R Charleston. X.

APRIL 1984

£1.00

SERVICING-VIDEO-CONSTRUCTION-DEVELOPMENTS

ABOUT

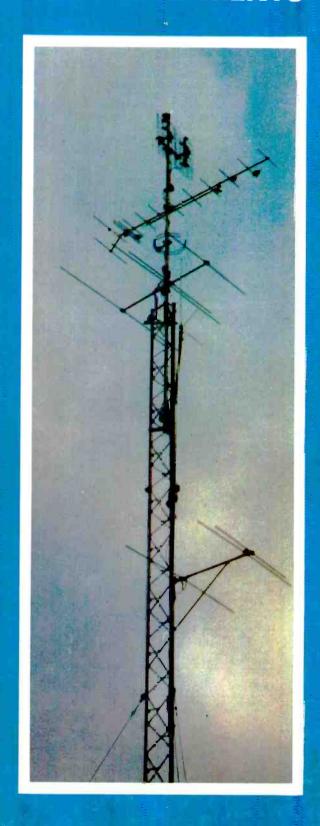
THE RIGONDA VL100 PORTABLE

DEBAND UHF

DX-TV

EST REPORT:

LT FINDING



Interested in Television Servicing? va ZED Pack. Effect Repairs at Minimum Cost. TO3 Mounting kits (BU208)

	I ry a ZE.	D Pa	ick. I	meci nepairs a	F TATEL	HHHU
Z 1	300 mixed ½ and ¼ watt and minia-		Z20	10 Assorted switches including:		Z44
	ture resistors	£1.95		Pushbutton, Slide, Multipole,		Z45
Z2	150 mixed 1 and 2 watt resistors	£1.95		Miniature etc. Fantastic Value	£1.20	Z46
Z 3	300 mixed capacitors, most types		Z21	100 Assorted Silver Mica caps	£2.20	Z47
	amazing value	£3.95	Z22	10 Mixed TV convergence Pots	£1.00	
Z4	100 mixed electrolytics	£2.20	Z23	20 Assorted TV Knobs including:		Z48
Z 5	100 mixed Polystyrene Capacitors	£2.20		Push Button, Aluminium and		Z49
Z 6	300 mixed Printed Circuit			Control types	£1.20	
	Components	£1.95	Z24	10 Assorted Valve bases		
Z 7	300 mixed Printed Circuit			B9A, EHT, etc.	£1:00	
	resistors	£1.45	Z 25	10 Spark Gaps	£1.00	Z50
Z8	100 mixed High Wattage Resistors.	,	Z26	20 Assorted Sync Diode Blocks	£1.00	
	wirewounds etc.	£2.95	Z27	12 Assorted IC Sockets	£1.00	Z51
Z 9	100 mixed Miniature Ceramic and		Z28	20 General Purpose Germanium		
	Plate caps	£1.50		Diodes	£1.00	Z52
Z 10	25 Assorted Potentiometers	£1.50	Z29	20 Assorted Miniature Tantalum		
Z11	25 Assorted Presets, Skeleton etc.	£1.00		Capacitors, Superb Buy at	£1.20	Z53
Z12	20 Assorted VDR's and		Z30	40 Miniature Terry clips,		
	Thermistors	£1.20		ideal for small Tools etc.	£1.00	
Z13	1 lb Mixed Hardware, Nuts, Bolts,		Z31	5 CTV Tube Bases	£1.00	Z54
	Selftappers, "P" clips etc.	£1.20	Z32	10 EY87/DY87 EHT bases	£1.00	
Z14	100 mixed New and marked		Z33	20×PP3 Battery Connectors	£1.00	
	transistors, all full spec, includes:		Z34	6×Miniature "Press to Make"		Z55
	PBC108, BC148, BC154, BF274,			Switches, Red Knob	£1.00	Z56
	BC212L, BC238, BC184L and/or		Z35	12 Sub Min S.P.C.O. Slide		Z57
	Lots of similar types ONLY	Y £4.95		Switches	£1.00	
(Z14A)	200 Transistors as above but		Z36	12 Min D.P.C.O. Slide Switches	£1.00	Z58
	including power types like BD131,		Z37	8 Standard 2 Pole 3 Pos Switches	£1.00	Z59
	2N3055, AC128, BFY50 etc.	£9.95	Z38	4×HP11 Batt Holders		
Z15	100 Mixed Diodes including:			(2×2 Flat type) 4 fo	or £ 1.00	
	Zener, Power, Bridge, Signal,		Z39	3.5mm Jack Sockets, switched,		
	Germanium, Silicon etc. All full			enclosed Type 8 fe	or £1.00	н
	spec.	£4.95	Z40	100 Miniature Reed Switches	£2.30	
Z 16	20 IN4148 Gen Purpose Diodes	£1.00	Z41	100 Subminiature Reed Switches	£4.20	Ty
Z17	20 IN4003/10D2	£1.00	Z42	20 Miniature Reed Switches	£1.00	Br
Z 18	20 Assorted Zeners.		Z43	12 Subminiature Reed Switches	£1.00	TH
	I watt and 400 mw	£1.50		ZENER DIODE	S	pac
				ZENERDIODE		etc

High quality	COA	X P	LUGS,
silver plated fixing.	- 1	5	for £1
COAX COUP	LERS IG	5 5	for £1
SOCKET		3	for £1

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1μf 350v	10 for £1.00
2.2µf 63v	20 for £1.00
4μf 350v*	10 for £1.00
10μf 25v	20 for £1.00
22μf 16ν	20 for £1.00
100μf 25v	20 for £1.20
160μf 25v*	20 for £1.50
330µf 25v	10 for £1.00
400μf 40v*	8 for £1.00
470μf 25v	10 for £1.00
470µf 35v	8 for £1.00
1000μf 35v	6 for £1.00
1000μf 40v*	5 for £1
*Axial, All others are	Radial.

