield Road, Stevenage, SG1 5SN on receipt of an *s.a.e.* The 2m. CW event is on Apr. 17, 0900-1500 GMT, again a Single-op. or Multi-op. contest, according to *RadCom*. (Last year it was a “classless” affair.)

Deadlines

April 6 is the next copy deadline and for June it is May 4. All your letters, etc., to:— “VHF Bands”, SHORT WAVE MAGAZINE, 34 High Street, WELWYN, Herts., AL6 9EQ. 73 *de* G3FPK.

A MICROPROCESSOR CONTROLLED MORSE DECODER PART V

PETER LUMB, G3IRM

Pulse Generator

SOME useful, though not essential, tests can be carried out by means of a pulse generator and a suitable circuit is shown in Fig. 10. Each time the microswitch is pressed a positive-going pulse appears at pin 11 of IC22 and a corresponding negative-going pulse appears at pin 8. Only one pulse is generated each time the switch is pressed and its length depends on the value of C12 and the position of R32. Using the values shown, the pulse width can be varied from 7mS to 400mS. The range can be altered by changing C12, and R32 should be calibrated by means of an oscilloscope. The negative-going pulse from the generator is taken to one of the Morse inputs. Y1 on the oscilloscope is connected to pin 12 on IC18; with a double beam oscilloscope Y2 can be connected to the pulse generator output. Using C11 = 0.68 μ F set the pulse generator to produce a pulse about 100mS wide. Y1 should now display pulses 10mS wide each time a dot is inserted corresponding to 12 w.p.m. Trigger the oscilloscope from Y2 so that the display appears each time a pulse is inserted. Varying the pulse length slightly should produce the following results:

Pulses	Meter	Oscilloscope
made longer	goes lower	Y1 pulses lengthen
made shorter	goes higher	Y1 pulses shorten

There will always be 10 clock pulses for each dot inserted by the pulse generator unless very wide pulse variations are made. If the dot length changes from very short to very long or *vice versa* it takes the speed controller some time to catch up as only one correction pulse is generated by the microprocessor for each dot received. If very short pulses are inserted they will be rejected by the program and the speed of the Morse clock oscillator as indicated by Y1 and the meter will not vary. Insertion of a long

Table of Values
Fig. 10

IC22 = 74LS00	R31 = 1K
IC23 = 74LS121	R32 = 47K
SW6 = microswitch	C12 = 1 μ F tant.

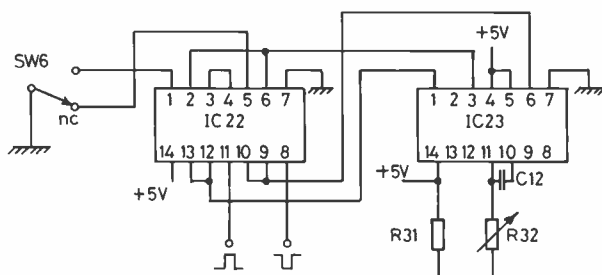


Fig.10 PULSE GENERATOR

(E
042)

Table of Values
Fig. 11

R33, R34, R35, R36, R39, R40 = 10K	C18 = 200 μ F
R37, R38, R42, R43, R44, R45, R46 = 1K	C19 = 82 pF polystyrene
R41 = 10M	TR3 = BC108 or similar
R47 = 3K3	IC24 = 4118
R48 = 2K2	IC25 = 8212
R49, R52 = 270R	IC26 = <i>see text</i>
R50 = 68R	IC27 = 74LS174
R51 = 100R	IC28 = SFF96364
C13, C14, C15, C16 = 0.01 μ F	IC29 = RO3-2513
disc at various points on board	IC30 = 74LS165
C17 = 47 μ F	IC31 = 74LS163
	IC32 = 74LSO4
	IC33 = 74LS132
	X2 = 1.008 MHz

pulse to correspond to a dash will change the display to a 'T' (D1 lights) but again neither the 'scope display nor the meter will change.

The Display Circuit

This part of the circuit is a quite straightforward constructional job with nothing in the way of complications. It is based on the Thomson EFCIS CRT controller, the SFF96364. A number of designs have been published using this IC and each has closely followed the circuits shown in the data sheets produced by the manufacturers. The design used six small memories which had to be connected together, a thing the writer does not like to have to do. The published circuits all use about 18 to 20 integrated circuits, whereas the writer's version has only 10 and provides the same facilities as the original design. Only one memory is used and the latches and gates used in the original circuits have been replaced by an 8212 input/output port manufactured by Intel and a number of other makers. The circuit diagram is shown in Fig. 11 with a board layout in Fig. 12.

As in Fig. 4 the address lines have been omitted and the corresponding 'A' lines must be connected. These only involve the CRT controller IC28 and the memory IC24; no other address lines are needed. IC26 deserves a special mention as it is a ROM specially programmed to the instructions given by the CRT controller manufacturers and is required to interpret the inputs to decide whether a character is intended or one of the various cursor movements available. It can be bought ready programmed as the ROM for "Elekterminal"; this is one of the designs published (in *Elektron* magazine) using the SFF96364 and is therefore programmed to the maker's requirements. The circuit can be assembled on a piece of Veroboard the same size as the processor unit, but it only needs one 12-way Minicon for connections to the processor; the connections needed are PBO to PB6, STB and power lines. These all connect to the corresponding connector on the processor board. The video output, which is a standard 1v pk/pk signal is also taken to the connector strip for connection to the video monitor; R51 controls the width of the display. A direct connection can be made to such a monitor and this is recommended as better definition can be obtained. Alternatively, the signal may be tapped into the video circuits of a television receiver.

Perhaps the easiest alternative to a video monitor is to add a modulator as used in TV games and home computers and feed this signal into the aerial input of the television receiver.

Checking the Display Board

Connect the monitor and board together and supply 5v to the circuit. Do not connect the processor board at this stage but take the PBO to PB6 lines to the six lowest switches on the programmer;

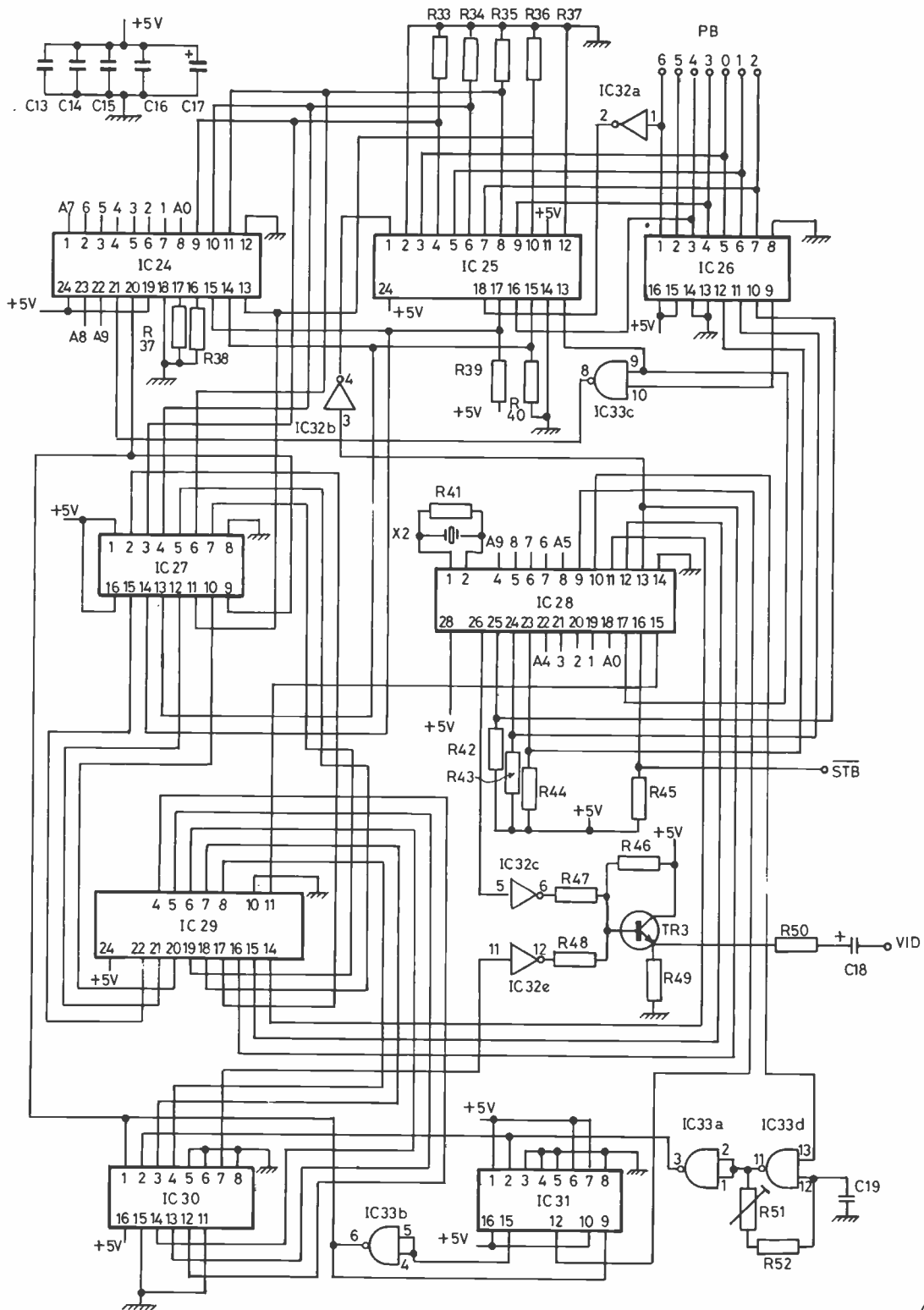


Fig.11 DISPLAY CIRCUIT

(E 043)

no connection is needed to switch 7. Connect \overline{STB} to the negative-going pulse output on the programmer. ASCII data can be set up on the switches and each time the programming switch is pressed the symbol corresponding to the data will appear on the display. A list of codes in octal is given in Table 7. Also shown are the meanings allocated to some of the codes in this design though these can easily be changed by the program if so desired. There is obviously no need for a back space. It might be thought that this

could be used to correct an error but the processor would not know how far to go back to make the correction!

The Spacing Switch

The diagram for this is given in Fig. 13. It can be built on a small piece of *Veroboard* and soldered on to unused tags on the switch for support. The switch is 11-way single-pole stopped down to 8 positions; these positions give spaces of 030 to 120 clock pulses (24

Table 7

(Note — codes not shown are non-print)

		Holding code
010	Back space	
011	Forward one space	
012	Line feed	
013	Up one line	
014	Clear display and cursor home	
032	Clears line but cursor remains in position	
033	Line feed	
034	Cursor home	
035	Carriage return	
040	Space	
041	!	Error
042	"	see text
043	#	121
044	\$	Understood
045	%	041
046	&	
047	'	
050	(
051)	
052	*	VA 104
053	+	AR 051
054	,	162
055	-	140
056	.	124
057	/	061
060	0	076
061	1	056
062	2	046
063	3	042
064	4	040
065	5	037
066	6	057
067	7	067
070	8	073
071	9	075
072	:	167
073	;	151
074	<	064
075	=	060
076	>	065
077	?	113
101	A	004
102	B	027
103	C	031
104	D	013
105	E	001
106	F	021
107	G	015
110	H	017
111	I	003
112	J	026
113	K	014
114	L	023
115	M	006
116	N	005
117	O	016
120	P	025
121	Q	034
122	R	011
123	S	007
124	T	002
125	U	010
126	V	020
127	W	012
130	X	030
131	Y	032
132	Z	033
133		
134	\	Brackets 154
135		
136	^	AS 047
137	_	Invalid code various

to 80 decimal). How it works will be described in the second part of the program.

The Program — Part II

This is listed in Table 8 which shows the additions required to complete the main program together with a few amendments to the preliminary program. Once again only the addresses listed need be programmed, all others can be skipped by pressing the addressing switch only. 000 005 to 000 032 clear the monitor display and return the cursor to the top left hand corner of the screen, its home position. 000 271 to 000 276 decides if a word space has been received and if it has the program jumps to 001 070 to insert a space. This part between 001 070 and 001 114 also counts the number of characters and word spaces printed out on each line of the display and stores the count in register 'L'. It also checks 'L' to see if the count is 065 or more; if it is, the carriage return and line feed are initiated at 001 150. In this way a line nearly always ends in a complete word.

One of the faults of the earlier display built by the writer was that each line was filled before a new line was started resulting in nearly every word at the end of each line being broken between this and the next line. Very long words starting near the end of a line can still over-run on to the next line but these are few and far between particularly in amateur Morse. A program was written to insert a hyphen at the end of such lines and, although this was fairly long, it worked until it was realised that if only one letter was carried forward to the next line it could just as well have been printed in its correct place at the end of the previous line in place of the hyphen. To avoid this the program was made even longer and the whole idea was abandoned as not being worth the trouble.

The address which determines whether a space is to be inserted is 000 272, and the data at this address can be changed by the spacing switch. Some amendments have been made at 000 333 to 000 337 and the program continued to 000 373. Before the Morse holding codes can be printed out they must be changed into ASCII and this is done by this revised program. What is known as a 'look-up table' will be programmed between 002 000 and 002 377. When the processor is holding a Morse holding code it goes to the corresponding address in the look-up table where it finds the ASCII code required, which it then transfers to its 'A' register to print out at 000 341. This section in conjunction with 001 226 to 001 233 clears the 'L' register when a line of print is full, and a word carries forward to the next line so that 'L' can start again at zero to count characters in the new line.

000 366 enables the interrupt circuits. If the restart (interrupt) switch is pressed, this fact is remembered in IC20 and the EI instruction at 000 366 transfers the program to 001 000 via 000 054 to 000 056. How the interrupt works is illustrated in Table

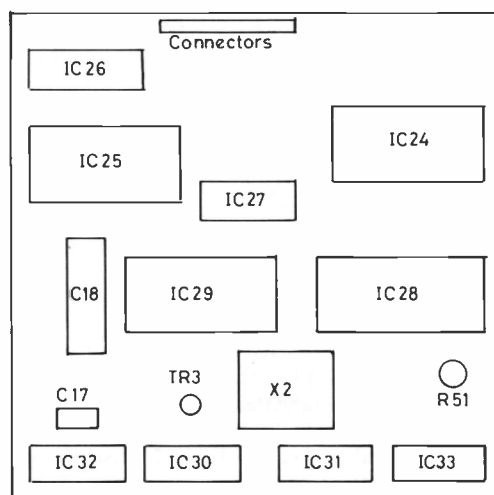


Fig.12 DISPLAY BOARD LAYOUT

Table 8

Address	Data Mnemonic	
000 005	076 MVIA	023 120 MOVDB
006	014	024 130 MOVEB
007	323 OUT	025 311 RET
010	201	030 076 MVIA
011	076 MVIA	031 137
012	007	032 323 OUT
013	323 OUT	033 201
014	203	034 076 MVIA
015	075 DCRA	035 007
016	323 OUT	036 323 OUT
017	203	037 203
020	036 MVIE	040 075 DCRA
021	000	041 323 OUT
022	123 MOVDE	042 203
023	035 DCRE	043 303 JMP
024	302 JNZ	044 353
025	023	001 045 000
026	000	070 175 MOVAL
027	025 DCRD	071 376 CPI
030	302 JNZ	072 065
031	023	073 322 JNC
032	000	074 150
271	076 MVIA	075 001
272	100	076 076 MVIA
273	271 CMPC	077 040
274	312 JZ	100 323 OUT
275	070	101 201
276	001	102 076 MVIA
303	325	103 007
325	173 MOVAE	104 323 OUT
326	007 RLC	105 203
327	202 ADDD	106 075 DCRA
000 330	332 JC	107 323 OUT
331	030	110 203
332	001	111 054 INRL
333	137 MOVEA	112 303 JMP
334	345 PUSHH	113 073
335	046 MVIH	114 000
336	002	150 076 MVIA
337	153 MOVLE	151 015
340	176 MOVAM	152 323 OUT
341	323 OUT	153 201
342	201	154 076 MVIA
343	076 MVIA	155 007
344	007	156 323 OUT
345	323 OUT	157 203
346	203	160 075 DCRA
347	075 DCRA	161 323 OUT
350	323 OUT	162 203
351	203	001 164 000
352	341 POPH	165 026 MVID
353	054 INRL	166 005
354	076 MVIA	167 035 DCRE
355	077	170 302 JNZ
356	275 CMPL	171 167
357	312 JZ	172 001
360	226	173 025 DCRD
361	001	174 302 JNZ
362	006 MVIB	175 167
363	000	176 001
364	120 MOVDB	177 076 MVIA
365	130 MOVEB	200 012
366	373 EI	201 323 OUT
367	000 NOP	202 201
370	000 NOP	203 076 MVIA
371	303 JMP	204 007
372	250	205 323 OUT
000 373	000	206 203
001 000	333 IN	207 075 DCRA
001	202	210 323 OUT
002	346 ANI	211 203
003	360	212 036 MVIE
004	017 RRC	213 000
		214 026 MVID

005	062 STA	215	005
006	272	216	035 DCRE
007	000	217	302 JNZ
010	076 MVIA	220	216
011	005	221	001
012	323 OUT	222	025 DCRD
013	203	223	302 JNZ
014	075 DCRA	224	216
015	323 OUT	225	001
016	203	226	056 MVIL
017	363 DI	227	000
020	006 MVIB	230	303 JMP
021	000	231	073
022	110 MOVCB	232	000

9. Port C is read which inputs the switch codes. The lowest four bits are masked out to zeros and the data rotated right producing the octal numbers listed. The number selected is then transferred to 000 272 to determine the length of the next space detected. The interrupt is then disabled at 001 017. Registers B, C, D and E are cleared and the program returns to where it left off at 000 370, followed by a jump back to the space input. As mentioned earlier, 001 150 to the end of the program are to initiate line feed and carriage return.

The look-up table is given in Table 10 and fills the whole of the third section of the memory, 002 000 to 002 377. All the addresses must be programmed, all those not listed being programmed as 137 — the code for a dash on the line in ASCII. All data held as a Morse holding code must lie between 000 and 377 and those which correspond to a valid symbol are listed in the look-up table. Should any other data be present it will be one of the codes represented by a dash so that any invalid code will initiate a dash print out on the line. If letters are inadvertently joined the number produced by the ADDD instruction at 000 327 can be over 377 and, if this happens, what is known as a 'carry flag' is set in the microprocessor. This carry is detected at 000 330 and the program jumps to 001 030 to insert an invalid symbol; this is a slight modification made after the preliminary program was written and ensures that all invalid codes are detected. (In the preliminary program some of the very long ones were missed and an incorrect symbol printed).

A small complication arises when an erase is received. The holding codes are 077, 177 and 377 depending on whether 6, 7 or 8 dots are received. Should a string of 9 or more be received the register overflows and produces a wrong print-out. In all the time the writer has used a decoder this has never occurred. In fact many amateurs send a series of the letter E when they mean erase and this prints out accordingly; the additional alterations to the program to avoid this were not considered worthwhile.