CAN TIPES	
22µf 375v (3 pin)	50p
50µf 250v (3 pin)	50p
100μf 350v	80p
2000μf 100v	£1.00
1000μf 100v	60p
2,200µf 40v	60 p
2,200µf 63v	70p
3,500µf 35v	50p
220µf 400v ITT/RBM	£1.00
6,800µf 70v	£1.00
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100 of EACH colour

R.B.M. USERS LOOK!

No more messy soldering, 24 pin I.C. sockets for **\$L901** etc. SPECIAL OFFER: 5 for £1.00 100 for £12.50.

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160v-400v only	£2.00
100 Assorted Mullard C280's Cosmetic imperfects etc.	£2.00
200 Mullard Miniature	
Electrolytics Cosmetic imperfe	cts
etc.	£2.00
PACK OF EACH	£5.00

12V BULBS on leads. Suitable for most VIDEO RECORDERS.

70p each 4 for £2

CAR RADIO SUPPRESSOR KIT

Comprises: in line aerial suppressor, power lead suppressor and clock/accessory suppressor. With leaflet.
£1.95 each, 10 for £12 Further Discount on large quantities

£3.95 £4.95

£4 £10

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0v7, 2v7, 4v3, 4v7, 5v6, 6v2, 6v8, 7v5, 27v, 30v. ALL 400mw.

DIODES

1.3 watt. 12v. 13v. 18v. 47v.

£6.60

£3.00

£1.00

100 for £2.50

100 for £3.00

100 for £5.00

100 for £2.50

£1.00

£1.00

8 for £1.00

6 for £5.00

6 for £5.00

4 for £1.00

5 for £2.00

£1 each, 6 for £5.00

10 of one value

10 of one value

10 of each

10 of each

25 × IN4002

20 × IN4003

20 × IN4005

20 × IN4148

12 x BY127

IN 5402 3a 200v

CA270AE£1.00

TBA810P£1.00

555 Timer 30p TAA 66 IB £1.00 SN76660N 50p

TBA820

8 × BY255 (3A 1,300V) 10 × BA158 (600v 400ma)

6A. 100V, Bridge Rectifier. Very small. 80pea. 3 for £2.00

I.C.'s

MC1327P£1.00 6 for £5.00 TBA 120SB 50p each, 5 for £2.00

	•
"3500" Transductor	£1.20, 3 for £3.00
"8500" Focus Assembly. Rotary type	£1.50, 3 for £4.00
"8500",0022 2000v Line Capacitor	10 for £1.00
"1590/91" Portable metal boost Diode (W11)	5 for £ 1.00
"1500" Bias Caps 160µf 25v	20 for £1.50
"1500" Jellypot. L.O.P.T. Pinkspot	£3.50
"900/950" 3 stick triplers	£1.00, 3 for £2.50
"950" Can. 100 + 300 + 100 + 16µf	£1.00

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SPECIAL OFFER

PHONO PLUGS, metal with plastic tops. Red, grey or black 20 of ONE colour 20 of EACH colour £2.

Single nut fixing as used in various JAP portables "Mitsumi" varicap tuner "AM-UF-125"

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LIGHTWEIGHT STEREO HEADPHONES. Good quality with
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 5Ω , 10Ω , 20Ω , 30Ω , 50Ω , 100Ω . 20002, 1K. 8 of one type £1.00. 8 of each type £6.00.

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TO220 Mounting kits (TIP33) 10 for 60p TO 126 Mounting kits (BD 131) 12 for 60p Pack of each Mounting kit. All include insulators and washers

3a 1000v Diodes (IN5408 type) 8 for £1.00 Brushed Aluminium Push Button

Knobs, 15mm long × 11mm Diam. Fit standard 3 1 mm square shafts

Chrome finish 10mm × 10mm Diam

Aluminium Finish. Standard Fitting

Tuner P/B Knobs, Black and Chrome. Fit most small Diam Shafts, ITT, THORN, GEC etc.

Spun Aluminium Control Knobs (ITT) 'Shaft, suitable for most sets with recessed spindles

Slider Knobs. (Decca) Decca "Bradford" Control Knobs Black and Chrome. 1" Shaft

14 Pin DIL I.C. Sockets 16 Pin Quil I.C. Sockets

16 Pin DIL TO QUIL I.C.

22 Pin DIL I.C. Sockets

B9A Valve Bases P.C. Type

as above

Sockets

£1.50

10 for £1.00

10 for £1.00

10 for £1.00

8 for £1.00

8 for £1.00

8 for £1.00

12 for £1.00 12 for £1.00

10 for £1.00

10 for £1.00

20 for £1.00

HITACHI PORTABLE V.C.R. Nicad pack. Type VTBP60E £20 each. Brand New and Boxed 3 for £50

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THORN "VIDEOSTAR" Nicad packs. Same as above but secondhand, untested. Contain 10 "C" size Nicads (HP11) which can be replaced if necessary. £10 each, 3 for £25.