Final Wiring

The interconnections between the various units can now be made from Fig. 9, the programmed memory board inserted on its

Table 9

Interrupt coding	PC	RRC	Octal	Decimal
Switch				
1	0011XXXX	00011000	030	24
2	0100XXXX	00100000	040	32
3	0101XXXX	00101000	050	40
4	0110XXXX	00110000	060	48
5	0111XXXX	00111000	070	56
6	1000XXXX	01000000	100	64
7	1001XXXX	01001000	110	72
8	1010XXXX	01010000	120	80

X = don't care

Table 10

Note: all addresses between 002 000 and 002 377 not listed below must be programmed with data 137

Address	Data	Address	Data
002 001	105	002 041	043
002	124	042	063
003	111	046	062
004	101	047	136
005	116	051	053
006	115	056	061
007	123	057	066
010	125	060	075
011	122	061	057
012	127	064	074
013	104	065	076
014	113	067	067
015	107	073	070
016	117	075	071
017	110	076	060
020	126	077	041
021	106	104	052
023	114	113	077
025	120	121	042
026	112	124	056
027	102	135	047
030	130	140	055
031	103	151	073
032	131	154	134
033	132	162	054
034	121	167	072
037	065	177	041
040	064	377	041

pin connector and power connected. Morse can now be decoded and printed out on the monitor. At this stage the Morse must be at negative-going TTL levels and the final article in the series will deal with filters and conversions to TTL.

to be concluded

BOOK REVIEW

A GUIDE TO AMATEUR RADIO

Nineteenth Edition

A LARGE proportion of people now entering the amateur radio hobby does so *via* Citizens' Band radio experience. Unlike the reviewer and his contemporaries who graduated to their full licences through a short wave listening apprenticeship, these *ex-CB*-ers have very limited, if any, knowledge of amateur radio, so Pat Hawker's, G3VA, *A Guide to Amateur Radio* is essential reading.

First published fifty years ago, this new, nineteenth edition has been extensively revised to include the new amateur bands resulting from the W.A.R.C. Conference in 1979, and the consequential revisions to U.K. and international regulations. The book comprises twelve chapters, the first, "This is Amateur Radio", being mostly in question and answer form. The next, "Fundamentals of Electronics", briefly introduces Ohm's Law, capacitance, inductance, etc., symbols for components, colour codes, and so on. Chapter 3, "Getting Started", deals with propagation, simple antennas and log keeping, but includes material on frequency synthesisers and phase-locked-loops.

"Amateur Radio Equipment" is the fourth chapter and covers sets, ancient and modern, from the past 45 years. It is amply illustrated and has an eight-page list of 22 manufacturers' equipment with some references to vintage dates. The following two sections deal with "Communications Receivers", and "Transmitters" with numerous block and circuit diagrams, and physical layouts. The latter chapter also includes sections on TVI, AFI and frequency measurement. Chapter 7 is a short one entitled, "The Antenna" and includes the usual, basic material.

The next chapter, "Workshop Practice", is based upon an earlier *Radio Communication* article by G3OMK and contains some useful notes and illustrations on "chassis bashing", etc. Chapter 9, "The Licence Examinations", includes a U.K. amateur bands availability table as at April, 1982, so does not show the 18 and 24.9 MHz bands, the EHF ones above 24 GHz, or the restricted 50 MHz details. The tenth chapter, "Operating an Amateur Station", covers reporting, the Q-code, band plans and countries lists. The final two chapters are devoted respectively to the RSGB and International AR Organisations.

The first appendix is called, "1982-85 Radio Amateurs' Examination Syllabus and Objectives", which says it all, and lists the subjects the R.A.E. candidate needs to know before enrolling for the examination. The next appendix lists forty sample R.A.E. questions and gives the answers, while the last appendix, "Safety Pointers", is a brief one suggesting how best to avoid injury and death in pursuance of the hobby. The book has a useful two page index.

A Guide to Amateur Radio is published by the Radio Society of Great Britain and is a paperback of 160 pages, in 246 x 184mm. format. It can be well recommended to all would-be radio amateurs as a first-class reference book. It is available from *Short Wave Magazine* Publications Department at 34 High Street, WELWYN, Herts., AL6 9EQ, for £3.40, including postage and packing.

N.A.S.F.

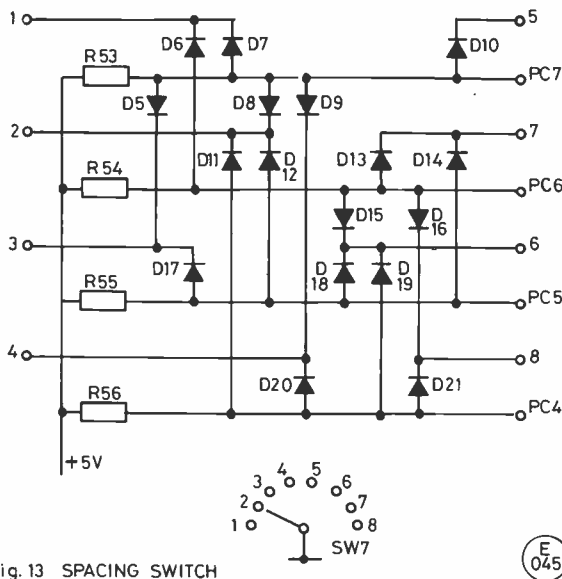


Fig. 13 SPACING SWITCH

Table of Values
Fig. 13

R53, R54, R55, R56 = 2K7
D5 to D21 = 1N4148

SW7 = 1-pole 8-way rotary switch

THE "WHITFIELD" SSB/CW/QSK TRANSCEIVER, PART II

AN EASY-TO-BUILD, 5 WATTS OUTPUT,
MODERN DESIGN COVERING 160
METRES, 80 METRES, AND 3 – 3.5 MHz

IAN KEYSER, G3ROO

WE start this month with the main interconnection diagram, Fig. 2. It can be difficult to know where to put this in a series article: some would say at the end, but I think it will provide the prospective constructor with some insight into the finished project. Also, references will have been made to it while explaining the various sections of the rig.

The Receiver Section

This time we are going to cover the main receiver PCB and SSB generator. This is starting at the back-end and working towards the aerial, but the PCB will be described in the opposite direction — the signal in towards the loudspeaker. The complete diagram is given in Fig. 3. It looks a lot to take in at one go, but really it's not too bad. This PCB includes receiver mixer, filter, IF strip, AF preamp., AF filter, and audio output stage; in addition there is the Tx microphone amplifier, the balanced modulator and the SSB IF amplifier.

The signal in from the RF preselector (or RF amplifier if used) is fed into pins 12 and 13 of IC1. This device is a high level mixer from Plessey, the SL6330, having characteristics which approach those of diode ring mixers when run under optimum conditions; this section, along with the IF amplifier, is identical to Peter Chadwick's design. The mixer current, and so its operating conditions, is set by R1001, and C1004 decouples the programming current input, pin 11; pin 4 of this device is the supply input and is decoupled by C1003, the mixer output being on pin 3. The signal load is a 1mH RF choke, RFC1001, capable of push-pull output if required; however, this is not needed in this application and so the second output is taken to the supply rail from Reg 1001, C1005 serving the dual function of decoupling the output of Reg 1001 and the mixer unused output on pin 14.

The decoupling capacitors throughout the rig have been set, wherever possible, at 0.01- μ F for the sake of simplicity, as the only requirement for these components is that their reactance at the frequency present at a point is less than one-tenth of the impedance of the circuit at that point and so act as a short-circuit to the RF/IF signal. In the majority of cases this also applies to the coupling capacitors in the set.

The local oscillator signal is coupled by C1006 into pin 5 of the mixer, and the signal out of pin 3 is coupled to the filter FL1001 via C1007; R1007 is set to the input impedance of the filter to ensure the flattest possible response of its passband. The output of the filter is the 455 kHz difference signal resulting from the subtraction of the input signal from the local oscillator signal. This filter has a bandpass of about 3 kHz, adequate for SSB and a very good stop-band figure; the slope of the filter is perhaps not quite as good as one might wish, but when the cost is taken into consideration it is more than adequate for the job in hand.

The IF amplifier integrated circuit, IC1002, is the Plessey SL6700, which includes two IF amplifiers, AGC detector and the SSB balanced demodulator. The two IF amplifiers are capacitively coupled by C1008 and the output of the second amplifier, on pin 6, is connected to the tap on the primary of IF transformer T1001; C1009 is used to block the DC component,

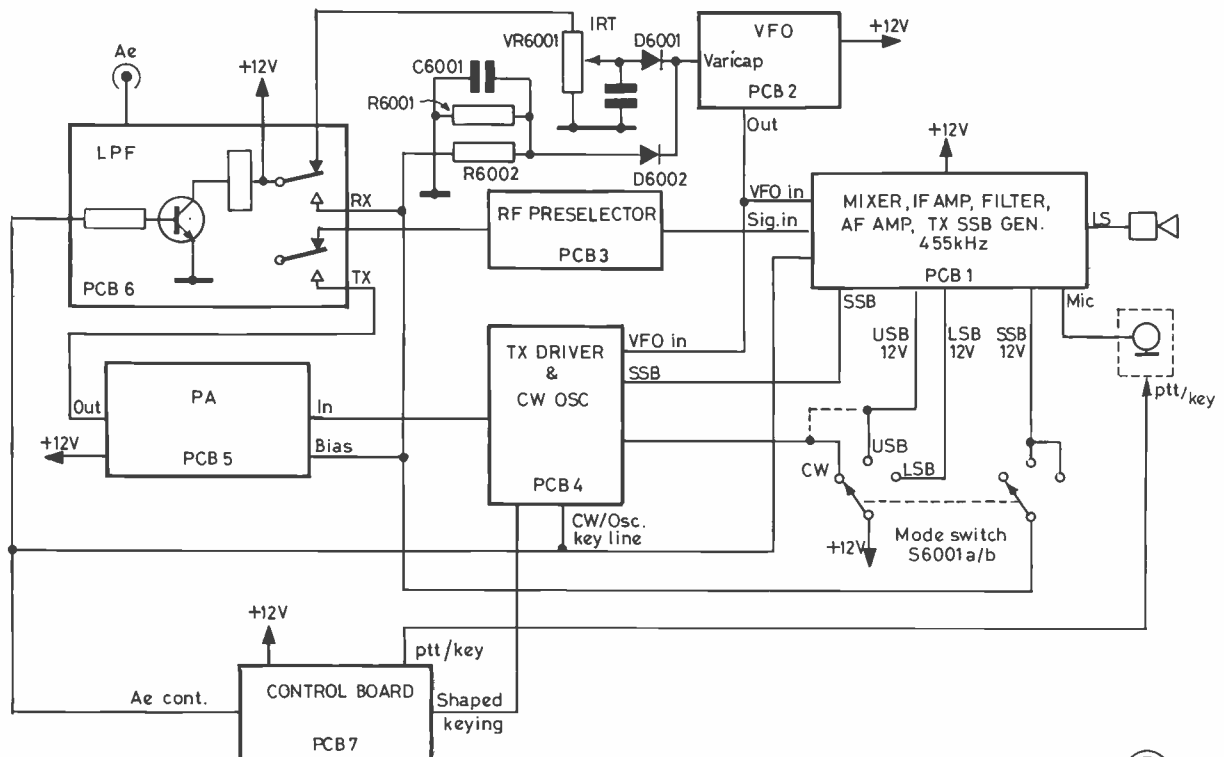


Fig. 2 THE "WHITFIELD" INTERCONNECTIONS

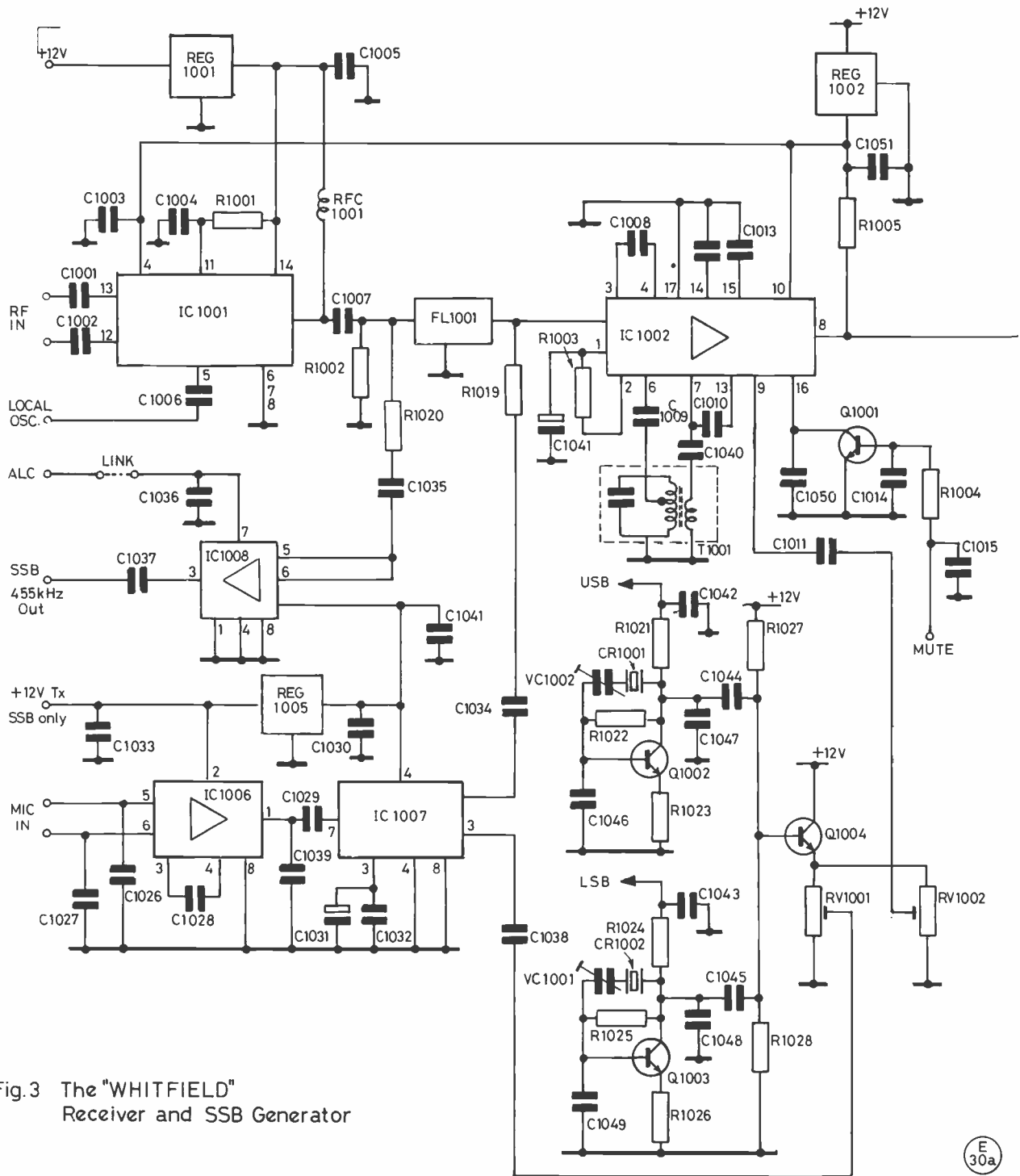


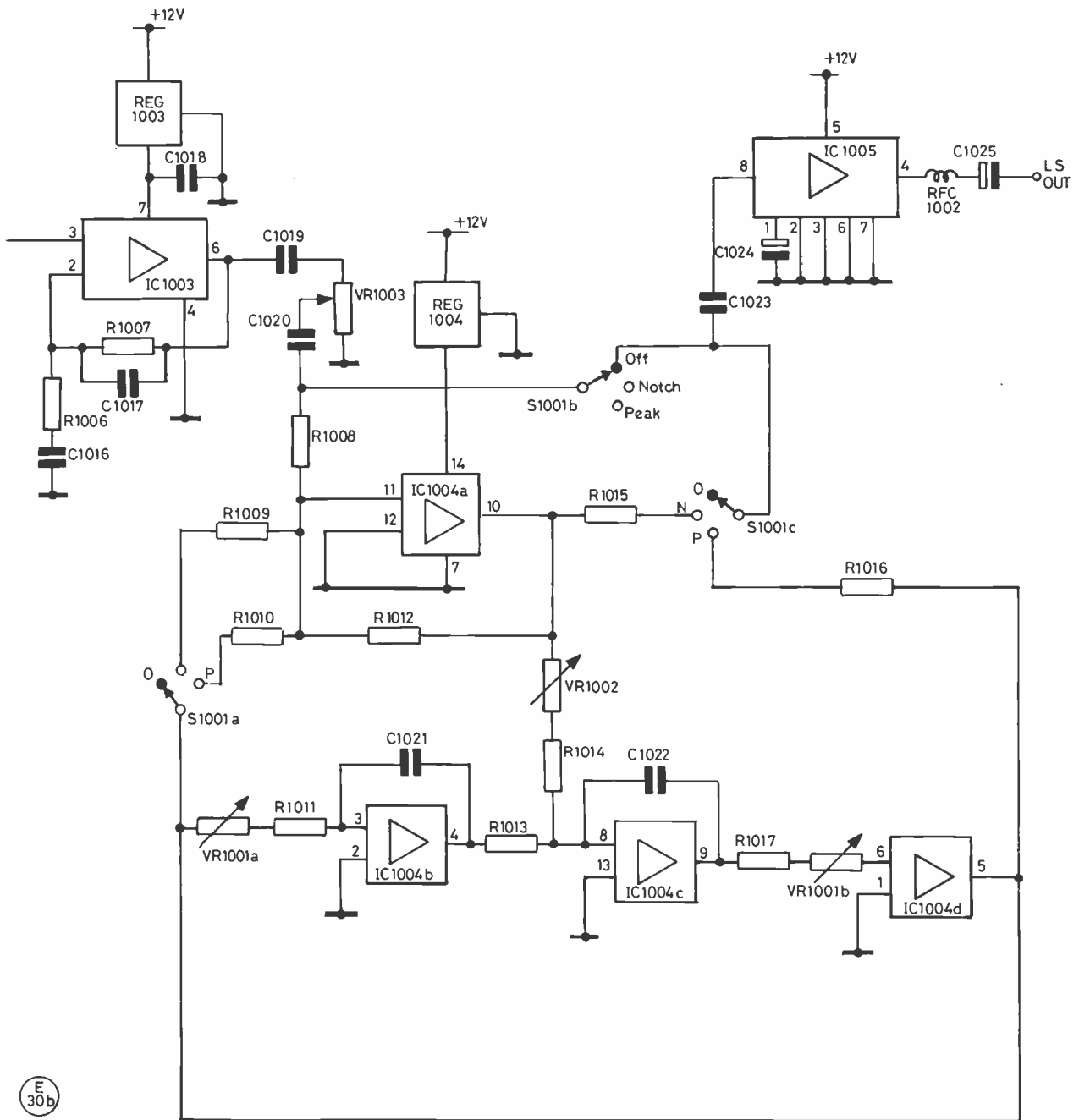
Fig. 3 The "WHITFIELD"
Receiver and SSB Generator

E
30a

T1001 is used to transform the impedance of the output to match the relatively low input impedance of the two detector inputs (the AGC detector and the balanced demodulator). Pin 13 has a DC component and C1010 prevents this from shorting out *via* the secondary of T1001. The BFO or CIO (carrier insertion oscillator) signal from the output of the emitter of Q1004 is coupled into the balanced modulator on IC1002's pin 9 *via* C1011, and the SSB audio is available on pin 8 — R1005 acting as the collector load for the balanced modulator.