MISCELLANEOUS

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Line output transformer for
RBM823A £4.25 each, 3 for £10.00
ITT VC200 4P/B Transistor Tuner. Suitable for some Pye
and Philips sets. 3 hole fixing £2.75 each
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2½"×2"×½" complete with 9 foot coaxial lead and plug.
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Convergence Panel for above. Brand new leads
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Decca etc. 75p each, 3 for £2.00
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"TAIYO" type 50p each, 3 for £1.00
PYE CT200 Control Knobs 8 for £1.00
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Mains Neons 10 for £1.00
2k2 Screened Resistors.
White ceramic, 9 watt, with fusible link. 8 for £1.00
E.H.T. Discharge probe, with heavily insulated handle,
with lead and chassis connector. £1 each, 3 for £2.50

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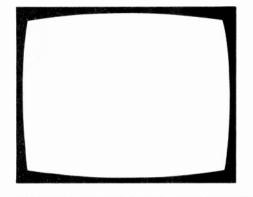
£1.20

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Please quote ZED code where shown. Send cheque* or Postal Order. Add 60p P&P and 15% VAT.
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TELEWISION

April 1984 Vol. 34, No. 6 Issue 402

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QUERIES

We regret that we cannot answer technical queries over the telephone nor supply service sheets. We will endeavour to assist readers who have queries relating to articles published in *Television*, but we cannot offer advice on modifications to our published designs nor comment on alternative ways of using them. All correspondents expecting a reply should enclose a stamped addressed envelope. Requests for advice on dealing with servicing problems should be directed to our Queries Service. For details see our regular feature "Service Bureau". Send to the address given above (see "correspondence").

this month

297	Lead	0
4 3/	LCQU	CI

298 Notes on the Rigonda VL100

Large numbers of these 6in. Russian monochrome portables were imported into the UK. They are robustly constructed but tend to be put on one side when anything goes wrong because of the Russian transistors etc. used. Notes on the circuitry employed, transistor substitutes and possible fault conditions.

300 Next Month in Television

303 Wideband UHF Preamplifier Roger Bunney
The emphasis in this design is on low noise, which for best results is more important than a high gain figure.

304 Teletopics

News, comment and developments.

306 VCR Clinic

Reports on VCR servicing and fault conditions from Steve Beeching, T.Eng. (C.E.I.), Derek Snelling and Mike Phelan.

308 All About Field Strength

How field strength is measured, how to make use of the measurements and how to convert them to voltage at the aerial socket. Covering both terrestrial and satellite transmissions and the relationship between field/signal strength and receiver performance.

312 Sensing out Faults

How to make maximum use of your senses in seeking the causes of fault conditions.

313 Book Notice
Recent books on the techniques used in VCRs.

314 Letters

316 This Little Ting Here

Les Lawry-Johns
The customers decided to wait and have a fag whilst Les sorted out the Z718 whose tuning was up the creek.

318 VCR Servicing, Part 27 Mike Phelan
The 3V24's capstan servo, still/slow and edit start systems.

The B & K 467 CRT Tester/Reactivator

Test report on this impressive instrument that even boosts Trinitron tubes.

322 TV Fault Finding
Notes on TV faults and servicing procedures from Richard Roscoe,
John Coombes, Tony Thompson and M.S. Barakat.

324 Long-distance Television Roger Bunney
Reports on DX reception and conditions and news from abroad.
Plus how to receive ATV transmissions.

327 Service Bureau

328 Test Case 256

OUR NEXT ISSUE DATED MAY WILL BE PUBLISHED ON APRIL 18

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NEW MKV PAL COLOUR **TEST GENERATOR FOR TV & VCR**

TEST **DEMONSTRATIONS** WEST END LANE





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- ★ Facilities for sound output.
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SPECIAL TEST REPORT TELEVISION Post/Packing £2.50
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PAL COLOUR BAR GENERATOR (Mk4)



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- ★ Simple design, only five i.c.s on colour bar P.C.B.

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950, 1400, 1500, 1580, 1591 £6.80
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GEC Series 1 & 2 £9.20
GEC Series 1 & 2 £9.20
GEC 2010 2038 series £7.80
GEC Series 1 & 2 £9.20
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ITT CVC 5 to 9, CVC20 £11.30
ITT/KB VC 200, 300 SERIES £8.80
ITT CVC 5; CVC30 series £10.15
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SPECIAL OFFER PYE 725 (90°) 731 to 741 £10.60
SPECIAL OFFER PYE 725 (90°) 731 to 741 £10.60
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PYE 40, 67 £2.00
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THORN 9000 to 9600 £14.80
THORN 9800 9600 £14.80
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COMPUTER 16 CAM MODULE (PhysPhips) = 3.00 20		22 13	PANELS	S + UNITS	SINCLAI	IR .	Moulded Plastic Hex. 6mm Trim Tools 10	R.B.M. A823 (plug in) AV 7.60 BYX36/10 30 KORTING (similar to Siemens TVK1) BYX36/200 35
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## ATTEMES RICHARGEABLE 10	63V	1 12 2.2 12	Log: 5K-10K-25K-50K-100 250K, 500K, 1M, 2F	VI			76mm 45	DECCA 20 2.48 IN4003 4
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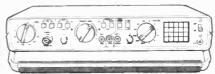
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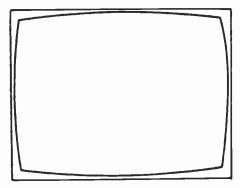
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COVER PHOTO