The supply for IC1002 is five volts from Reg 1002, the output of which is decoupled by a small 100 μ F electrolytic capacitor. C1012

decouples the AGC detector on pin 14, and C1013 decouples the output of the detector on pin 15; pin 15 also has an audio component which can be used for AM detection if required. To mute this IF amplifier on transmit it is possible to use the AGC line by shorting-out the AGC decoupling point on pin 16. This is not done directly but by a transistor, the reason for this being that it is unwise to trail wires from RF sensitive points throughout the set when it is not necessary, Q1001 acts as the switch, and its base as the control which is well and truly decoupled by C1014, C1015 and R1004. By increasing the voltage on the mute input the gain of the IF strip steadily decreases.



Before going on to the AF stages I will cover the CIO circuit. There are two oscillators, Q1002 and Q1003, one for lower sideband and the other for upper sideband. The circuits of these oscillators are very straightforward and hardly need any explanation. To enable one or other oscillator the supply is switched by the mode switch shown on Fig. 2. When in CW mode either oscillator can be used according to which one gives the best tone, and this depends on the frequency of the CW oscillator in the transmitter. The outputs from these two oscillators are fed to the base of Q1004 which is an emitter-follower stage. The emitter load is made up of two miniature presets, one for the

receiver balanced demodulator and the other for the transmitter balanced demodulator, enabling the levels to be set independently.

Now for the audio stage. IC1003 is a 741 op. amp., something that everyone must have used at one time or another! Its function here is as a high-gain AF amplifier with frequency-dependent feedback C1016, C1017, R1005 and R1006; this gives a roll-off at about 6 kHz. An eight volt supply is provided by Reg 1003 and decoupled by C1018, an electrolytic. The output from pin 6 is DC blocked by C1019 to feed the volume control. C1020 is a DC block to preserve the DC levels in the filter circuitry.

Ah, now the AF filter! Here I will reserve the right not to go too

deeply into the circuit having tried to find a way of describing it without becoming too verbose — and it's just not possible! I think that it is sufficient to say that in the notch mode IC1004a, in conjunction with the IC1004b, c, and d loop, provides an amplifier with unity gain at all frequencies except at resonance; in the peak mode IC 1004a does nothing, and the conventional loop filter comprising IC1004b, c, d takes over. I have used this filter for years with the 741 but they are much too bulky to be included in this circuit. Instead I have used a Norton amplifier (LM3900), though not quite as the manufacturers intended (that's amateur radio!). The problem was trying to keep the component count down, and allowing proper biasing would have meant a lot of extra components. By running the device at reduced supply voltage (6 volts from Reg 1004) and due to the very low audio level — tens of millivolts — there is no audible distortion.

At this point, a few words on using the filter in notch mode could be useful. At first it will appear that the filter is not working: this is due to the fact that the 'Q' is very high and you're tuning through the tone you wish to reject. The trick is to switch to the peak mode and peak the undesired signal, then switch to the notch mode and adjust the filter tuning to give maximum rejection.

IC1005 serves as the audio output stage, this device developing 1 watt of audio into 8 ohms with a 12 volt supply. C1023 is the input coupling capacitor, valued at 0.1 μ F. A word here about these low value audio coupling capacitors: we are used to using in audio circuits values of 1 to 10 μ F for audio coupling, but in these instances the impedances are high. Considering C1023, for example, the output impedance of IC1004a or IC1004b (depending on the filter mode) is low, in the region of 500 ohms or so, the input impedance of IC1005 is very high — in excess of 100K at a guess. Now, the reactance of a 0.1 μ F capacitor at 1 kHz is only about 1.5K ohms, so if you look at the equivalent circuit the amount of signal lost is minimal. The output of IC1005 is on pin 4 — the RFC in the output is for stability and is called for in the application notes; however I have, in the past, left it out and not noted any instability.

The SSB Generator

The microphone signal is amplified by IC1006, an SL1630. C1026 and C1027 are RF filter capacitors of 0.001 μ F; these are

Table of Values
Fig. 3

R1001, R1019, R1020 = 220R	C1046, C1047 = 400 pF, poly. or disc
R1002, R1005 = 1K8	Q1001 to Q1004 = BC108 or equiv.
R1003 = 1K	IC1001 = SL6440
R1004 = 1M	IC1002 = SL6700
R1009 = 4K7	IC1003 = 741
R1006, R1010 = 220K	IC1004 = LM3900
R1008, R1012, R1021, R1024 = 47K	IC1005 = ULN2283
R1011, R1013, R1017, R1018 = 2K7	IC1006 = SL1630
R1014 = 10K	IC1007 = SL1640
R1015, R1016 = 470R	IC1008 = SL610
R1012, R1025 = 470K	Reg 1001, 1003 = 78L08
R1023, R1026 = 100R	Reg 1002 = 78L05
R1027, R1028 = 33K	Reg 1004, 1005 = 78L06
C1001 to C1007, C1011, C1033 to C1038, C1040 to C1045 = 0.01 μ F d/c	FL1001 = CFS455/LFD 2, <i>Ambit</i>
C1008 to C1010, C1013, C1014, C1026, C1027, C1039, C1048 to C1050 = 0.001 μ F d/c	CR1001 = CRM460A, <i>Ambit</i> 16-46073
C1015, C1016, C1019, C1020, C1023, C1029, C1030, C1032, C1051 = 0.1 μ F, C280	CR1002 = CRM455, <i>Ambit</i> 16-45573
C1017 = 220 pF d/c	TI001 = <i>Toko</i> YHCSI1100, or <i>Ambit</i> 35-11000
C1018, C1031 = 1 μ F, 16v. elec.	RV1001, 1002 = 4K7 min. horizontal preset
C1021, C1022 = 0.033 μ F, C280	VR1001 = GM70R, 25K dual, 48-25315
C1024 = 10 μ F, 16v. elec.	VR1002 = VM10, 50K lin., 48-50313
C1012, C1025 = 100 μ F, 16v. elec.	VR1003 = VM10, 50K log, 48-50314
C1028 = 0.0047 μ F, d/c	VC1001, 1002 = 9-50 pF, 06-50003
	RFC1001 = 1mH
	RFC1002 = 33 μ H
	S1001 = 4-pole, 3-way

Note: all resistors are 1/4-watt; semiconductors and presets available from *Ambit International*.

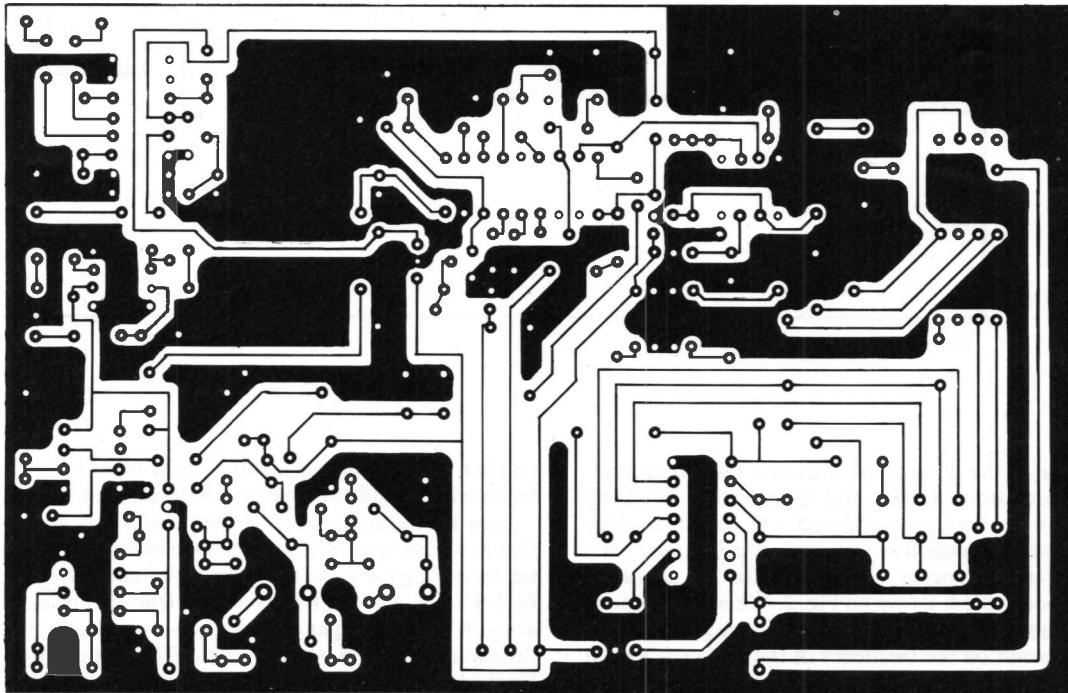


Fig. 4 WHITFIELD PCB — TRACK SIDE

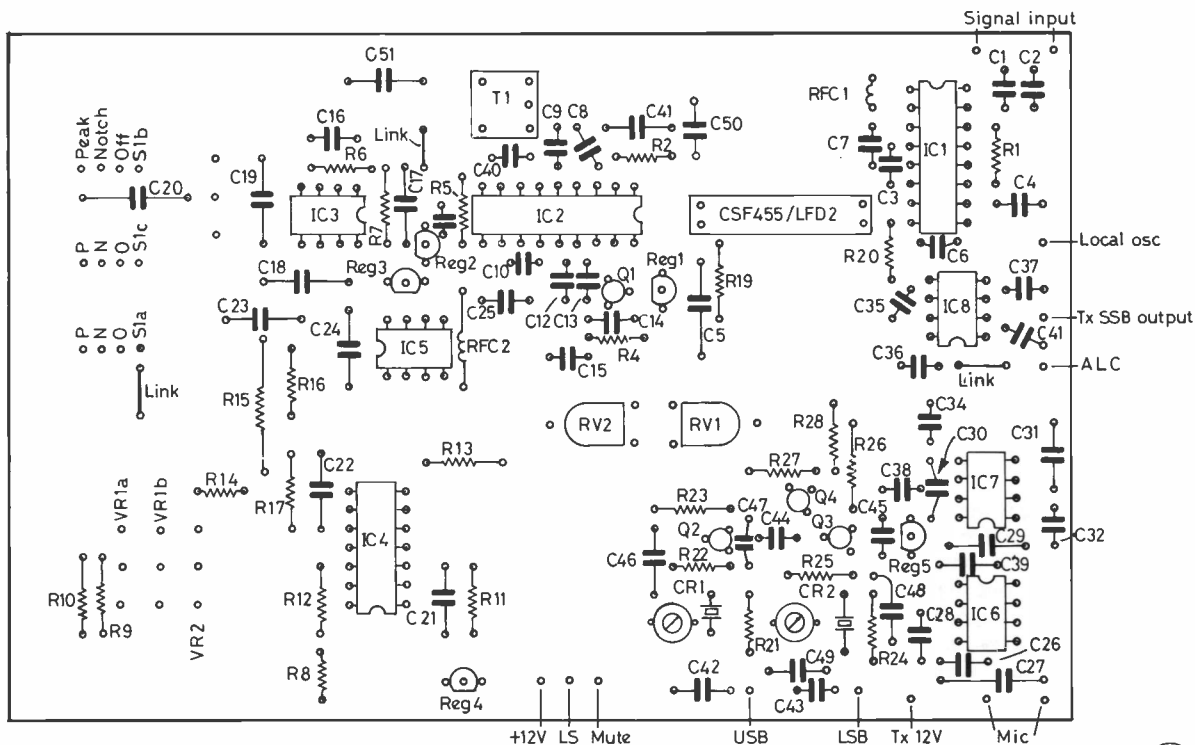


Fig. 5 WHITFIELD PCB COMPONENT LAYOUT

E 032

sufficient to keep RF problems to a minimum, providing that screened leads are used for the microphone. There is only one external component of note associated with this device, and that is C1028 which sets the roll-off frequency of the amplifier; I have it set at about 5 kHz. C1030 decouples the incoming 12 volts on Tx supply, and C1029 is a 1 μ F capacitor for DC blocking to couple the amplified audio signal to the balanced modulator, IC1007. No external balancing of the carrier signal is required as the device itself provides over 20dB; that combined with the 20dB or so of the filter is quite sufficient. C1031 and C1032 are decoupling capacitors for the internal bases of the balanced modulator, and as there are both audio and radio frequencies present I have used values of 1 μ F and 0.01 μ F to cover the whole spectrum; the internal inductance of the 1 μ F capacitor would not enable it to be an efficient decoupler at RF.

IC1007, an SL1640, has internal output load and so C1034 is used for DC blocking. R1019 reduces the loading effect of the output of the balanced modulator on the modulator in the filter circuit, so losing gain in the receiver; R1020 serves the same purpose but is not so important. The reason for this is that the input impedance of IC1008, an SL1610, is relatively high and so the loading effect is minimal. The SL1610 is a wideband RF amplifier with a gain of 10dB and is interchangeable with the SL1611 and SL1612, which have gains of 20dB and 34dB respectively; thus if there is insufficient gain it is possible to replace this IC to compensate for losses. Pin 7 on this device is for AGC purposes and is brought to the board edge in case it is required or ALC at a later date. The SSB output signal of 455 kHz has an amplitude of about 200mV, sufficient to drive the Tx mixer. With that, the description of this PCB is ended!

PCB Construction Notes

The PCB foil side is given in Fig. 4, and the component side in Fig. 5. The PCB uses double-sided board, the top side for the groundplane and the underside for the interconnections. Actually, with careful drawing, it is possible to get all the earth connections on the underside, but it is tight and not really necessary. One point to note is that prior to putting any

components on the board at least one interconnection from top to bottom for each groundplane island should be drilled and soldered to prevent any problems of DC continuity later on.

The board should be cleaned using an abrasive — I find that one of those green pan scrubbers is ideal — then washed in hot water and dried thoroughly. The board is then placed under Fig. 5 and, using a sharp point such as a scribe, all the holes are marked. Drill the holes with a 0.8mm. drill and remove the burrs with fine emery paper; this makes marking the pads with the pen very simple. Carefully draw all the tracks, and if mistakes are made use an ink-rubber to remove the fault before re-drawing.

Finally, using the pen, fill-in as much groundplane as possible. To save painting the top side of the copper PCB float it in ferrite chloride; however this is an optional idea as it really only saves a few minutes painting. Next take a 3/16th drill and clean the copper away on the top side of the PCB around the holes that take the component wires to the tracks — not those to the groundplane. After completing and testing the PCB these earth points are soldered on both sides of the board.

to be continued

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REPEATER SHIFT FOR THE ICOM ICB1050 AFTER CONVERSION TO 10-METRE OPERATION

P. OSBORNE, G4RPF

HAVING modified the Icom ICB1050 CB rig as per G3XSE's instructions (*S.W.M.* February 1983), the pleasures of 10 metre FM contacts soon revealed themselves.

There was, however, one slight problem; many contacts could be heard being made through repeaters on 29.62 MHz and 29.64 MHz (channels 27 and 29 for those of you without calculator brains). At times these signals registered end-stop on the converted rig, which considering the set is slightly deaf anyway thrilled me to bits. (Note the *ex-G8* enthusiasm). After enquiring as to the input frequencies of these marvellous boxes and being told that they lie 100 kHz lower than the output, I proceeded to play with 'XSE's patented wrist action. Basically this involves whipping the channel selector down 10 channels from the repeater output, transmitting, and then returning to the output again to receive. This is a super method for the first few overs but does cause the wrist to become somewhat limp and in need of refreshment (not by the famous lager as this causes channel inaccuracies to creep in and creates more limpness in other parts).

It's Got to be Easier

There just had to be an easier way of getting repeater shift apart from obtaining another converted CB rig (must remember to wash my mouth out with best bitter).

In fact three alternatives exist. The first is to obtain an assistant, a young lady if you like, to flash through the channels. This could prove more costly than the other two alternatives as a training session is required and possibly a bit of buttering-up/persuasion (a meal or a pint) and then some tipping afterwards. The second method is to go the whole hog and fork out for a mixer crystal to be switched in for the transmitter repeater frequency shift, *i.e.* a 16.86125 MHz crystal. This may cost over £6 (anything over £1 is out with me) and involves a hell of a wait. Finally there is the logical approach achieved by subtracting or adding 100 kHz (10

channels) on the synthesiser address lines. This should work out the cheapest.

As it is binary coding we are working with, the shift of 100 kHz (10 channels) is easier to add than subtract from the original address, although I did try to find ways round this as a means of imitating the standard method of selecting the repeater output and shifting down from that to transmit.

Original ideas used a handful of resistors, diodes, 4011 and 40106 integrated circuits, which were cheap if not to be found in a junk box. These ideas all failed to pass the final theoretical check before putting solder, components and board together.

On the verge of giving up the idea of solving the problem logically and shelling out for the crystal instead, I made a final dive into a large CMOS data book in which I tumbled upon the solution — a four-bit full adder. This chip combined with previous ideas produced the circuit shown in Fig. 1.

Circuit Description

Fortunately, whilst the microphone incorporates the four-wire system which many CB sets use, such that without the microphone the audio output is muted, the ICB1050 only uses three of these wires (*i.e.* mic., PTT and ground). The fourth wire is grounded during receive-only, is not used, and lent itself nicely to the modification. An additional switch had to be added to this line, though, because otherwise the repeater shift cannot be switched out. We will deal with this part of the modification later.

When the repeater shift mode is selected the base of TR1 is held low in receive. This causes the collector to rise to almost 5 volts, hence placing the binary count of 0101 onto pins 15, 6, 4 and 2 in that order. The count of 0101 is in fact 10 when looked at in relation to the full binary code word applied to the synthesiser chip, and as the channel spacing is 10 kHz we have a shift of $10 \times 10 \text{ kHz} = 100 \text{ kHz}$. Therefore, the receiver is listening 100 kHz higher than the channel selected and shown on the channel display.

If we now go to transmit the base of TR1 goes high pulled up by R1. The collector goes low to 0V and now the binary count to be added to the synthesiser address is 0000 (*i.e.* a big fat zero channel adjustment); so, the transmitter frequency is that selected and shown on the channel display.

Table of Values

Fig. 1

R1 = 10K, ¼W 10%	TR1 = BC109 or similar
R2 = 47K	IC1 = CD4001 or MC14001, or equiv.
R3 to R6 = 100K	IC socket = 16-pin DIL
<i>Also Veroboard or PCB, as preferred.</i>	

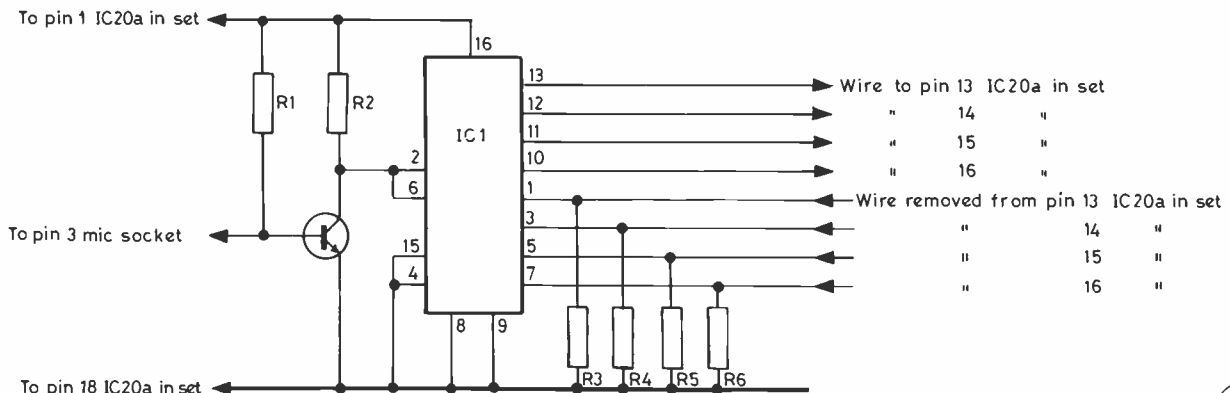
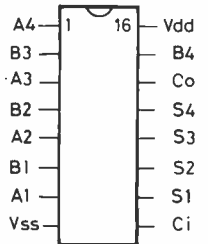


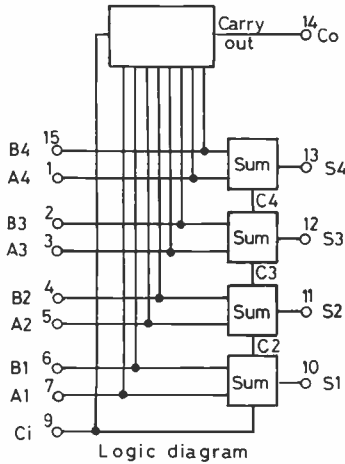
Fig. 1 REPEATER SHIFT BOARD CIRCUIT DIAGRAM

A _i	B _i	C _i	C _o	Sum
0	0	0	0	0
1	0	0	0	1
0	1	0	0	1
1	1	0	1	0
0	0	1	0	1
1	0	1	1	0
0	1	1	1	0
1	1	1	1	1

Truth table



Terminal assignments



Logic diagram

Fig.2 LOGIC DETAILS TRUTH TABLE & PIN ASSIGNMENTS

E 039

Construction

The circuit is very simple and components could be easily mounted on a piece of Veroboard, as mine were initially. However, there are those of you with the need to have things extra neat on a PCB; the design for the PCB is shown in Fig. 3 and should be easy either to copy photographically or using a good artistic hand and a Dalo pen.

Having obtained your board vero or otherwise remember the construction rates which especially apply to CMOS devices that is, resistors and transistor first, chip last. A chip holder may be a good idea allowing you the ability of gauging the size of board required and where you are going to place components in relation to the chip without actually handling the chip.

Fitting

Get your rig out and open it up (no — not with a sledge hammer). You will see that pin 3 of the mic. socket has been grounded, along with pin 2. So next lift the wire and the capacitor from pin 3 and transfer them to pin 2. This now leaves pin 3 free for the repeater modification.

You can now insert your switch in the scheme of things; this can be any single-pole single throw switch which will inhibit ground from pin 3 reaching the repeater shift board. Without this vital item you will not be able to obtain simplex working any more. You can fit the switch anywhere in the line between the microphone and the board. On my set I modified the microphone wiring as shown in Fig. 4 and placed the switch on the back of the microphone, making it easier to use under mobile conditions. Alternatively, the switch can be placed inside the set between the mic. socket and the repeater shift board. There just so happens to be a hole spare on the front backing panel, in line with the power switch, so the front panel could be drilled and the switch fitted there. Someone suggested that the Hi-Lo power switch itself could be used, providing you don't require that option. (Good idea, huh!)

Now you are ready to fit your board. Start by removing the wires from pins 13, 14, 15 and 16 on the synthesiser chip (IC 20A in the manual). Place these into the holes or onto the pins of your board (make sure they are in the correct order as per Fig. 1).

You're on the final leg now. Take your replacement wires and put them into the holes where you ripped the others out. The power supply leads need to be taken behind the board and soldered to pins 1 and 18 on the track side of the board. The wire to pin 3 does just that, although you may want to insert your switch at this point as previously discussed.

Now it's your turn to do a little bit of thinking. Where are you going to put this board? Three suggestions (apart from in the set) are:—

- (1) Use some good insulating material and twin-stick tape to adhere the board to the inside of the speaker-lid cover.

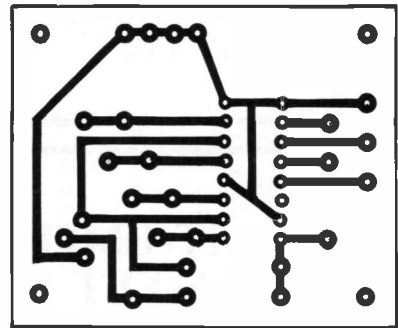
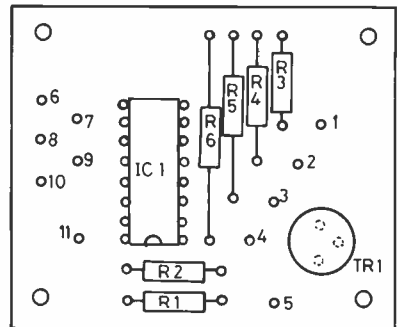


Fig. 3(a) PCB-COPPER SIDE (Full size)

E 40a

E 40b



PCB PIN OUTS	
1	Wire removed from pin 16 IC20a in set
2	" " " pin 15 " "
3	" " " pin 14 " "
4	" " " pin 13 " "
5	Wire from pin 3 mic socket
6	Wire to pin 18 IC20a track side
7	" pin 16 "
8	" pin 15 "
9	" pin 14 "
10	" pin 13 "
11	" pin 1 " track side

Fig.3(b) PCB COMPONENT SIDE AND PIN OUTS

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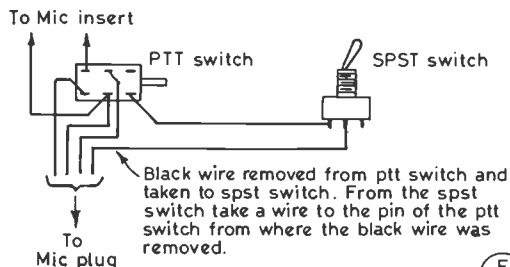


Fig. 4 MODIFICATION TO MICROPHONE

E 041

(2) Mount the board using standoffs and screws to the speaker-lid cover.

(3) Glue the board (if it's small enough) to the main PCB near to the 'S' meter.

Before your take up any mounting option check the board for solder bridges because you won't be pleased to get the unit together and find it doesn't work, or, worse, you've done the synthesiser chip a mischief.

Testing and Operation

With your super repeater shift board embodied in the set you can switch on. (Tune your nose for maximum sensitivity — no smoke? — good.) If you have a friend (some people haven't, you know) with a 10m. FM set get him to put a carrier up on 29.6 MHz (*i.e.* channel 25). Check you can hear it on channel 25. Now switch in the repeater shift and re-dial to channel 15; you should be able to hear the carrier, because you're listening to channel 25 really (amazing!). Still on channel 15, press the PTT (caution: a dummy load is necessary) and get someone to monitor for you on channel 15.

These tests are conclusive proof that your repeater shift will work on demand — so go get 'em! Your set is now worth approximately £1.00 more and can do almost anything the purpose-built 10metre FM sets can do. OK, so it's not too brilliant on receive and the channels are limited but if you're a broke G4 like me it's a super way of getting started on 10 metres FM.

Finally, I would like to thank G3XSE for his bent ear and explanations.

THE LIGHT-EMITTING GaAsFET

A LOOK AT AN IMPORTANT BRITISH DEVELOPMENT

JOHN WILKINSON, G4HGT

Introduction

SEMICONDUCTOR technology is moving at a fast pace — sometimes advances are made but their applications are not developed fully. The light-emitting GaAsFET, developed by *Siliconex Ltd.*, is one such specimen. By combining the high gain-bandwidth product of the GaAsFET with the usefulness of a light-emitting diode on the same chip, a multiplicity of uses can be thought up. It is hoped that this article will encourage the reader to make use of this interesting transistor. First, let us take a look at the two devices separately before describing the finished product.

The Light-Emitting Diode

A light-emitting diode consists of a forward-biased *p-n* junction. Within the structure, close to the junction, holes and

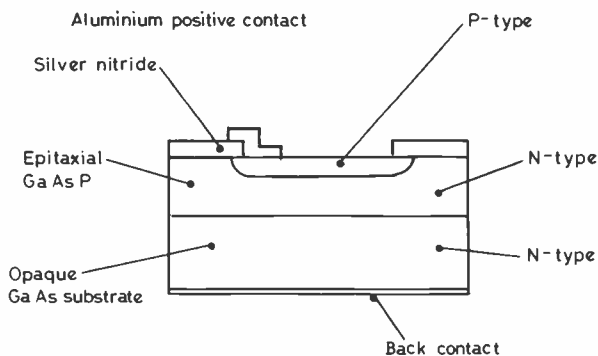


Fig. 1 LIGHT EMITTING DIODE (Cross section)

E 033

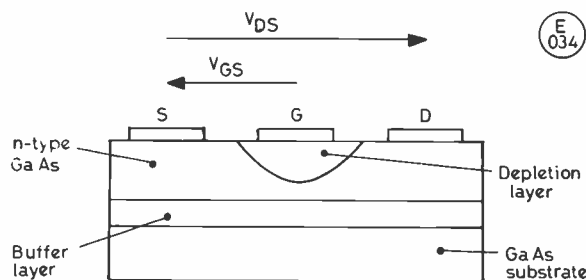


Fig. 2 Ga As MESFET (Cross section)

E 034

electrons will be recombining, that is, the energy possessed by unbound free electrons will be transferred to another state. This results in the emission of the excess energy, usually as heat but occasionally as photons. The percentage of energy emitted as light depends on the material used; for silicon and germanium junctions the amount is insignificant but gallium arsenide based devices produce considerable amounts of visible radiation.

Gallium arsenide (GaAs) has a bandgap of 1.45eV (electronvolts) which results in radiation at about 850nm, in the infra-red region. By adding phosphorus, to produce gallium arsenide phosphide (GaAsP), the bandgap is increased and the wavelength of the radiated light is reduced. The optimum ration of arsenic to phosphorus is around 60:40 resulting in red light of 650nm wavelength.

Increasing the proportion of phosphorus further results in a reduction in light intensity but fortunately the human eye is more sensitive to green than red light so the reduction in light emission is countered by an increase in eye sensitivity. Gallium phosphide (GaP) produces green light while using nitrogen as an extra dopant (GaAsP.N) results in orange radiation.

The construction of an LED is shown in Fig. 1. The GaAsP layer is grown by vapour phase epitaxy as an *n*-type layer on a single crystal GaAs substrate. The light emitting areas are defined by the deposition of a silver nitride layer into which windows are etched by conventional photolithographic techniques; diffusion from zinc vapour produces *p*-type regions limited by the windows in the nitride layer. Aluminium contacts are then added by evaporation and power can be applied. Light is emitted through the thin (1-2µm) *p*-type region. To maximise the amount of light passing out of the window a substrate of GaP may be used and in this situation a reflective back contact increases light output.

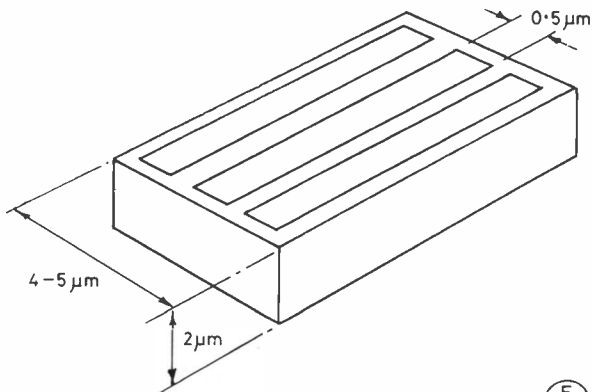


Fig. 3 GaAs MESFET Chip dimensions

E 035

The GaAs MESFET

Most microwave FETs are constructed on GaAs instead of silicon due to the former's higher electron bulk mobility and greater maximum electron drift velocity. The GaAs MESFET is easier to fabricate for microwave use due to its simpler construction.

The structure of a MESFET is shown in Figs. 2 and 3. The GaAs substrate is produced by doping pure GaAs with chromium. An intermediate semi-insulating buffer layer can be grown onto the substrate; this will give improvements in noise and gain performance. Then a very thin ($\approx 1\mu\text{m}$) *n*-type layer (GaAs doped with either sulphur or tin) is grown onto the buffer layer using vapour or liquid phase epitaxy.

The source and drain areas are formed on the surface of the *n*-type layer and sintered to form low resistance ohmic contacts. The gate control electrode is a METal-to-Semiconductor (hence MESFET) contact onto the *n*-type layer. For optimum microwave performance the source-gate spacing and the gate length should be small, and using standard photolithography a gate length of $0.5\mu\text{m}$ can be achieved.

Electrons flow from the source to the drain through the thin *n*-type layer when a positive drain to source voltage V_{DS} is applied. With the gate shorted to the source ($V_{GS} = 0$) and a small V_{DS} applied, a depletion layer is formed restricting the electron flow. For small values of V_{DS} the *n*-type layer will act as a linear resistor; as V_{DS} is increased, the critical electric field is reached and the electron flow starts to saturate. When V_{GS} is made negative enough, the depletion layer reaches the semi-insulating substrate and device is cut off. This is summarised in Fig. 4.

Combination of the Devices

It can be seen by comparison of Figs. 1 and 2 that the LED and GaAsFET are very similar in construction. This has led to the production of a four terminal device, the Gallium Arsenide Fet

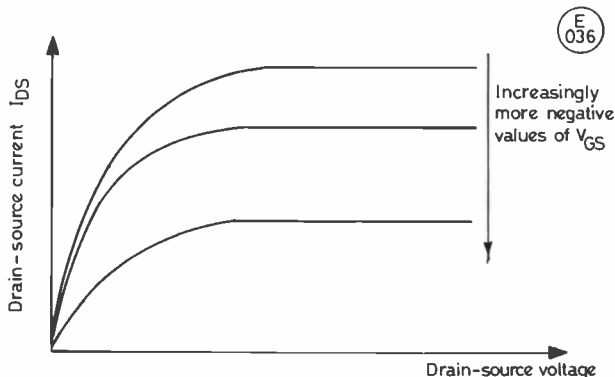


Fig. 4 I-V CHARACTERISTICS OF A GaAs MESFET

E 036

Incorporating Extra Light-emitting Diode (or GaAs FIELD), Fig. 5. The light-emitting junction is positioned between the gate and drain terminals of the transistor and the LED is forward biased by application of a positive voltage V_{LS} . The chip size must be made larger to accommodate the LED and this has a detrimental effect on performance at high frequencies.

The principle of operation can be considered in three ways:

(a) V_{DS} applied; $V_{LS} = 0V$.

The device behaves exactly as a GaAsFET with the LED section reverse biased, hence inoperative.

(b) V_{LS} applied; $V_{DS} = 0V$.

In this situation the LED will operate with the gate terminal voltage V_{GS} controlling the current and hence brightness of the LED. Since the input impedance at the gate terminal is very high ($\approx 100M$ at DC, reducing at UHF), control of the light source is achieved by voltage variation only, *i.e.* little current is taken from the driving source so the resultant power gain is very high.

(c) V_{LS} and V_{DS} applied.

The performance of the device is determined by the difference between the voltages V_{LS} and V_{DS} . The device will amplify as normal but the intensity of the light output will depend on the level of the input signal. For a fixed V_{LS} , increasing the current flow I_{DS} by means of V_{DS} will cause the voltage drop across the *n*-type region to increase so eventually the *p-n* junction will become forward biased, causing light to be emitted. In this way the switch-on point of the LED can be selected by choosing the correct values of V_{GS} , V_{DS} and V_{LS} .

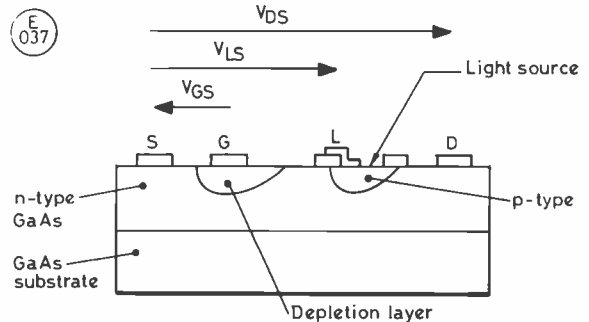


Fig. 5 CROSS SECTION OF LIGHT EMITTING GaAs FET CHIP

E 037

Applications

Flashing Light Multivibrator. The light emitting GaAsFET can be used to reduce the component count in toys, etc. The transistors and indicator bulbs in an astable multivibrator can be completely replaced by the new device which is mounted on the front panel of the equipment in a similar manner to conventional LEDs.

Audio Amplifiers. Although not really suited for audio purposes, using the new device in the preamplifier/ tone-control circuits of an audio amplifier can produce a primitive sound-to-light convertor. As explained earlier, changes in doping levels can change the colour of the emitted light. Thus using different transistors in the bass and treble circuitry will give the desired effect. It is thought that *Mullard Ltd.* used a similar technique on their early germanium transistors marked with red and white spots.

Receivers and Transmitters. By using the principles outlined in an earlier section, a signal strength meter can be incorporated in the preamplifier of any amateur receiver. Since the switch-on voltage V_{LSmin} is usually measured in millivolts, only stations using high power will be detected. From path loss and antenna gain calculations, stations running above 10kW e.r.p. (400W and 14dB antennas) should be detectable up to half a mile away on a dipole. This approach has been used in a design which is published in this month's issue of the German magazine *Dubious*.

COMMUNICATION and DX NEWS

E. P. Essery, G3KFE

DURING the last month, the highlight has been the pleasure of finding *both* ends of my aerial halyard at ground level, thanks to number one son who clambered up aloft to recover it; in other words, I have to admit to rather a low in activity since last putting pen to paper for this column.

Sunspots and things, too, haven't been all that encouraging, though as this comes to be written there are the first signs of the spring 'lift' about, albeit the forecast for the immediate future as to conditions is one of unremitting gloom!

Another hazard we have now to cope with is the mad sweep of the infernal videotape recorder, as mentioned elsewhere in last month's issue. Yet another design from the drawing-board of Satan, specially arranged to receive TVI from radio amateurs — as if we save up TVI to throw at the poor thing. There are hundreds of thousands of them now, all with this marvellous bit of design which says that when they are switched off the TV aerial is connected to the TV by way of the videocorder; and they have a little amplifier in the VTR to help the signal struggle through as far as the TV set. . . . Has anyone got a proof-tested blunderbuss with full instructions?