Our cover photo this month shows the aerials in use on Roger Bunney's lattice mast at Romsey, Hants. At the top a double stacked Triax BB u.h.f. grid system which is also at present being used for ATV reception. Lower down there's a 13-element wideband Triax Band III array, an omnidirectional Triax 88-108MHz f.m. array and a three-element wideband Band I array.

NEXT MONTH

Watch out for next month's bumper issue – see page 300 for details.

TELEVISION

The Skills Required

At the end of last month's leader I commented that there's probably no harm in manufacturing under licence rather than undertaking the original research. The subject deserves to be kicked around a bit more, since it has great relevance to the UK's present industrial condition and where we go from here.

The point I wished to make was that there's no advantage to be gained from a bone-headed insistence on being scientifically or technologically self-sufficient. At the other extreme, to abandon research and come to rely entirely on imported technology, becoming in the process a nation of odd-jobbers for multinational companies based elsewhere, won't do either. To cut ourselves off from original technological development would in the long run be asking to cease to be a country with a substantial industrial base. The problem is what sort of balance to strike, how to allocate funds, resources and know-how, and in deciding what's worth doing and what's best left to others. There is also the interesting business of joint venture efforts, which can be quite different from simply manufacturing under licence.

The history of the UK's television industry has been a rather mixed one. There's been plenty of research and development, but not quite the same degree of success with applied technology for mass production. The UK did not develop a colour TV system, neither has it developed a VCR system. It did however pioneer TV development initially, played a major role in the application of solid-state technology to TV receiver use, developed teletext and viewdata and, more recently, the MAC system for satellite transmission. Plenty of R and D then, but not all along the line. This is as it should be. The world would have been no better a place with a UK colour or VCR system to add to the confusion in these fields. The basic technology here can be had under licence agreement. It's beneficial however if one has something to offer in return.

Joint venture agreements in the fullest sense involve two-way collaboration, with both sides contributing to the technology involved. Merely assembling bought in kits on the other hand means opting out of the technology concerned. An interesting example of a joint venture with technological commitment on both sides was highlighted last month – RCA and Hitachi's collaboration over the CED disc system. Joint venture arrangements that involve technical collaboration end up with both sides having a foot in the research department door.

It's not always easy to get at the full details of such joint ventures – they must, after all, be subject to a degree of commercial secrecy. But this sort of arrangement is an important way in which a country with limited means and technological resources can keep in touch with technical development. Provided of course one is in a position to offer technological collaboration. What one needs here above all else is qualified manpower. And this seems to be something of a problem.

UK universities are at present producing some 2,000 electronics and electrical graduates a year. This is nothing like enough, and is appalling in view of the hopes placed on the electronics industry in particular for future industrial regeneration. Plessey alone is on record as stating that it would like to employ another 700 graduates "in the electronics and other numerate disciplines". The company has reached the point where it has had to send recruiting officers to Australia and New Zealand and advertise on the continent. Plessey's personnel director Parry Rogers thinks that "the situation of skill shortages will get worse, and threatens to become the major limiting factor in our growth".

There is something deeply disturbing about this. Shortage of trained manpower affects not only companies like Plessey, which tend to do much of their own R and D work: it also affects the prospects for joint venture operations, whose importance for a country such as the UK we've just noted. A recent paper on foreign investment in the UK, produced by the Royal Institute of International Affairs, pointed out that one of the main attractions of the UK has been the availability of "scientific skills". It seems that this means much more to a foreign multinational company contemplating investment in the UK than the offer of hand-outs to locate plants in depressed areas. It may be that we have a just adequate pool of skilled people to meet current needs, but it's quite clear that the government and the educational authorities have been doing nothing like enough to ensure an adequate supply of trained personnel to meet future needs.

Unfortunately the problem doesn't stop with the need for a few more new graduates and technicians. The skills required are increasingly of a wider variety than numeracy and a specialist degree or certificate. Creative engineering ability tends to come with experience and means the ability to see opportunities in business and production terms as well as basic technological ones. How many engineers are there who've taken a course in business studies? The need is possibly for some restructuring of higher education. We need only look to certain other countries to see how it can be done. There are also some perhaps less obvious aspects of the need for a wide range of skills. There's been a fascinating correspondence recently in the Financial Times on the need for engineers to be able to speak Japanese. We tend to think of English as the international language of electronics, as indeed it is, but if you have to talk business to a senior Japanese engineer you will soon appreciate the importance of being able to do so in his own tongue. The significance of this in making joint venture agreements work is clear enough. But how many engineering degree courses include Japanese as an option? It's not entirely unknown, but hardly commonplace!