Ten Metres

Still, thank Heaven, has its devotees. G2ADZ (Chessington) wrote a nice letter with some DX and beacon reports, and wondered what had become of his old friends G2XC and G5BY. Both we know to be still about, so perhaps they might drop a line to your scribe who will pass on messages as required. Turning to Bill's DX, and here he notes the band opening up at the 'wrong' times. He managed 9J2TS, XT2BG, CP4FI, FM7CY, VP2EAA, TT8AD, DL1JW/HP1, and various ZSs. Gotaways included VS6BQ, 5Z4CQ/KA7KSY, N0ZO/DU2, VU2VZ, and various A4s. Among the odd signs noted were TO3NJ, EW2A, and L8D/X. EW2A was clearly Russian, around the Minsk area, the L8D/X was another manifestation of the Argentines, but what the TO3 was we don't know.

G3NOF (Yeovil) is back in action after several months of QRT due to ill health, and even now can only have afternoon and early-evening sessions. Nice to have you back again Don, patchy conditions you report notwithstanding! On a few days the North Americans appeared, but often the band was totally dead. G3NOF QSO'ed with East Coast W/VE, FG7BT, N8NCJ/8P6, VP2EAA and 9K2BE.

Voices out of the past next; this one is GD3OOK (Baldrine) who last reported as GM3OOK, and 9V1RS back in the early 'seventies. John uses an elderly and much modified FT-101 Mk.1. On the aerial front there are dipoles for 80 and 40m. on the same feedline, while the 20-metre radiator is the thirty-foot mast which holds-up the 'Veess', fed of course through a simple ATU. As far as Ten goes — not John's main band it must be said — there were CW QSOs with SV3RF and UL7NCL.

G4LDS (Chelmsford) seems to have mended his rig almost beyond repair — it now refuses to operate unless the *shack* is well warmed-up. Who should complain of that? Conditions were found to be pretty patchy, but G4LDS managed SSB to WB2MNO, WA3GX1, EA8UX, KE4FJ, KB4XK, UA6AAZ, KQ2V, N8CQA, VP5WJR (QSL to KA5BPE), WD0CQA (N. Dakota), K4NUQ, W6LHI, VU2AID, VU2AIG, VE3YY and VE3MAP.

Up in the Borders GM4CXP found himself with an aerial trying its hardest to 'improve the take-off' in a gale — with of course the inevitable result! On a different note, GM4CXP heard G4CG putting in an Auroral signal while working OH1MY who was also audible at 559 — and clearly not Auroral. GM4CXP then worked OH1MY himself, plus LA2CBA, and SM4DLS, the latter on SSB, all with no trace of *Ar*.

Turning from GM to GW, we have a report from GW4OFQ (Carmarthen) who is still without his linear, but managing. The G5RV aerial has been persuaded to rise to 55 feet, and first impressions are of improved signals. Sad to say, Roger has to work nights which is a bit of a bind for an LF addict — but, hopefully, we can tell him what he's missing! On Ten he didn't miss with SSB to J28DP, PZ1CC, G4AVW/ST3, YC2HV, FG7AA, 9K2BE, A4XCB, N8DCJ/8P6, CP6EL, and WP4ATF, all in the bracket between morning tea and a late-finishing lunch.

Our last report on the 28 MHz scene seems to be the Sage of Knutsford, G4HZW. Tony missed out last time as he was 'away working in Southern G' — sounds as if he had to tote a six-shooter! The TS-820, 'Quad and 28 MHz band didn't get on all that well this month, as there was not a lot of DX about. Interestingly enough, this year, as last, the band made its first try at a (Spring) opening on February 26. This year it was W6/W7, but last year a little better, while the mid-February event of 1981 occurred earlier and yielded KH6 and KL7 with the

old FT-75! Anyway, this is the list, mostly SSB but the odd one on CW: 5H3TM, 8Q7AZ, 9J2DS, A4XCB, A22DC, A92DQ, FB8ZP (Amsterdam Is.), UA9s, RL7GFF, RL7GFD, UL7NCM, U18LBB, UK8JBH, UA0AHV, RA0SFI, UK0WAJ, VK3PGA, VK6AZP, VK6IH, VU2GI, VU2JXO, G4AVW/ST3, all W call areas including WA6SOV, who was RS57 with his three watts, ZS3CP, ZS6BWX, with VK0JS as the Gotaway of Cycle 21! Summing up, an appreciably poorer lot than last year with no JAs or ZLs to note at all.

Top Band

A notable and welcome revival of interest in this band, but still no sign of WIBB. Does anyone have any news?

G3BDQ (Guestling) has been concentrating on the band of late, and is amazed to find just how many times VK6HD has appeared in his Top Band log; but, as John says, he has everything going for him in that direction, as his QTH boasts a clear run down to the sea with nothing at all in the way. Otherwise, John keyed with UT5AB, UB5NAR, OE1JNB, ZB2EO, 4X4NJ raised at 2015 and 599 both ways on February 22, and various other European Russians.

Turning to G4BUE (Upper Beeding), Chris put up a set of four slopers — the quarter-wave variety — but was not able to come to any firm conclusions about them; all were cut to exactly the same size but the VSWR on each varied quite considerably, and discussion with G3FXB, and re-reading W6SAI's article hasn't cleared up the puzzle. However, this is not to say you can't work things with them! Tests against a quarter-wave sloper and an inverted-V, or just shunt feeding the tower, always brought the sloper out as best. The score with the slopers to date is some 53 countries; in just four weeks the following CW QSOs were made: VE1BVL, EA9EO, UG6BGD, RF6FFW, FC9VN, ZB2EO, 4X4NJ, HH2VP, KV4FZ, EA6JD, W1, W2, W3, W4, W8, EA8QO, 4U1ITU, UM8MAZ, UD6DKW, NP4A, RA9AKM, TF3KG, EA6JD, and all the usual EU prefixes.

VK5AIM (Elizabeth Downs, S. Australia) writes with some news of the VK LF-band scene. He mentions Harry, VK3XI, at 78 a good signal on the bands, until he lost the lot, including his home, in the disastrous fires that swept the area recently. As for the bands, we have it from VK5AIM that they now have 1.8-1.825 MHz as primary users, with 1.825-1.875

MHz shared as secondary users and the requirement to avoid 1.870 MHz, ± 4 kHz.

G2HKU (Sheppey) hasn't been 100% fit of late and so his activity has fallen off a little, but he managed SSB with OK1KSO, OH2BNP, PA0PN, GU3HFN, OH1MA, and LX1PD, while CW was used to tackle EK3BI/1, EA6JD, and UT5AB.

G3ZGC/8P6 came on for part of the CQ WW 160m. contest, and noted no other 8P6 stations around before his CQ caused a king-sized pile-up, the more so as the contest had already run for 24 hours. He worked FG7AM, V2AAW, HH2VP, VE3BMV, VE1AXT, and NP4A, plus numerous Ws. A few days later Richard was signing G3ZGC/J6L, and a turn around Top Band yielded absolutely nothing, although there is some weird effect which has it that from Castries, St. Lucia, 80m. may be well open to Europe but nothing whatever will be heard on Top Band — an effect requiring investigation, we suspect!

Nearer to home, we turn to G4AKY (Harlow) who says he has been a little less active due to preparing his talk on Top Band DX for the Bishops Stortford club. However, Dave still manages to get on, and his log includes VE1BVL, UH8DC (at which time YB5AES was just audible, peaking at 2240z), UD6DKW, NP4A, KV4FZ, EZ9MAZ (followed by a hearing of NA5R in Texas), W1FC, HH2VP, V2AAW, EA9KQ, UL7BAK, VE1BVL again, GI4ONL, WA2SPL, KA1PE, N4IN, N4SU, W1JBW, W2KFG, W1HND, W2FJ, W2QD, OK1HBT, UA9CBO, UL7NCL, GU3HFN, GD4BEG, VE1BVL again, K2GNC, 3V8AA, HB9AQS all worked with the G4AKY QRP rig, E11DA, and of course the usual Gs and EUs.

Eighty

Here we start with G3ZPF (Dudley) who says he has been surgically separated from his Apple-2 micro, albeit the wound was well staunched with folding money . . . David's brother has gone out now for a BBC micro and colour monitor, and he notes sourly that although the blurb says it has been "designed to keep RFI down" it still has S9 burbles at HF whenever it is in use; hence the sudden interest in a change of QTH! Digging around on Eighty CW did manage to turn up 4U1TU and SV0BS, and it was a surprise to find both were in the 'wanted' list!

Our most consistent reporter on Eighty is G2NJ (Peterborough) who also keeps his eye on what goes on in the QRP world. This month he has a mention for G2CNN/A who was operating from Ongar earlier in the month; before he left there to return home to Norfolk he was already planning /A trips to Thame and Royston. Nick also mentions three fine QSOs with G4GIQ, Northwich, who was using his new one-watt transmitter;

another station at the one watt level was G4OPE in Birmingham. G4EIM/P was worked from a platform on the German Bight, and was to return to Hull on February 16. As for Maritimes, LZ1JK/MM was about late on February 21; he worked YU3DAA but conditions were very bad and he disappeared in the static.

Turning to GD3OOK, we find John looks at all bands, although his favourite is undoubtedly 7 MHz. As far as Eighty goes, the tab was LA9PCA/OY and 7X4AN, both of course on CW. John endorses G2ADZ's words on lists, and mentions the USSR DX Net on 3640 kHz. While the net-control wasn't actually passing reports not copied, he was endeavouring to explain to a recipient that he had it wrong and in which direction his guessing should go! Another abuse creeping in of late years is the widespread idea of 'buying' a QSL; while John was at 9V1RS he often got dollar bills, s.a.e's and so on, asking for QSLs for QSO's *which just didn't exist*, or from stations who were worked on 7 MHz and wrote asking for a QSL for 3.5 MHz as well! John says he feels sure that while most DX stations are aware of the practice, those without managers and snowed under with QSLs could easily make a mistake and send out a QSL for a dud contact.

Eighty for GW4OFQ included such as F5RV/FC, KR2N, KM1R, VK6HD, 7X4AN, K1PT, K1HDO, K2BT, VE1DX, NP4AT, CN8AR, HH5CB, HI8GB, HK3YH, HP3FL, PY8ZWM, KP2G, OY6FRA, LA9PCA/OY, PZ1DH, and 9Y4NP.

Turning to GM4CXP, Derrick was amazed to hear PA0GG one afternoon on fifty milliwatts, RST429 rising in fifteen minutes to a peak of RST539. He seemed not, sadly, to be listening for calls back, as neither GM4CXP nor a PA who called were able to attract his attention; but Derrick's own one watt from a quickly wound-down FT-101B was certainly getting out as he was promptly the recipient of a report from G4RAR up in Derbyshire. However, Derrick says he feels that winding his '101 down in this way is slightly undignified and so he is setting to work to build a QRP transmitter for himself.

Now over to G3ZGC in the Caribbean. Richard was in J6L and says there is a strong Caribbean group around 3797 kHz with KP4DEX/V2A and J6LCV as the leaders. They often get perfect copy of European stations but have the very devil of a job to raise any, despite numerous calls — it may in fact be the European QRM that is upsetting things, although midnight is late enough for much of the casual EU operators to have gone to bed.

Just one QSO mentioned by G2HKU, namely the CW one to JA3SVG/MM, location of the ship not mentioned.

Forty

Much neglected by many of us. However, for those with older rigs there is little doubt that the noise is daunting. G4ITL changed his rig for a TS-830S a couple of weeks ago and has been quite amazed to find just how much more is audible on the new box — his old one just did not have the dynamic range to cope with the band after dark.

GD3OOK took his key and waved it under the noses of the following successfully: CN8CY, EA6EJ, HK3DDD, HZ1AB, J37AE, KL7Y, LX2BQ, OY7ML, TF3YH, VK0JS, K4FW/VP2K, VP9DR, XE10X, YV4DDT, ZL1AZE, ZL2UW, 4Z4DX, 9H1BB, plus JAs some mornings and lots of PYs at night.

The letter from VK5AIM indicates that the VK band is 7.0-7.1 MHz exclusive, but they also have a shared 7.1-7.3 MHz to play with as well. The band, however, is a bit of a Cinderella at night because of the Asiatic signals, but during the day it gets used for local nattering, and of course dawn and dusk see DX opening aplenty. Again the cry arises from VK — "we can call our heads off, but you lot won't answer!"

Final entry for this band comes in from G3BDQ, who found CW worked well to QSO with VK3AHU, UA9COT, VK3VJ, and ZS2AM, the latter at 2000z.

"CDXN" deadlines for the next three months:

May issue—April 7th

June issue—May 5th

July issue—June 2nd

Please be sure to note these dates.

The New Bands

VK5AIM reports that the VKs have now got their segments at 10, 18 and 24 MHz.

G3BDQ says he tried the band with his TS-530S — for which he has organised himself an outboard VFO to make split-frequency working a mite easier — and worked VK3MR, VK3YD, VK7RY, KV4CI and sundry Ws.

A few CQs from G3ZGC/J8 yielded interesting QSOs, as it appears the other islands in the Windwards group don't yet have the band. CW contacts are noted with G3AAE, G3RFS, G6ZO, G3YYF, G3JFF, G4FBS, GD3LSF, G4GZQ, G3LIK, G5CPL, VE3JPW, G2TA, DJ9GD, GM4KGJ, and G4LNA, all on February 1 and 2.

Finally GM4CXP; Derrick reckons this 'new contraption' was good enough for his CW to raise KA1XN, VE2LI, VE1ASJ,

KV4CI, and DL2GG/Y V5, with the worst report being 559 from YV5-land.

Nothing at all in the way of reports on the other two bands, although we have heard the odd signal ourselves.

Snippets

By the time this reaches you, chances seem pretty fair that an expedition to Spratly will have come and gone; the calls, we understand will have been 1S1S1 and 1S3NG, the former on CW and the latter SSB, starting March 22 or 23 for five days; the QSLs for this one will go to DK9KD.

Later this year or maybe in the early part of 1984, we hear, a DX-pedition to Clipperton is on the cards, with a team of eight FO8s, six Americans and maybe a couple of JAs.

The proposal for a Bangladesh operation seems to have come to nought at the time of writing. 5X5FS, who is on pretty regularly, says *he* has been operational from Uganda for over 30 years!

If you seek Rodrigues, then look out for 3B8DA/3B9, who is due to remain there until the end of May.

The Heard Island DX-peditions both came off, but both were bedevilled by the poor band conditions, and spent the greater part of their time on Twenty or just twiddling their thumbs; however, they still managed to run up a formidable total of QSOs between them. For all the above, acknowledgments to *TDXB*.

From *DXNS*, we see that BY8AA is mostly QRV on weekdays, around 21048 seems a good spot, while BY1PK is active on Saturdays around 21090 kHz and 0700z.

That Bangladesh operation mentioned earlier didn't quite come to nought — JA8MWU managed about two hours and thirty QSOs before 'army interference' caused him to have to give it best; at the time of writing he is on from 8Q7JA and says he hopes to return to S2 next year.

9U5 now has N4HX as the U.S. Ambassador — he is ex /TT and TYA11 — and he hopes to get something set up in the line of a call sign.

One of those who laughed at the *Panorama* bit about the high-technology drain to USSR was G3ZPF. David notes that one of the items seriously being said to be pirated was the good old 7400 IC; a quick calculation suggests getting half-a-million pounds worth from *J. Birkett*, a £200 air fair to Moscow, flogging them for say five million, then home for a ten-year stretch. Out in five years for good behaviour . . . it seems like a good deal!

We were right about the SP's being let off the hook to work Heard Is; G3ZGC worked SP9PT, the latter enquiring after the whereabouts on the band of the Heard pile-ups.

Despite his recent illness, G3NOF managed to latch on to VK0JS for country no. 340 — congratulations.

G4LDS has some strong words to say about some of the SWL cards he is getting in through the Bureau; just a signal report, no indication of band, or of QSB, QRM, or QSN. He mentions a G SWL, who reported in such a manner when Chris was in the middle of a mini-pile-up of JAs! Some of them never learn — until they get on the air and have to look at SWL cards of similar value!

G4BUE is up to 301C, with an assist from FB8ZQ, LU3ZI and a VK0 for the last three; the first-named was very sharp with the card which Chris received in the week following. Changing tack to QRP, G4BUE offers his 'Ears of the Month' award to K6DDO for hearing his 100 mW signal on 21 MHz; this means Chris has now worked 26 States for a WAS with 100 mW or less of RF.

GD3OOK says he is temporarily land-based as the tanker he served on for the previous six months didn't lift a single cargo of oil — eventually the owners just took half their fleet off the market, which means John may be looking at an "extended period of leave!"

Now W1WY's Contest Calendar. The ARCI QRP Spring Contest is over the weekend April 23-24. No doubt all the details are available from the QRP Club — try G4BUE. Logs to be received by May 21, to WA2JOC, 230 Mill Street, Danville, PA 17821, USA.

We have already mentioned the CQ WW WPX Contest SSB leg over the weekend March 26-27, and it now falls to speak of the CW leg; this is on the weekend May 28-29 and follows the same rules. Logs to *CW Magazine*, WPX contest to be postmarked no later than May 10 for the SSB leg, and July 10 for the CW leg, the address being 76 N. Broadway, Hicksville NY 11801, USA.

We have an airmail letter to hand from D. Anderson, ZD8DA, on Ascension. He says that he and ZD8MF are now QRT from Ascension, and they wish to thank all those who gave them such interesting QSOs; QSL cards are now 'in the works' for despatch as fast as they can manage. They add that ZD8FX is the current operator on the island, and is operational on 7-28 MHz.

Twenty

GW40FQ comes in at this point, to report on things in the afternoons, with the newly raised G5RV; it made SSB contacts with ZC4GO, FC6HUP, 3B8FE, 5H3YL, 7X2CK, TU2CJ, 3V8AA, and 7P8CI.

G3ZGC/8P6 made just one QSO of interest on this band, which was CQ3BX, a 'special' in Madeira.

G3NOF mentions hearing VK0HI on in the early evenings, but didn't raise him. However, the 'NOF touch is not gone, as he worked SSB to FB8WH, J39BS, VE7CGD, VE7DX, VK0JS for the 340th country, XO2JCG, and 4X6GS.

Twenty is clearly not the favourite band

for G4LDS, but like most of us if you want the DX you have to use it sometimes! This meant SSB contacts with VE3FED, VE3LJX, Europeans, EK9C/0, F8HB/EA6, HV3SJ, KA8JHD, W9SFZ, and W2RWE.

The only 14 MHz activity noted by G4BUE was his CW QSO with VK0CW.

GD3OOK used CW to contact FK8CE, FY7BO, KL7GNP, TA2BO, VKs and WL7E.

Coming to the G2HKU report, on SSB it was just the ZL skeds with ZL3FV, and ZL3RS, while a switch to CW came up with UA9CQS, JA6GU, HL4XM, FY7YE, G6ZY/EA6, 9H1CH, SV0AA, FO8FW, and VK3XB.