Notes on the Rigonda VL100

Malcolm Burrell

These small (6in. tube) monochrome portables have been around for many years and were imported in considerable quantities. I've not had a lot to do with them but recently I wanted a small set for use as a simple video monitor. I bought a couple of VL100s in pieces and set about getting one of them going. Whilst most shops are reluctant to handle these sets, you quite often come across one in the corner of a workshop. The problem is lack of information and the Russian components with markings that tend to cause confusion. This is a bit of a pity. Although the design is very basic, they are interesting sets that can in most cases be repaired quite economically provided the tube is known to be good. The Television Tube Shop advertises the tubes at £14 plus VAT, and even this major replacement could still be a viable proposition.

The first point to note when servicing these sets is the Russian symbols for the transistor connections. As near as we can get, K is the collector, b the base and 3 the emitter (sometimes the shield as well).

Power Supply Circuits

The mains unit screws to the rear and supplies about 14V d.c. to the input socket at the back. If you haven't got one, it should be a fairly straightforward item to build. Alternatively a 12V car battery can be used.

The input from the mains unit or battery is fed to a series regulator which provides a 10.5V supply to operate the set. The bulk of this circuit lives on the top panel, with adjustment provided by R132. This is set for 10.5V at the collector of T27 (later version, see Fig. 2), which is mounted on a heatsink at the rear.

The main difference between the two versions of this chassis (Models VL100 and VL100M) lies in the power supply, see Fig. 1. In the earlier version a simple emitter-follower T26, with feedback to its base, drives the series regulator transistor T27. Three transistors are used in the later version. T30 provides sensing, driving the emitter of T26 by emitter-follower action. T27 is the series regulator as before.

Excessive voltage with a hum bar may well indicate a fault in the regulator. Check the transistors – the types don't seem to be very critical and things like the BC142 or

BFY50 (npn) and the BC143 or 2N2905 (pnp) work well for the smaller types while a TIP32 can be used for T27 with modifications to the mounting.

The Signals Side

On the r.f. side, the rotary u.h.f. tuner can be one of two or three types and tends to occupy quite a large area within the set. In some versions there's a separate preamplifier stage. The main i.f. strip employs three transistors followed by a diode detector. The sound signal is extracted at the collector of the video driver transistor. There are two intercarrier sound amplifier transistors followed by a ratio detector. The five-transistor audio circuit uses a two-transistor class A output stage. While the video driver/output transistors, the audio driver and the a.g.c. transistors are npn types, the rest of the signal transistors are pnp types with their collector circuits returned to chassis.

One of the vision i.f. transistors in my rebuilt set was open-circuit. An AF117 put that right. The audio output transistors T28/29 were missing and, after replacing the bias diode D21 which was short-circuit, acceptable audio was obtained by inserting a pair of AC128s. One of the a.g.c. transistors was missing while the other was short-circuit. That good old standby the BC107 worked a treat in both positions.

A BF337 can be used in the video output transistor position (T5).

Timebase Circuits

The line output transistor T25 is mounted inconspicuously alongside the top regulator panel, which also houses the line output transformer. I was interested to see what might happen if you need to replace the line output transistor, so I wired in a TIP32 – it worked! An AU110 is reputed to work here, with possibly some alteration required to the values of the flyback tuning capacitors C81/2. The deflection power requirements are very low, due to the 70° tube with its extremely narrow neck. One bonus from this is the lack of heat developed, and I would think that most line output transistor failures are likely to be the result of the inherent problems with germanium

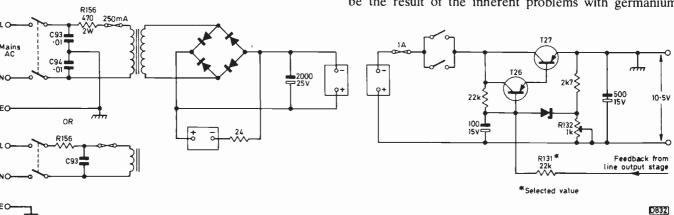


Fig. 1: Mains unit, with battery charging socket, and the earlier two-transistor series regulator circuit,

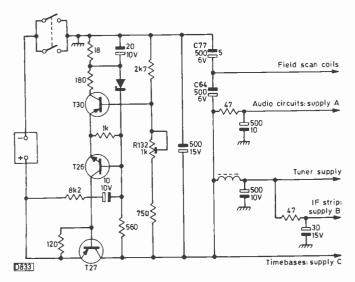


Fig. 2: Later three-transistor regulator circuit.

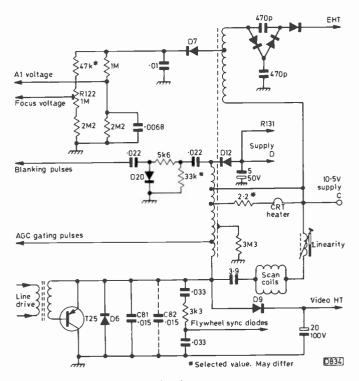
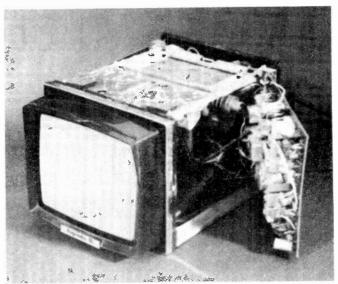


Fig. 3: Line output stage circuit.

types rather than overwork.