The band for G3BDQ was a matter of VKs on CW, plus SSB contacts with 6Y5IC, JW4GN (Bear Island) around 2000z and 14190 kHz.

Fifteen

Last over before stumps are drawn for this month!

G3ZGC/J8 was the magnet that, as already mentioned, resulted in a call from SP9PT looking for the VK0s, and another contact that same session was with T42AMC, a special from Cuba.

"Patchy but not completely dead" says G3NOF, who proves it by working North Americans as early as 1230 and as late as 2130z. The Middle East was often in evidence around 1700 GMT, and SSB contacts were made with A92Z, K7MX, KW7Y, LU5ZI (S. Shetlands), VE5HP, VE7EYI, VQ9CI, YN5JAR, W6RTN, W6RU, W6XH, XO2JCG (Canadian Winter Games station), ZS2RJ and 5Z4WL.

Fifteen for G4LDS was SSB with 3B8FK, 9U5JM, TF5GW, WB6DEU, and K81YD.

Most of the G4BUE activity on 21 MHz was CW, in between playing with aerials and work. It took the QRO rig to raise FB8ZQ, and also K4FW/VP2K and ON6BC/C9.

For GD3OOK it was CW all the way and on 21 MHz this mode netted him KC7UU/5N6, LA8UX/OD5, LU3ZI, SV2QR, and 5Z4CS.

There was just one QSO on the band for G2HKU, namely the CW one with ZY5XFR.

It was, on the other hand, SSB that managed ZD9BV for G3BDQ, his QSL going via W4FRU; in addition there were, as John puts it, lesser fry not worth a mention!

Finis

That's it for another time. The deadline for next time will be found in the 'box', and is for arrival, addressed to your scribe, "CDXN", SHORT WAVE MAGAZINE, 34 High Street, Welwyn, Herts. AL6 9EQ. Meantime, have fun!

A BEARING PLOTTER FOR D/F WORK IN THE FIELD

J. GLANVILLE, G3TZG

ONE of the problems during radio fox hunts, and direction finding competitions in the field is laying off the radio bearing on to the map. Generally one has to support the map board whilst juggling with a protractor, ruler, and pencil. It is a situation which often occurs in amateur radio where a third humanoid hand would be useful. To overcome some of the difficulties of angle measurement in the field the author has developed an instrument which remains stationary on the map board, and will offer the facilities of indication of relative angles and distances from the transmitter site. Also bearings can be marked on the map, or "laid off" without recourse to a separate ruler, or scale.

Basically the device consists of a 360° protractor with a magnet inserted in the centre; the magnet supports a spindle around which an acrylic cursor rotates. Distance scales are marked on the cursor which also has a central slot to enable a pencil to be inserted for the purpose of laying off bearings. A map board with a steel backing or a board made entirely of sheet steel is of course required.

A general view of the instrument is shown in Fig. 1. This depicts the device magnetically held to the map board with the centre lying over the transmitter position. The drawing illustrates the manner in which bearings may be laid off. One hand steadies the tip of the rotary cursor, whilst the other hand encribes the bearing by means of a pencil inserted into the central slot of the cursor. A sectional drawing showing the basic construction is shown in Fig. 2.

Construction

The construction is quite straightforward, but some care in marking out, and assembly is required if best results are to be achieved. A *Rolinx* 150mm. diameter 360° protractor was chosen for the prototype. Having chosen the basic protractor the next step is to cut a circular hole in the centre to insert the magnet.

The magnet chosen was a "Shallow Pot Magnet No. 826", marketed by *James Neill Tools*, Sheffield, under the "Eclipse" label. This pot magnet has an approximate diameter of 19mm. so the central hole in the protractor should be expanded to a diameter such that the magnet can be fitted centrally with a firm, but not excessive, push fit. Magnets of the 826 type have a central hole, and into this hole is inserted a 4BA countersunk head machine screw. This screw with suitable spacers acts as the central spindle.

Fig. 2 shows the method of mounting the central knob, which on the prototype was formed from the plastic cap of a shampoo bottle; such caps are about 25mm. diameter and 17mm. high. (This type of bottle cap has a serrated outer surface which is useful for digital operation!) A hole is drilled into the centre of the bottle cap. This hole may be drilled undersize, and opened out with a needle file to locate as centrally as possible on the 4BA screw. A

spacer of about 10mm. diameter is mounted on the central screw; Over this is placed a plain washer of about 15mm. diameter. The bottle cap is then placed on the screw, and over this is placed a plain washer of about 10mm. diameter; this is secured by two 4BA nuts, one of which acts as a lock nut. the dimensions of the knob assembly may be varied to suit the particular bottle cap chosen, but accuracy with regard to rotation about the central point must be maintained.

Next the cursor is constructed, the material for this component being acrylic sheet (Perspex) of about 3mm. thickness. Fig 3 shows the outline dimensions of the cursor; the diameter of the central hole will depend upon the particular bottle cap chosen. First form the outer shape of the cursor, then cut the pencil slot somewhat undersize. Drill a pilot hole in the boss of the cursor, and carefully increase the diameter of this hole until it is a firm push fit over the bottle cap knob. If the knob has a serrated outer surface then serrating the cursor hole to match may facilitate a firmer assembly.

Mount the cursor temporarily on the knob, and ensure that it rotates evenly around the central point of the protractor. Having ensured that the cursor is centrally located it is now necessary to mark out the radial line to enable the accurate cutting of the pencil slot. Initially this may be accomplished by marking the acrylic surface with a fine pointed fibre or felt tip pen. Place the assembly on a flat surface with the circular magnet keeper removed. Align the cursor along the 90° radial on the protractor, and with a straight edge mark a line with the pen. Rotate the cursor to the 270° point and check that the alignment matches. Check also at 0° and 180° that the alignment of the ink line is reasonable. If the alignment is unsatisfactory then a probable cause is positional error of the central hole in the bottle cap knob; in this case a fresh cap should be obtained. When the cursor alignment is satisfactory scribe a light line on the upper surface

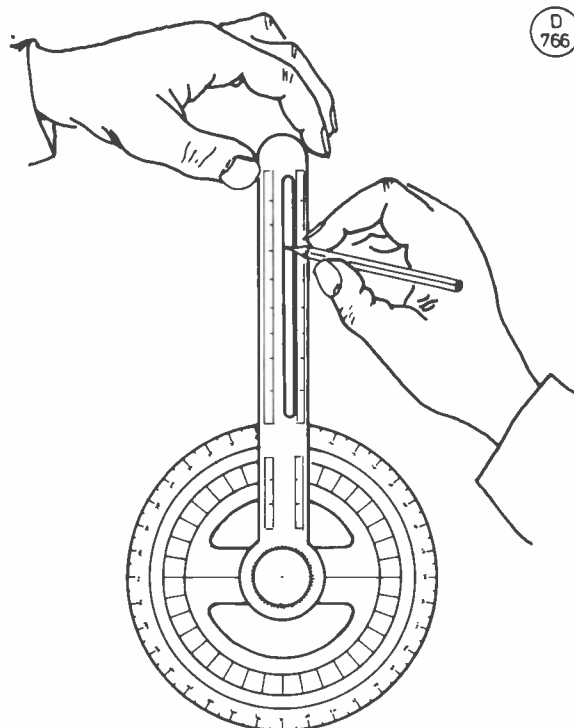


Fig.1 GENERAL VIEW OF INSTRUMENT

with a tool such as an engineer's striking knife. This line is the radial to which the pencil slot must be accurately aligned by careful filing and polishing. The cursor is removed from the knob for this operation. Having formed the slot a radial line may also be marked on the undersurface of the cursor in addition to the line on the upper surface; this will help to avoid parallax errors when the instrument is later in use.

At this point the distance scales can be mounted. On the prototype the author fitted two distance scales, one at five miles to the inch, and the other to match the Ordnance Survey 1:50,000 scale. The scales were drawn on thin white card and fixed to the underside to the cursor with transparent tape. Gaps in the distance scales were left in the area of the graticules and degree figures on the protractor. The cursor is then carefully re-fitted to the central knob.

Alignment may be checked by placing the instrument on a blank sheet of paper on the map board. Mark off three bearings at 0° , 120° , and 240° , with a pencil. Remove the instrument from the board and extend the pencil lines until they cross. The three lines should cross at the same point, or should exhibit a very small triangle or 'cocked hat'. If the cocked hat is reasonably small the final assembly can commence.

Remove the cursor and the knob. Cement the magnet in place with a small amount of epoxy resin such as *Araldite*. Place the knob on the spindle, and tighten and lock the nuts to give a satisfactory stiffness; a small portion of *Araldite* may be applied to the top of the lock nut at this stage. Then apply a thin layer of *Araldite* to the outer surface of the lower part of the knob and refit the cursor. Having ensured that the cursor rotates satisfactorily a toothpaste tube cap may be affixed to the top of the knob in order to cover the spindle and lock nuts. Assembly is now complete.

Any thin flat sheet of steel will serve as a map board. The author's board was made from the outer skin of a washing machine that had gone 'silent key'. Remove all sharp edges from the board for it will be used in close contact with fingers. Thin brass 'U' clips will hold the map in place, and a thin sheet of acrylic of the type sold by art shops may be placed over the map if required.

Use

To establish the device on a given position on the map draw faint lines passing through the required position running north/south and east/west. These lines should be long enough to extend beyond the protractor diameter. Then remove the keeper from the magnet and align the 0° mark of the protractor along the north/south line. Align the $90^\circ/270^\circ$ protractor line along the

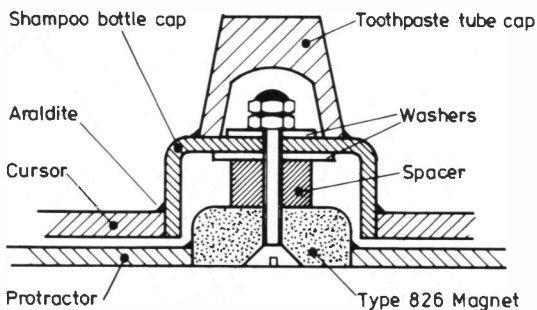


Fig. 2 Sectional view of the construction

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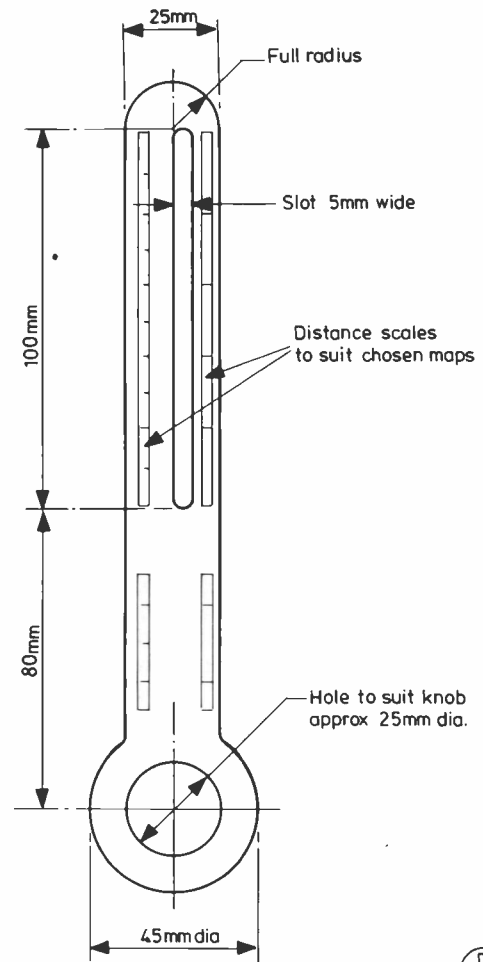


Fig. 3 ROTARY CURSOR (3mm Acrylic sheet)

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east/west line on the map. The instrument is now centred, and bearings can be laid off. To lay off a bearing first set the bearing number with the central knob, hold the tip of the cursor with forefinger and thumb of the left hand, insert the pencil in the cursor slot, and draw a line by running the pencil along the left hand side of the slot.

If the instrument is constructed with a reasonable amount of care it should enable bearings to be laid off to within an accuracy of a degree or so. This should be quite adequate for the average fox hunt, for it must be remembered that a Class-A commercial radio bearing is classified as having a tolerance of within ± 2 degrees.

Having constructed the device the question arises — what do you call it? After all it is not exactly a protractor. An angle measuring device is a goniometer. You can have crystal goniometers, and radio goniometers, so since this instrument is secured with a permanent magnet what about "Magnetic Goniometer"? That seems sufficiently grandiose!

I can just visualise the scene on a hectic field day! "By George! We are having a good field day. Hand me the magnetic goniometer old man. I want to lay off the true bearing of the VK I've just QSO'd on 70cm. simplex."

BASICS FOR THE S.W.L. AND R.A.E. CANDIDATE, PART X

SUGAR-COATED THEORY

LAST time around we looked firstly at how an aerial radiates — the electric field along the line of the wire, and the magnetic field around the wire, remember? — and then we went on to talk in general terms about transmission lines.

Let us now imagine we have a longish piece of fifty-ohm twin-feeder. If you've never seen this stuff, it looks for all the world like the flat twin plastic mains wire often used with a table lamp. We know that if this length of feeder is open circuit at one end, and energised with RF at t'other, we will see a point of high voltage at the end, and a point of low voltage at a quarter-wave back from the end; and we will see standing waves aplenty if we look for them. Now, let us take this feeder, and open it out from the end for a quarter-wave length, and hang it up in free space; we will have a horizontal top of half-wave length over-all, with twin feeder at the middle to energise it. We have made ourselves, to a first approximation at least, a *half-wave dipole*.

If now we had some means of measuring the resonant frequency (don't ask just how, for the moment) we would expect to find our dipole would want to resonate exactly at our chosen frequency. Alas, it wouldn't — due to some minor effects we didn't take into account — but it would nonetheless be pretty close. Bring it down out of 'free space' into our back-yard or loft and we might find the picture a bit different, though still we would be pretty close. In fact, if we are talking about a wire dipole and HF, we can say that the half-wave length of wire, in feet, is given by $468/f(\text{MHz})$. Thus for, say, 14.1 MHz, $468/14.1 = 33.2$ feet. If you are one of the disadvantaged who can't calculate in feet, then use length in metres = $143/f(\text{MHz})$ in the same way and get the answer out in your pet units. Both formulae take into account the *end effects*, and lots of folk are satisfied to cut their dipoles so and hang 'em up with no more ado. Not us — we're not that daft!

Now, let's imagine we have our half-wave dipole in free space and we want to know to where it will radiate. To a close approximation you can do this by circulating the aerial and noting the proportion of aerial you can see, taking the power at right angles to the aerial line as, say, unity. If you are looking at a horizontal half wave dipole in free space, and you sketch out the result of your efforts, you will see you have drawn a vertical doughnut shape with the aerial wire poking through either side of the hole in the doughnut's middle. Lo! — we are in agreement with the Book of Words! There are, however some Practical Types who will say "my half-wave dipole radiates off the ends for sure — I work Joe Bloggs in that direction every Sunday morning, so sky-wave can't come into it!" Truly, Practical Man confuses himself, and us, all the time! We were talking about our dipole in free space. His aerial, on the other hand, is near ground, and there are other reflecting or refracting objects within range of the aerial.

To give you some sort of 'feel' for how much objects can disturb things, here is a short anecdote. The writer used to work, years ago, on an aerial development job; some of the work could be done in the lab, but for the rest we had to have a clear test site. This was a field, some twenty acres in size and as near as dammit a square. In the middle, we had a mast with a rotator up on top; at the bottom of the mast was a box with mains power so we could supply a signal generator and feed RF as required up aloft. In one corner of the field was a hut fitted out with mains power and lighting, and a receiving aerial. A couple of hundred yards to one side was a house in the garden of which was a large apple tree. In a line from the mast, through the receiving aerial and on behind the

latter was a valley with a railway line running across. We found that when the tree came into blossom and leaf in the summer it put a quite definite and noticeable lopsidedness into any 'polar diagram' measurements, while a train coming out from behind the valley would instantly upset our gain measurements, sometimes by over two dB!

To revert to our low practical aerial, if we imagine the aerial sitting over a mirror, and look along the end of the wire, we can see not the end of the aerial but some of its reflection in the mirror. Now, mention of the mirror brings us to the matter of the vertical quarter-wave of 'Marconi' aerial (our dipole is a 'Hertzian' one). Now, the Marconi is only half an aerial; its other half is its *reflection in the ground*. Without the reflection, it won't — it can't — work.

Imagine for a moment a mirror laid on its back and stick a pin upright on it with a dab of Blu-Tack or such. Now sight along the mirror surface and always you will see the reflection of the pin. If you scrape off the silvering from the mirror back, the image disappears. Repeat the experiment with a smaller mirror; this time you will notice that as you get your eye down to the plane of the mirror, so the image of the pin in the mirror gets nearer the edge of the mirror and disappears off it. This is a useful analogy when trying to understand the quarter-wave vertical aerial — which *needs a good earth*, and that ideally that good earth should extend several wavelengths all round the feedpoint of the aerial. While you can buy good verticals, you can't buy a kit of parts for a good earth — you have to create such by the sweat of the brow and swear-words, not to mention blistered hands and thirsts raised and quenched. Such is the *real* nature of DX!

To return to our horizontal half-wave aerial in free space. We discovered that if we plotted the strength of radiation from it we ended up with a thing like a doughnut. This is rather in the nature of a three-dimensional polar diagram, but what we generally mean (always, unless clearly stated otherwise) by the words 'polar diagram' is a graph of field strength at a distance 'X' from the aerial, as one circulates round the aerial, and plotted on 'polar' graph paper, where zero is the centre, and the other axis radiates out from the centre by degrees — see Fig. 2. What our polar diagram actually shows us is a slice, or section, through the three-dimensional doughnut; and so for our horizontal dipole, a horizontal slice through level with the aerial would give us a pattern like a figure-eight with the dipole sticking out of the middle.

Now, why do we keep on talking about half-wave dipoles, or quarter-wave aerials with a reflection in the ground? Is there a magic about them? Your old-timer will growl from behind his pint "you can make *anything* radiate, provided your ATU can match it to the transmitter!" And *he's dead right!* So — why all the fuss? Well, most of us like to make or own something that does what it claims to do, and we like to know that we have it 'perking' just-so. When we talk aerials we have a pretty limited range of test equipment to hand, and most of that is hardly of precision nature. In this case, if we make a design that can be expected to give certain SWR readings in return for certain dimensions, then we

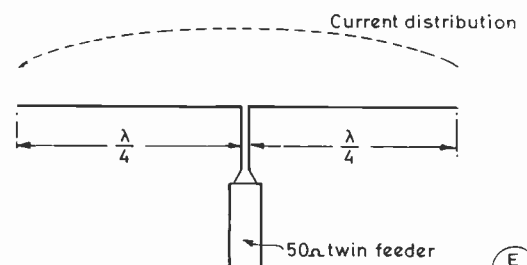


Fig. 1

The half-wave dipole, as derived by opening out a quarter-wave of 50-ohm transmission line.

can look at the SWR and 'prune' until we get it right, and then reasonably assume that the aerial is 'on the nose'.