The field timebase is a bit unusual. The first stage T13 is an emitter-follower used to apply the negative-going field sync pulses to the emitter of T14. When they occur, T14 switches off and T15 switches on to discharge the field charging capacitor C57. This gives the flyback. During the scan, C57 charges via T14 and T16. Linearity feedback is applied to the emitter of T16. In the absence of field sync pulses T14 will switch off when the negative charge on the left-hand plate of C57 exceeds the fixed bias applied to the base. R78 acts as the hold control. The oscillator section is followed by a complementary-symmetry driver stage and a totem-pole output stage. AC188s with heatsinks can be used in the output stage. I found that field sync was weak due to T13 being open-circuit base-to-collector: fitting a BC212 in this position gave marvellous locking.

Out of curiosity I tried a BC107 in the sync separator position (T21). It worked quite successfully. The sync separator feeds T13 in the field timebase, via a double



The Rigonda VL100M with cabinet shell removed.

integrating network, and the phase-splitter transistor T22 in the flywheel line sync circuit. A BC212 was tried in the line oscillator position (T23) but it was necessary to reduce the value of R108 to restore the correct frequency. The line driver is T24.

Faults and Servicing

Whilst soak testing the rebuilt set a sound fault put in an appearance – there was intermittent volume variation, crackle and sometimes excessive intercarrier buzz. Probing and voltage checks were unhelpful, but a replacement AF117 in the T8 position put an end to the trouble. It seems that the transistors used in the intercarrier sound channel are prone to be noisy.

Several hours elapsed before the set eventually went dead, with a puff of smoke from the power unit. R156 was the source of the smoke and C93 was found to be short-circuit. Replacing these components restored normal operation.

Since the panels hinge outwards for service, sudden loss of sound, vision or odd effects should direct attention first to the wire connections, which have a habit of fracturing close to the board.

The earphone jack socket was not present in the sets I had, though one was used as the aerial connector. Removing this and drilling a larger hole enabled me to use a

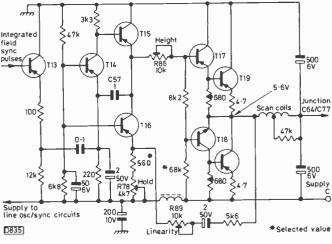


Fig. 4: Field timebase circuit.

next month in

TELEVISION

BUMPER ISSUE

The May *Television* will be another of our larger, 68-page issues.

TV PATTERN GENERATOR

Now that off-air BBC and IBA test card transmissions are so infrequent, service engineers are having to rely increasingly on test pattern generators. Our latest design features a circle, crosshatch, grey scale, frequency gratings, colour bars, border and patterns for I.f. response and chroma delay checks etc. Most of the patterns are held in an EPROM. TTL, composite video and u.h.f. outputs are provided and construction is on PCBs.

OPROBLEMS WITH OLDER VCRs

Various things happen to a VCR as it gets older — basically wear of one sort or another begins to cause problems. Many dealers and rental concerns simply suggest a new machine, but with a bit of insight much can be done to get a worthwhile second lease of life from a VCR. Nick Lyons describes test and repair procedures.

• CLASSIFICATION OF OSCILLATORS

Oscillators are fundamental to electronics but come in a bewildering variety of forms. Despite the profusion of circuit techniques, examination of the principles of operation shows that there are only three basic types of oscillator, employing positive feedback, negative resistance, or the selective amplification of noise.

• SERVICING FEATURES

More fault reports in VCR Clinic and TV Fault Finding, plus Service Briefs – notes on recent Thorn and ITT chassis.

• THE MYSTERIOUS MULLARD

Vintage TV this time takes a look at one of the earliest Mullard sets – the single-channel, 9in. Model MTS389. One odd feature was the strange selection of valves used in the set.

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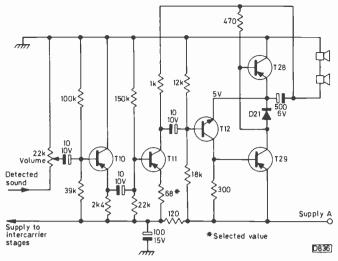


Fig. 5: The audio circuit.

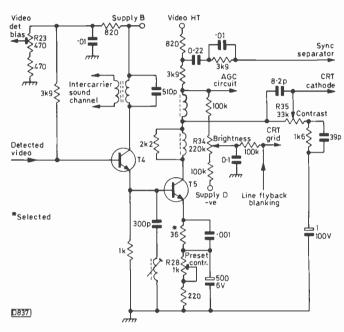


Fig. 6: Video driver and output stages.

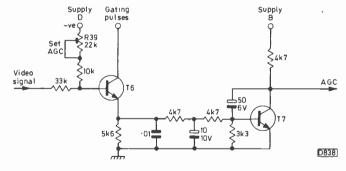


Fig. 7: A.G.C. circuit.

chassis-mounting coaxial socket – some difficulty was experienced as the tuner connections tended to foul this when the panel was hinged down. No isolation components are required.

Spare parts are available from Rigonda Supplies, 332 Cann Hall Road, London E11. Send a s.a.e. with enquiries.

These are quite nice little sets, soundly built and probably better than some small screen portables from other parts of the globe.

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Wideband UHF Preamplifier

Roger Bunney

For minimal displayed noise (snow) on the screen, a preamplifier for use with weak signals should have the lowest possible noise figure, lower than that of the tuner's first r.f. amplifier stage. The ubiquitous OM335 hybrid preamplifier is not good enough in this respect: despite its high gain, typically 27dB, the noise figure of 6dB is somewhat above that of a u.h.f. tuner's first stage. It's a sad fact that many enthusiasts go for an amplifier with a high gain figure without considering the noise level: a 20dB gain with 5dB noise will produce degraded performance compared to a gain of 10dB with a 2dB noise figure.

The unit described in the present article was constructed for indoor use as a first-stage amplifier. It has linear operation across the u.h.f. bands, freedom from overload or instability, a lowish gain (typically 11.5dB) and a low noise figure (typically 2dB). If the amplifier is used following a mast-head amplifier there will be little improvement in weak signal performance since the system noise figure will have been set up the mast. It's vital that the first stage of electronic amplification contributes as little noise as possible.

Fig. 1 shows the circuit, which uses a BFR91 low-noise wideband amplifier transistor capable of operating at over 1GHz. With a collector current of 3mA, the noise figure at 500MHz is 1.8dB. Between 2-5mA the noise figure is under 2dB. The circuit is arranged so that Tr1 passes 4.5mA at 9V. Tr1's collector load consists of the u.h.f. choke L2 and the series damping resistor R3, the ratio of the turns to the value of R3 giving a slight lift towards the top of Band V. The value of R3 could be reduced to say 68Ω or 82Ω to flatten the response. Using an extra turn for

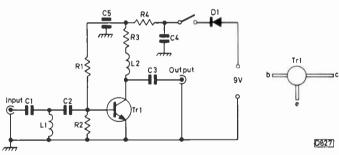


Fig. 1: Circuit diagram.

	Compone	nt details	6	
C1, C2 C3	4·7pF 5-6pF	L1, L2	2¼ turns,	
C4	0·001μF	Tr1	BFR91	
All 63V ceramic plate		Available from Ambit		
C5	$0.001 \mu F$	D1	BA148 etc.	
feedthrough		Box RS5	09-923.	
R1	10k	Coaxial sockets		
R2	1⊬5k	RS455-539, surface		
R3	120	mounting		
All W, 1	0% low-noise	Submini	ature SPST	
carbon f		switch		
R4	220, } W			

L2 will move the peak in the response to group A or B. The winding is made from one of R3's leadout wires. D1 provides reverse polarity protection.

Construction

The smallest RS diecast box (35mm wide) was used, with the amplifier built across it on a small piece of copper-clad laminate held by the coaxial socket mounting bolts via 6BA tags soldered to the copper side. Use short lead lengths following normal u.h.f. practice. Since a 9V battery cannot be accommodated within the box, 2mm sockets are fitted for the supply.

Performance

I've found the design to be repeatable – the amplifier was originally conceived as part of a forthcoming DX-TV project. No alignment is required and the amplifier should work on completion.

For DX reception I use the ET021 series tuner, whose MOSFET amplifier has a very low noise performance. Because of this, many preamplifiers provide no improvement. With the present design however recognisable pictures are obtained with inputs as low as simply line syncs (P½ to P1½-2 on the ATV scale). There's complete stability across the spectrum with or without input termination. At 9V the noise figure is typically 2dB and the gain is as follows: 11.5dB at 470MHz; 11.5dB at 500MHz; 11.2dB at 600MHz; 11.6dB at 700MHz; 13.8dB at 800MHz; 13dB at 860MHz. The unit will work happily at up to 12V, but don't exceed this voltage.

Use of a tuned collector circuit, i.e. two turns tuned with a 2-10pF trimmer and with R3 deleted (and the value of R4 increased to compensate) would increase the gain and reduce the bandwidth. For increased wideband gain, C3 could be taken to the base of a second BFR91 transistor.

The amplifier is particularly useful where a nearby highpowered transmitter makes the use of a mast-head amplifier impractical.

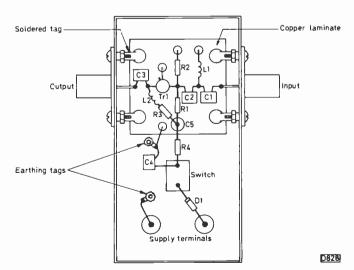


Fig. 2: Constructional details.

TELEVISION APRIL 1984 303

Teletopics

SATELLITE PROSPECTS

Douglas Hurd, the Home Office minister responsible for broadcasting, is on record as saying that the government would like to see a UK satellite TV service using a UK satellite. Wouldn't we all? But progress towards this aim seems to be painfully slow following the collapse of the BBC's plans to start a service in 1986. The tripartite working party set up to investigate the possibility of a cooperative DBS project, with representatives from the BBC, the IBA and the Independent Television Companies Association, has completed its initial investigation and has reported back to Jeffrey Sterling, the chairman of P & O and special adviser to industry secretary Norman Tebbit. Having identified the main problems, the working party has now set to work on a suggested plan of action.