The old-timer had even less test-gear than we have (even the GDO is a post-war invention!) and so his aim was to get the beast to radiate as best he could regardless. If the RF didn't go to VK and he wanted to work VK, then he pulled it down and put another one up, until he found one that would raise the VKs. A simple field-strength meter at the bottom of the garden, a pair of binoculars, and lots of 'suck-it-and-see' would, in many cases, bring our OT to the conclusion that the easy option was to stick up a half-wave dipole, but not before he had learned that RF can be got out and away from some very unpromising places and set-ups *provided* one isn't too fussy about where it goes and possesses an ATU that will match anything you hang on its output terminals to whatever the transmitter wants to see. However, the above statement doesn't alter the basic fact that if you are using a system requiring an earth (Marconi feed) then the more work you can do on the earth the better.

A summary so far; there are two basic types of aerial, namely the half-wave dipole, and the quarter-wave Marconi which can only resonate by virtue of the 'image' of itself *in the ground* and which therefore needs a ground connection. However, the old-timer can take an old bit of wire, string it up, and persuade it to radiate.

Clearly, then, if we now cast off the shackles of 'length' as part of our thoughts, we should still be able to obtain radiation or reception. Thinking about the dipole for a moment, let us take it down from free-space and pull it open further until the feeder has split down to give us a half-wave either side of centre. Each side will present an open-circuit to the end of the feeder it is connected to, so the SWR will be pretty alarming. The practical result might be that if we put much power up the feeder it would flash-over, or the current at the low-voltage points might even be enough to melt the insulation; but if we beefed-up the feeder and the spacing a bit it would still work — always providing we could dream up an ATU to match it. And here we might find that it is useful to adjust the feeder length to something the ATU finds easier. No, 'pruning the feeder' doesn't mean we are changing the SWR; it means we are changing the impedance presented to the ATU to something a bit

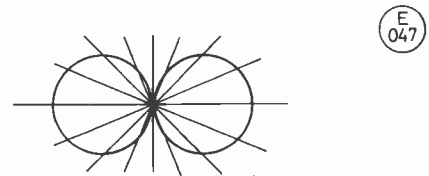


Fig. 2 POLAR DIAGRAM OF A HORIZONTAL 1/2 WAVE DIPOLE

Polar diagram of the half-wave dipole, related to the strength of the signal transmitted from the dipole in free space, in all directions. If we drew the entire pattern in 3-D we would have a vertical doughnut with the aerial element in the centre hole.

more amenable, usually in the reactance term. To put it bluntly, this is 'groped-and-hope' for most of us moderns. The old-timers often used open-wire feed (polythene wasn't invented, co-ax was both expensive and lossy, so open-wire feeder was a very much better bet) and they discovered that if a multi-band aerial was Zepp-fed with open-wire feeder, then on some bands it would need a series-tuned circuit in the ATU and on others a parallel-tuned arrangement. This was a bore for multi-band ops, so experimentation led to the observation that certain feeder lengths made it possible to get away with the preferred method of tuning on, for instance, all bands but one. They didn't have 10, 18, 21 or 24 MHz though!

If we adopt the modern scheme and arrange things so our feeder operates with low SWR, then we don't, in theory, need an ATU. In practice, though, especially with solid-state PA lacking any tank circuit, one would find an ATU worth while. If, on the other hand we just hang up a wire and work it against earth, particularly if we do lots of grafting on the earth arrangements, then with an ATU we might do as well, particularly if the idea is to work all bands. It is probably a fair bet that most of the world will be covered on one band or another, so you will have to get to know your own system by lots of listening. Another good reason for being an SWL!

Next time we'll take a look at directional aerials.

to be continued

CLUBS ROUNDUP

By "Club Secretary"

WE must come back to this question of *updating* your club's details at regular intervals. The situation is just this: we know from our experience that a change of a fundamental nature can happen overnight — a club Hq burns down, or a major personality clash occurs, or the sudden death of a guiding hand in club affairs — and our records, made as they must be of history, are out of date. A new chum writes in, we say to him "join the local club" and give him the now out-dated details, and he goes away to find for himself. If he succeeds in making contact, the incorrect data he was given doesn't exactly give him confidence in the club officers (or, indeed, in us!) and if he isn't 'taken up' very actively on his first visit he will probably be lost as a member. In the worst case, of course, he just fails to make contact and is surely lost to the club.

Hence our firm rule: we expect the data to be updated, at least quarterly, on venue, Hon. Sec. name and address, telephone number, and meeting routine, and we take this information on to a card-index system here. If our information is older than that, the lot goes out as being no longer recent enough for publication.

Reports

Abergavenny have a weekly berth in Pen-y-fal Hospital, Abergavenny, above Male Ward 2, every Thursday evening. Their RAE courses are at Nevill Hall Hospital, most Tuesday evenings, in the Seminar Room.

At the AGM of **Acton, Brentford & Chiswick** they talked about putting MCC back on the calendar — we would if there were firm indications of support from enough clubs. Their next session at Chiswick Town Hall is on April 19, for a discussion of members problems.

Down in Axminster, the "Cavalier Inn" is the home of the **Axe Vale** crowd, on the first Friday of each month. They also have an RAE class. More details from the Hon. Sec. — see Panel.

A new Hon. Sec. appears in the Panel for **Aylesbury Vale**, and she tells us they are now to be found at the Stone Village Hall, Stone, near Aylesbury on every fourth Tuesday. The next date noted is April 19 for a surplus equipment sale, with G4JFZ as auctioneer.

Over to GI now, and the **Bangor** crew. They are booked in at

the Sands Hotel, Bangor, Co. Down, on the first Friday of each month, where new members and visitors are always welcome. Details from the Hon. Sec. — see Panel.

We notice that **Basingstoke** have just celebrated their first 21 years of life. We hear that they have moved their club address to the British Legion Hall, Crown Lane, Old Basing, Basingstoke, on the second Tuesday in each month. In addition they have RAE and Morse tuition as needed.

April 6 is AGM time for the **Bath** gang. This will be, as usual, at the “Englishcombe Inn”, Englishcombe Lane, Bath, where they normally foregather on alternate Wednesdays.

Over at **Biggin Hill**, they will have a demonstration station at the Spitfire Youth Centre on April 9, and on 19th the meeting will be a constructional evening with a competitive element. Ian Daniels leading the doings. The venue for this is at Biggin Hill Memorial Library.

If you are in the **Bolton** area, try a look in at Horwich Leisure Centre on a Wednesday evening; although details are not available, we understand they have quite a varied and interesting routine and lots of members.

Turning to **Bournemouth**, we are in need of some up-dated information. As far as we know they are still in Kinson Community Centre on first and third Fridays.

A similar situation applies at **Braintree** where we believe that they still have their place at the Community Association, next door to the town's bus station, on first and third Monday evenings.

Turning now to **Bristol** we see they have the quarterly business meeting on April 5, projects evening on 12th, RTTY on April 19th, and on 26th the computer group have their bite, with a general natter later; all are at the YMCA, Park Road, Kingswood, Bristol.

B.A.R.T.G. is synonymous with RTTY, whether by way of mechanical or electronic teleprinters or home computers. Details of membership from the Hon. Sec. — see Panel.

Bromsgrove have the second Friday in every month at Avoncroft Arts Centre, with a QRP meeting on the fourth Friday, also at the Avoncroft venue. For April the Construction Contest is to be judged.

First!

Bury recently had a quiz contest against Warrington, at which both clubs were ‘at home’! The trick was turned by the use of TV links; Warrington transmitted in colour, and Bury in b/w, the arrangements at Bury being handled by G8GTP; the path was one of 18 miles, and picture quality very good both ways. As for the result, Warrington won by the proverbial gnat's whisker. Find the Bury crowd at Mosses Community Centre, Cecil Street, on any Tuesday evening.

At **Cambridge** the gang are still to be found at the Visual Aids Room, Coleridge Community Centre, Radegund Road. April 1st is skipped as the college is closed and on 8th they have a Grand Junk Sale at Comberton Village Hall. Back to ‘home base’ for a two-metre Fox Hunt on April 15, and on 22nd they will be addressed by G3WLD — topic unspecified.

Changes

The **Cheltenham** change of venue to the Stanton Room, in the Branch Library at Charlton Kings also means a change of routine; they now foregather on first and third Fridays evenings, except that as Good Friday falls on one of their April dates, for that month only they have the second and fourth Fridays. The new place lies behind the church, and there is a car park alongside, which is handy. More details from the Hon. Sec. — see Panel.

For details on the **Chesham**, club, we are advised to refer you to the Hon. Sec. — see Panel for his name and address.

Church Room, Church Lane, Wormley is the home of the **Cheshunt** club every Wednesday evening. April 6 is down for a talk on the “BBC Micro and Amateur Radio” by G3TIK, with a slide show of the members' shacks organised by G8LNM on April



At the end of January, Bury and Warrington radio societies held an inter-club quiz with a two-way video link on 70cm. Here we see the Bury team, with video from Warrington being received: left to right, G4GSY (‘home’ question master), G3RSM, G6HBF, G8XUR and G8OVT. Warrington team members were G3NFB, G4JYP, G8HYP and G6AWD — and they won by two points! The mostly home-built video equipment at Bury was provided and operated by G8GTP, and for the quiz he ran 30 watts peak sync. output on 70cm. to an 18-ele. Parabeam.

Photo by G3VNO

20. April 13 and 27 both natter nites, with some RAE revision on the latter date.

Down in **Chichester** the Hq is at the Green Room, Fernleigh Centre, 40 North Street, Chichester, on the first Tuesday and the third Thursday of each month. April 5 seems to have been undecided at the time of their letter, and on April 21 they will be having the AGM.

April 21 is the date for **Colchester** at Colchester Institute, Sheepen Road, when they will be told all about the design and production of printed circuit boards by Bev Clues.

It's AGM time for **Cornish** on April 7, the venue as ever being the SWEB Clubroom, Pool Camborne.

At **Crawley** it seems to be the fourth Wednesday in the month, at Trinity Church Hall, Ifield, Crawley. They also have informal meetings which are rotated among the various member's homes.

April 7 and 21 are the dates for **Cray Valley** at Christchurch Centre, High Street, Eltham. The former date is the AGM, and on the latter one there is the Constructional Contest.

Turning to **Crystal Palace**, they have their sessions on the third Saturday evening of every month, the details of the April meeting being still ‘in the works’ at the time of their writing. The venue for this one is the All Saints Parish Room, Upper Norwood, which lies at the junction of Beulah Hill and Church Road, just opposite the old ITA mast.

Dartford Heath D/F are next on the list, and they have their meeting at the “Malt Shovel”, Eynsford, Kent, on April 6; these are usually arranged for the Wednesday before a Sunday hunt event, and so for any other dates we must refer you to the Hon. Sec. — see Panel for the details.

April 13 seems to be the main date for **Denby Dale**, when they will be welcoming *Lowe Electronics* to their Hq at the Pie Hall, Denby Dale. For other meeting details, we suggest you contact the Hon. Sec. — see Panel for his statistics.

At **Derby** they have the top floor of 119 Green Lane, and they use it every Wednesday evening. Thus for April 6 there is a bring and buy sale, on 13th a rig marking session with a UV pen — a good idea in case the rig is pinched — and on 20th they will be visited by “Everts Communications of 119”, leaving just 27th to mention for a talk on energy and nuclear power by a member of the CEGB.

Derwentside continue to inhabit their Hq at the R.A.F.A. Sherburn Terrace, Consett; for the other details we must refer you to the Hon. Sec. — see Panel.

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- STOURBRIDGE: M. Davies, G8JTL, 25 Walker Avenue, Quarry Bank, Brierley Hill. (Lye 4019)
- SUNDERLAND: A. Everard, G8PCD, 19 Roker Park Road, Sunderland, Tyne & Wear.
- SURREY: R. Howells, G4FFY, 7 Betchworth Close, Sutton, Surrey SM1 4NR. (01-642 9871)
- SUTTON COLDFIELD: A. D. Turner, G8TUR, 10 Jervis Crescent, Sutton Coldfield, W. Midlands B74 4PW. (021-353 2061)
- SWALE: B. Hancock, G4NPM, Leahurst, Augustine Road, Minster, Sheerness, Kent ME12 2NB. (Minster 873147)
- THAMES VALLEY: J. Axe, G4EHN, 65 Ridgway Place, Wimbledon, London SW19 4SP. (01-946 5669)
- THANET: I. B. Gane, G4NEF, 17 Penschurst Road, Ramsgate, Kent. (Thanet 54154)
- TORBAY: Mrs. M. Rider, 7 Kingston Close, Kingskerswell TQ12 5EW. (08047 5130)
- UNIVERSITY OF KENT (CANTERBURY): C. Allen, G6FRX, Eliot College, The University, Canterbury CT2 7NS.
- VALE OF WHITE HORSE: I. White, G3SEK, 52 Abingdon Road, Drayton, Abingdon, Berks. (0235 31559)
- VERULAM: E. Bailey, G4KIQ, 50 Bettespaw Meadows, Redbourn, St. Albans, Herts. AL3 7EW. (Redbourn 3291)
- WACRAL: L. Colley, G3AGX, Micasa, 13 Ferry Road, Wawne, Hull, Yorks. HU7 5XU.
- WAKEFIELD: R. C. Sterry, G4BLT, 1 Wavell Garth, Sandal Magna, Wakefield. (Wakefield 255515)
- WEST KENT: P. Reeve, G4GTN, 2 Court Road, Tunbridge Wells, Kent. (Tunbridge Wells 24689)
- WIRRAL: N. McLaren, G4OAR, 596 Woodchurch Road, Oxtou, Birkenhead. (051-608 1377)
- WORCESTER: A. C. Lindsay, G4NRD, 11 Durcott Road, Evesham, Worcs. WR11 6EQ. (Evesham 41508)
- YEOVIL: A. Denning, G4BJH, 19 The Rock, Yeovil. (Yeovil 23873)
- YORK: K. R. Cass, G3WVO, 4 Heworth Village, York.

The first Monday in every month is the one for the **Droitwich** group, in the Scout Hq, Station Road.

Over to **Dudley**, and here the venue is the Central Library, on the second and fourth Tuesday. April 12 is down for G3RJV of the G-QRP Club to give his chat about QRP working.

The **East London RSGB Group** are one of the few Sunday clubs — find them on April 17 at 3 p.m. in Wanstead House, Wanstead, Ilford, Essex. The entertainment will be a talk on Cable TV.

The **Echelford** arrangements are to gather in the Hall, St. Martin's Court, Kingston Crescent, Ashford, Middx, on the second Monday and the last Thursday of each month. For the rest, we have to refer you to the Hon. Sec. — see Panel.

On April 14, members (only) of the **Edgware** group will be making a visit to the *Lowe Electronics* shop at Kings Cross, while on 28th they will be back at Hq for an informal session, at 145 Orange Hill Road, Burnt Oak, Edgware.

A new Hon. Sec. reports in for **Exmouth**; they foregather on alternate Wednesdays at the 6th Exmouth Scout Hut, Marpool Hill, Exmouth. The programme details and any other information desired will be passed on with pleasure by the Hon. Sec. — see Panel.

Nice to hear again after a long time from the **Fareham** lads, still based on Portchester Community Centre, on Wednesday evenings. April 6 is down for a talk on RTTY, April 20 is a talk on making your own PCBs, with natter evenings on the remaining April 13 and 27 dates.

Turning to the **Farnborough** programme, we see a bring-and-buy sale on April 13, while the details of the April 27 entertainment were still not finalised when they wrote. The Hq is at the Railway Enthusiasts Club, Access Road, off Hawley Lane, near the M3 bridge, Farnborough.

A change of venue is reported for the **Fylde** group, to the Kite Club, Blackpool Airport, where they foregather on the first and third Tuesday of each month. On April 5 G4AHZ will be talking about aircraft instrumentation, while the April 19 evening is an informal.

Up in GM land the **Glenrothes** crowd will be foregathering at Provosts Land, Leslie, on April 17 for their main meeting, but we understand they also have informals each week — doubtless the Hon. Sec. will be pleased to put you in the picture.

We turn now to the **G-QRP Club**, where the accent is on QRP operating, whether on transmit or receive, and of course, it follows, of home-construction. With 1500 members in all continents, it just has to have something! To find out more, contact the Hon. Sec. — see Panel for his details.

Nowadays, the **Grafton** group is to be found on second and fourth Fridays of every month, at the "Five Bells" in East End Road, Finchley. At the time of writing we don't have the programme details for April, for which we must refer you to the Hon. Sec. — see Panel.

A restricted number of the **Greater Peterborough** gang will be paying a visit to a power signal box on April 28. For details of the club, contact the Hon. Sec.

Since January 13 the **Grimsby** club is to be found fortnightly on Thursdays at Cromwell Social Club.

April 8 for a natter, and 22nd for the AGM is the **Guildford** routine, at the club house of the Guildford Model Engineers in Stoke Park, Guildford.

The normal weekly meeting routine for **Harrow** is interrupted on April 1. However, they will be together again on April 8 for an informal, with a colour SS/TV demo. down for April 15. On April 22, G2TA will give his talk on DX-ing, and on 29th there is a computer games evening.

At **Hastings** the group is nowadays based on West Hill Community Centre for the main meeting; April 20 is a junk sale. They also have meetings on other Wednesdays and Fridays at Ashdown Farm Community Centre, not to mention an RAE class on Tuesdays, preceded by a Morse class.

The **HaVERING** chaps have a place at Fairkytes Arts Centre, Billet Lane, Hornchurch, Romford, Essex, where they are to be

found each week, as follows: April 6 and 20 are both informals, April 13 is a talk "A Staircase for the Shack" by G3KFW and on 27th they have a talk by G3RZP on "Plessey ICs for Communications".

As ever, the **Hereford** group are still meeting at the County Control, Civil Defence Hq, Gaol Street, Hereford. Here they are to be found on the first and third Friday of each month. Programme details from the Hon. Sec. — see Panel.

Over in East Anglia, **Ipswich** are to be found at the Rose and Crown, at the junction of the A45 Norwich Road and Bramford Road, on the second and last Wednesdays in each month; there is often Morse available on the other Wednesday evenings too. April 6, the club room is closed, but on 13th they have a talk on Ignition Interference Suppression instead; then on April 27 the essential matter of the AGM is tackled.

If there is anything you want to know about Amateur Radio in EI-land, or the clubs around the country, we suggest you get in touch with the Hon. Sec. of I.R.T.S. On a different note, we see that they have the AGM down for Sunday, April 24, at the Grand Hotel, Malahide, Co. Dublin, at 2.30 p.m. The previous evening is the Annual Dinner at the same venue, and on the Sunday morning there will be a Trade Show.

The GD lads have their **Isle of Man** club Hq at the Keppel Hotel, Creg-ny-Ba, every Monday evening, alternating between social and activity evenings. Visitors to GD are welcome, and doubly so if they can spare time to give the gang a talk; get in touch with the Hon. Sec. at the address in the Panel.

This month we seem to have solved the mystery of the clubs in **Jersey**. First we take the Amateur Radio Society; they have Hq at Le Hocq Tower, St. Clements on Friday evenings and Sunday mornings. The Amateur Electronics Club has its base at Quennevais Communicare Centre on the second Wednesday of the month. Other details from the Hon. Sec. at the appropriate address in the Panel.

New Club

This one is at **Keighley**, and they meet on the last Tuesday in each month at the "Globe Inn", Parkwood Street, Keighley. We understand that on April 26 Bill Cost will talk about the "Techniques of the Cinema".

It is the second Monday in each month for **Leyland Hundred**, at Astley Park Social Club, Chorley, Lancs.



Litesold announce the introduction of the SK18 soldering/de-soldering kit for the electronics hobbyist. The kit is centred around an 18-watt mains iron fitted with a 3.2mm. bit, and includes two alternative bits (1.6 and 2.4mm.), a 3-metre reel of 18 s.w.g. flux-cored solder, stainless steel tweezers, three double-ended soldering aids and a reel of de-soldering braid. Providing all that is required for soldering and de-soldering by beginner or expert, the SK18 kit comes in a PVC wallet and is available direct from Litesold at the special mail-order price of £14.55 inc. postage and VAT. Further details and order form from: Light Soldering Developments Ltd., 97/99 Gloucester Road, Croydon, Surrey CR0 2DN. (Tel: 01-689 0574.)

Over now to **Lincoln**, where the group, as for so long, foregathers at the City Engineer's Club, Central Depot, Waterside South, Lincoln. On April 13 they have a talk on contest preparation by members of a local contest club, and on 27th G3SZJ will be giving a talk and slide show about the RSGB.

The **Lothians** club, is based in Edinburgh, at the Drummond High School, on second and fourth Thursdays. April 14 is an operating night, and on 28th they start with D/F Hunt preparation, and follow that with the Construction Contest.

Maltby club has just held its AGM, so we don't have any programme details for April; however, we can say you can find them on Fridays at the Methodist Church Hall, Blyth Road, Maltby.

Talking of AGMs it is time for that event at **Meirion** on April 7. The venue is the Nannau Country Club, Llanfachreth, two miles north of Dolgellau.

April 19 at **Midland** is down for the final discussion on their Drayton Manor commitments, at 294A Broad Street, Birmingham, opposite the Repertory Theatre. We understand they do have other informal meetings at the same venue, and no doubt their Post Boy, G8GAZ, will tell you if you call him on S17 anytime between 1000 and 2200, or contact the Hon. Sec. at the address in the Panel.

A new Hon. Sec. takes over at **Mid-Warwickshire**, and she says they are still to be found at 61 Emscote Road, Warwick, on first and third Tuesdays. April 19 is down for a talk on electronics in medicine.

April at **Newark** is down for G4MDV and a Workshop and Construction project. The venue is the Palace Theatre, Appleton Gate, and the date the first Thursday of each month.

Norfolk's AGM is down for April 6 at Crome Centre, Telegraph Lane East, Norwich. On April 13 they have one of their short meetings, on 20th they go to Anglia TV, and on 27th they are at the short meeting game again.

Oddly enough, April 6 is also the AGM for **Northern Heights**, while on 20th G4DAX talks about RSGB; both are at the Bradshaw Tavern, Bradshaw, Halifax.

A busy lad is G4DAX; he also appears on the **North Wakefield** list on April 14. This group foregathers weekly at Carr Gate Working Men's Club, on Thursdays.

Nottingham have a Forum on the first Thursday of each month, when they talk over the committee work; the second Thursday of the month is a talk, the third Thursday they put the club station on the air, and there is again a lecture on the fourth Thursday. Should there be a fifth Thursday in any month, then they "play it by ear".

Turning now to **Pontefract**, we have it that they are in the club rooms at Carleton Community Centre in that town every Thursday evening, the Hq being on the top floor.

If you know of anyone interested in our hobby, but blind or disabled, you should put them in contact with **R.A.I.B.C.** which exists to get them going as may be needed; and of course there must be supporters and representatives to do the work, with a lot of help given by clubs by way of donations or other activities. Details of RAIBC from the Hon. Sec. — see Panel.

April 12 at **Reading** is a demonstration by **SMC**, and on 26th the VHF Contest Committee of RSGB, in the person of G2HIF, will be explaining their *raison d'être*. Both at the "White Horse", Emmer Green, Reading.

April 19 is the AGM of the **Reigate** group, and will be held at the Constitutional and Conservative Club, Warwick Road, Redhill, starting at 8 p.m.

At **Rhyl** they have a base at the 1st Rhyl Scout Hq, Tynewydd Road, Rhyl, on second and fourth Thursdays, the first meeting in each month being the informal, with club station on the air, and the second one the 'set piece' session, with lecture, films or whatever.

Anyone associated with the **Royal Navy**, either past or present; can join the club, as can folk from the Merchant Navy or foreign navies. All the details from the Hon. Sec. — see Panel for his vital statistics.

On to **St. Helens**; this means the Conservative Rooms, Boundary Road, St. Helens. On April 6 they have a talk by G4LHL on receivers, and on 13th there is a talk on an 'unknown subject' by G3WOH; but it does look as if the club gathers every week.

Salisbury had just had their AGM when we last heard; they foregather every Tuesday at Grosvenor House, Salisbury, where help with RAE and Morse is available as required.

It is some time since we last heard from **Sefton**, who are still to be found at the Liverpool Prison Officers Association Club in Hornby Place, Hornby Road, Walton, Liverpool 4, on alternate Wednesdays as from February 23 last.

Thursday evenings it is as for the **Shefford** crowd, at the Church Hall, Ampthill Road, Shefford. For the other details we must refer you to the Hon. Sec.

April 5 seems to be the date for the **South Dorset** crowd, at the Army Bridging Camp, Wyke Regis, Weymouth. Other details from the Hon. Sec. — see Panel.

On to **Southdown**, serving the area around Eastbourne; they usually have the first Monday of the month at Chaseley Home, South Cliff, Eastbourne, but for April the date is April 11 for a talk by Ron Lobeck, the local TV weatherman.

S. E. Kent (YMCA) is the name of the club serving the Dover area, the name obviously being a statement of the Hq which in fact is at Dover YMCA, Godwynehurst, Leyburne Road. April 6 is down for the AGM, but they are to be found every Wednesday evening.

Deadlines for "Clubs" for the next three months —

May issue—March 25th

June issue—April 29th

July issue—May 27th

August issue—June 24th

Please be sure to note these dates!

Spalding have a talk on SSB/TV by G3CCH on April 8, at Maples Room, White Hart Hotel, Spalding.

Next we come to **Stevenage**, and their Hq at *TS Andromeda*, Fairlands Valley Park, Shephall View, Stevenage — and if you have a vision of a Leander-class frigate on dry land you've got it wrong! April 5 is 'to be confirmed' and on April 19 likewise; they have Morse classes before every meeting and there is always something teed up on the night.

Stourbridge have a problem with the Hq, as the pub is being modified (to increase the power of the PA?); so we must refer you to the Hon. Sec. for the latest position.

The Hq is the brewery with no beer at **Sunderland**; the opening hours are Monday and Thursday evenings from 7-9 p.m., and Sunday mornings from 10-12.30 p.m. Find the spot in Westbourne Road, Sunderland.

April 11 is the AGM for **Surrey**, and on 25th they have an RAE revision session. The Hq is at *TS Terra Nova*, 34 The Waldrons, South Croydon, on the first floor mess deck.

A natter night is down for April 11, and on 25th the **Sutton Coldfield** lads have the Spring Clean Junk Sale. Both are at the club Hq at the Central Library, Sutton Coldfield.

Some rather elegant note-paper advises us that the **Swale** crowd are to be found at Nina's Restaurant, 43 High Street, Sittingbourne, every Monday evening. It is also understood that this month they are hoping to start both RAE and Morse classes — get the details by turning up at a meeting.

The Caernarvon Trophy of **Thames Valley** is being awarded on April 5, after a construction contest for a 10 MHz QRP transmitter. This one is at Thames Ditton Library meeting-room, Watts Road, Giggs Hill, Thames Ditton.

April in **Thanet** shows us meetings at Birchington Village Hall on April 8 for a talk on propagation by G3MOO, and on VHF contesting by G4DCV on 22nd. In addition they have a special-event station, GB2TH, running at Thanet Marathon.

Torbay mourn the loss of two local stalwarts in G2BNT and G3BHL. The club meets on Friday evening at Bath Lane, rear of 94 Belgrave Road, Torquay for informals each week; and on April 30 they have the AGM, for their Saturday evening formal, at the same place.

The **University of Kent at Canterbury** foregather on Mondays from 7.30 p.m. at the club shack; listen out on S15 for talk-in, or get in touch with the Hon. Sec. — see Panel.

There is a junk sale in store for the **Vale of White Horse** members on April 5, at the “White Hart” in Harwell village, with an informal on 19th too.

We hear that there are moves afoot to change the venue for the **Verulam** formal meetings, and so we feel it best to refer you to the Hon. Sec. — see Panel for his details.

Next we come to **WACRAL**, the club comprising those who feel themselves to be dedicated Christians as well as amateurs or SWLs; details from the Hon. Sec.

April 5 at **Wakefield** is a Questions Night, at Holmfield House, Denby Dale Road, Wakefield; on 19th they have the AGM, at the same venue.

Just one meeting is noted for **West Kent**, namely the AGM on April 29, at the Adult Education Centre, Monson Road, Tunbridge Wells. In addition they have informals at the Drill Hall in Victoria Road; details from the Hon. Sec. at the address in the Panel.

The **Wirral** crowd have a place at Irby Cricket Club, where they are to be found on April 13 for a demonstration by *Sota Communications*; on 27th they have a talk on passive D/F, tips and wrinkles by G8UZZ and others. In between, there is the informal on April 6 at the Railway Hotel in Meols, and on 20th at “The Harp” in Neston.

One week later than usual, the **Worcester** meeting at the “Old Pheasant” in New Street is on April 11, for the Construction Contest. April 25 is down for an informal at the same venue.

Yeovil have moved to Milford Recreation Centre, Milford Park, Yeovil; on April 7 G3KSK talks about the half-wave dipole, and on 14th G3MYM takes over to talk about aerial height. April 21 is down for a talk by an SWL member on his home-built delta-loop aerial, and on 28th there is a natter evening.

They would welcome visitors or new members at **York**, where the gang foregather every Friday evening at the United Services Club, 61 Micklegate, York. To judge by G3WVO’s letters each month they sound a really nice crowd there.

Finale

That’s it for another bumper month; the deadlines for the next few months are in the ‘box’, and are for arrival at Welwyn; address to your scribe, SHORT WAVE MAGAZINE, 34 High Street, Welwyn, Herts. AL6 9EQ.

Radio Amateur’s Examination

The periodic review of the syllabus for the Radio Amateur’s Examination is now due and the City and Guilds R.A.E. Subject Committee has established a working party for this purpose.

The principal objective of the Examination is to ascertain the candidate’s ability to operate an amateur station within the terms of the licence and not necessarily to test expertise in particular aspects of the Amateur Service. Suggestions for alterations or amendments to the existing syllabus would be welcome and should be sent to Mr. S. D. Allison, City and Guilds of London Institute, 46, Britannia Street, London WC1X 9RG

Mobile Rallies, 1983

April 10, Swansea A.R.S. Rally in the Patti Pavilion (next to St. Helens County Cricket Ground) on the A4067 Swansea-Mumbles road, 10.30 to 5 p.m., talk-in on S22 by GB2SWR, trade stands, local repeater groups, bring-and-buy, RSGB bookstall, operational HF/VHF stations, licensed bar and refreshments. Further details from Roger Williams, GW4HSH, QTHR (tel: Swansea 404422). **April 10**, Lough Erne A.R.C. Rally at the Killyhevlín Hotel, Enniskillen, from 1 p.m., talk-in on S22, trade stands, bring-and-buy, family attractions. Details from A. Sammon, 0365-4821 working hours. **May 1**, Maidstone A.R.S. Rally at the YMCA Sports Centre, Melrose Close (off Cripple Street), Maidstone, Kent, 11 to 5 p.m., admission 50p, talk-in on S22 by GB2YSC, trade stands, bring-and-buy, bookstall, family attractions, ample parking. Full details from D. Wilcox, G4FOE, QTHR. **May 8**, Lincoln Hamfest at the Lincolnshire Showground (4 miles north of Lincoln on the A15), starts 11 a.m., talk-in on 144 MHz (S22) and 432 MHz (SU8), facilities for the disabled, family attractions, refreshments, licensed bar, ample parking. Further details from Pam Rose, G8VRJ, c/o City Engineers Club, Central Depot, Waterside South, Lincoln. **May 15**, Northern Mobile Rally at the Great Yorkshire Showground, Harrogate, 11 a.m. to 4.30 p.m., talk-in, trade stands, bring-and-buy, full range of family attractions, bar and refreshments, ample parking. Details from J. Annakin, 25 Ashfield Place, Otley, Leeds LS21 3JN. **May 15**, Swindon and District A.R.C. Radio and Electronics Rally at Park School, Marlowe Avenue, Swindon, Wilts., doors open at 10 a.m., admission 50p, trade stands, talk-in on 2m. (S22) and 70cm. (SU8), many family attractions, refreshments, ample free parking. Further details from K. Saunders, G8SFM, QTHR. **May 22**, B.A.T.C. Exhibition of Amateur Television at the Post House, Leicester, doors open at 10 a.m., demonstrations of fast-scan, slow-scan and narrow-bandwidth television, plus the B.A.T.C. outside broadcast unit, trade stands, full range of Club books, bar. Full details from T. Brown, G8CJS, QTHR (tel: 0532-670115). **May 29**, East Suffolk Wireless Revival at the Civil Service Sportsground, The Hollies, Straight Road, Ipswich, from 10 a.m., trade stands, transceiver clinic, aerial testing range, ‘fleamarket’, ‘car boot’ sale, family attractions, licensed bar. Full details from J. Tootill, G4IFF, QTHR (tel: 0473-44047). **May 29**, Plymouth R.C. Rally at Tamar High School, Paradise Road, Stoke, Plymouth, starts 10 a.m., many trade and general interest stands, refreshments and bar, talk-in on SU22 and SU8. Full details from D. Whitbread, G6EQM, QTHR (tel: 0753-20224). **June 12**, Elvaston Castle Mobile Rally at Elvaston Castle Country Park (5 miles S.E. of Derby on the B5010), all the usual attractions with full on-site catering, opens 10 a.m., talk-in on 144 and 432 MHz by GB2ECR, admission free, 35p car park charge levied by local authority. Further details from Ian Cage, G4CTZ, QTHR. **June 19**, Denby Dale and District A.R.S. Rally at Shelley High School, Skelmanthorpe, Huddersfield. Full details from J. Clegg, G3FQH, QTHR. **June 26**, 26th Longleat Mobile Radio Rally, Longleat Park, Longleat, Warminster, Wilts., all the usual arrangements at this splendid site. Details from C. Rose, G8YCV, QTHR (tel: 0225-311687, or 0272-218279 day). **July 10**, Worcester and District A.R.C. Rally, at Droitwich High School, Ombersley Road, Droitwich. Details from B. Jones, G8ASO, QTHR (tel: Worcester 351565). **July 24**, Anglian Mobile Rally, at Stanway School, Colchester, starts 10 a.m., talk-in on 2m. Information from D. Sellen, G3YAJ, 020639-3938. **August 27**, Scottish Amateur Radio Convention, organised by the West of Scotland A.R.S., at Cardonald College, Mosspark, Glasgow. Full details from I. McGarvie, GM4JDU, QTHR (tel: 050581-2708).

More mobile rally dates will appear in subsequent issues. If you have not yet notified us of *your* rally, now is the time to do it! Send the information to our Club Secretary, marking the envelope “Mobile Rally”. And don’t forget we are always glad to receive photographs of rally events for possible publication.

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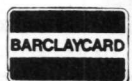
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R2	4.0291	8.0583	12.0875	14.9944	18.1312	44.9833
R3	4.0298	8.0597	12.0895	14.9972	18.1343	44.9916
R4	4.0305	8.0611	12.0916	15.0000	18.1375	45.0000
R5	4.0312	8.0625	12.0937	15.0027	18.1406	44.0083
R6	4.0319	8.0638	12.0958	15.0055	18.1437	45.0166
R7	4.0326	8.0652	12.0979	15.0083	18.1468	45.0250
S8	—	—	12.1000	14.9444	18.1500	44.8333*
S9	—	—	12.1020	14.9472	18.1531	44.8416*
S10	—	—	12.1041	14.9500	18.1562	44.8500*
S11	—	—	12.1062	14.9527	18.1593	44.8583*
S12	—	—	12.1083	14.9555	18.1625	44.8666*
S13	—	—	12.1104	14.9583	18.1656	44.8750*
S14	—	—	12.1125	14.9611	18.1687	44.8833*
S15	—	—	12.1145	14.9638	18.1718	44.8916*
S16	—	—	12.1167	14.9667	18.1750	44.9000*
S17	—	—	12.1187	14.9694	18.1781	44.9083*
S18	—	—	12.1208	14.9722	18.1812	44.9166*
S19	—	—	12.1229	14.9750	18.1843	44.9250*
S20	4.0416	8.0833	12.1250	14.9777	18.1875	44.9333
S21	4.0423	8.0847	12.1270	14.9805	18.1906	44.9416
S22	4.0430	8.0861	12.1291	14.9833	18.1937	44.9500
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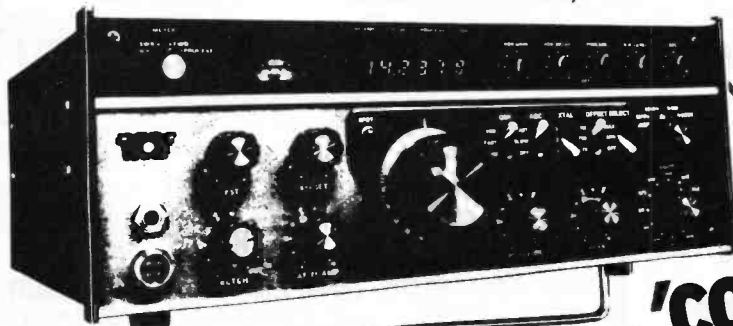
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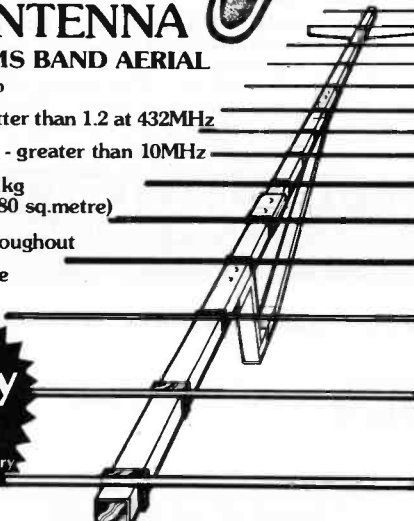
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