Unfortunately, many of the problems are not of the sort that can be resolved quickly. There is in particular the problem of who should be authorised to spend money from which sources on setting up a DBS service? This is compounded by the fact that the present ITV companies' franchises will come up for review within the time scale of the establishment of a DBS system. Do we, this time round, ignore the elaborate legal requirements that were laid down to ensure the accountability of ITV companies to the public? Or do we alter the franchise system, as is being suggested? Whatever the answer, legislative action will be required and will introduce delays. This is something that can't be got round, as the government's recent problems over cable prove (see below).

Another problem is the likely cost of satellite receiving equipment. An official estimate that an installation could cost some £500, implying a monthly rental of around £16, is considered to be beyond what the public would find acceptable. The BBC's chairman Stuart Young has suggested a £50 subsidy for each adaptor and tax incentives to TV rental companies to enable them to keep their charges down. Sir Clive Sinclair has made a characteristic contribution to this aspect of the subject in announcing that Sinclair expect to be able to provide DBS installations, including the dish, down-converter and descrambling electronics, at around £100. The broadcasting authorities have welcomed this prospect, though other manufacturers expressed doubts. One wonders whether the idea would be to offer such units as loss leaders initially until production built up? Apparently however Sir Clive's main interest is in producing high-definition sets for DBS reception at around £500 each.

Douglas Muggeridge, managing director of BBC External Broadcasting, has suggested that an international satellite TV service should be established, i.e. a TV version of the BBC's world radio service. The BBC has been conducting an enquiry into the prospects for an international TV news service. Anything of this sort would require government funding of course.

In Japan, Mitsubishi have announced a DBS receiver system for use with the BS2a satellite, which is due to start transmissions this May. The satellite's main purpose is to eliminate areas of poor reception, but it's also expected to signal the start of the DBS age in Japan. Of particular interest is the use of digital pulse code modulation for the

sound channels, giving high-quality sound similar to that obtained from the new compact audio discs. Mitsubishi's receiver system consists of a 75cm offset-type dish with low-noise converter and tuner. The use of Mitsubishi's dual-mode horn gives the aerial an aperture efficiency of over 70 per cent, which compares with 55-56 per cent for a conventional parabolic dish.

CABLE TV

The eleven cable operators who were awarded interim franchises last December have been told that due to legal problems firm licences will not be granted until late this summer, nine months later than originally planned. The government has discovered that it doesn't have the legal authority to issue licences until the Cable Television Bill and the Telecommunications Bill receive royal assent. Instead, the government has offered to issue letters of intent or provisional licences under the 1981 Telecommunications Act. The problem the operators have is in raising finance to start developing their systems, which is in turn delaying prospective start-up dates for the services. Michael Storey, managing director of Westminster Cable, commented that "it's not clear what has been achieved by the whole frenetic business of the interim franchises"

British Telecom has been awarded a contract to supply its Gamestar cable TV games service to Rediffusion's one million subscribers in the UK. A connection fee plus £9.95 a month rent for a Sinclair Spectrum microcomputer will be charged: twenty games a month will be provided, five being changed each month. A British Telecom spokesman commented "we expect to supply a growing number of interactive services as the cable industry expands."

BLUE TUBES

A reader recently sent us a cutting on the subject of tubes with light blue screens. Not that you would expect to find them in use in the UK. The idea is to use a phosphor system that filters out light in the yellow/green spectrum to give sharper contrast and improved brightness under brilliant lighting or sun-drenched viewing conditions. The rare earth element that gives the screen the blue appearance when the set is switched off is neodymium oxide. Sets fitted with these tubes are on sale in Japan and the USA.

AYR AGAIN

GEC-McMichael have acquired Ayr Viewdata, the manufacturer of teletext and Prestel adaptors that went into voluntary liquidation just over a year ago, and have resumed production of the former range at Ayr's West Byfleet, Surrey factory. Dealers interested in stocking these adaptors should contact GEC-McMichael Ltd. at Sefton Park, Bells Hill, Stoke Poges, Slough SL2 4HD.

VIDEO

Mitsubishi and Sanyo are both to double assembly of VCRs in the UK, from the present rate of 5,000 machines a month to 10,000. Sanyo has also announced plans to start production of VHS machines in Bavaria. Tatung and Binatone are expected to set up VCR assembly lines in the UK – Binatone is at present negotiating a licencing agreement with JVC. ITT's plans are to start production of VHS machines at their Bochum TV factory in W. Germany. The tape transport system will be imported but the electronics and control systems will be ITT designed, using some of ITT's digital TV electronics (Digivision).

Sharp is the latest firm to join the ranks of those who've announced their intention to introduce an 8mm camcorder later this year.

A new edition of the Ferguson "100 Questions and Answers on Video" has been published: 85,000 copies of the first edition were distributed. Copies can be obtained from the Ferguson Video Advisory Service, PO Box 121, Lea Valley Trading Estate, London N18 3BP. The new edition has been updated and revised to include the latest generation of video products.

New VCRs have been introduced by Mitsubishi, Hitachi and JVC. The Mitsubishi HS330 is a full-specification, two-speed machine with a suggested retail price of just under £700. Hitachi's VT33 front loader will replace the popular VT11 at a suggested price of around £450. JVC's new budget model HR110 is a non-remote control version of the HR120.

David Rozalla, managing director of Warner Home Video in the UK, has commented on the successes achieved against video piracy in the UK. He attributes this to the establishment of the Federation Against Copyright Theft in January 1983. Estimates suggest that piracy at present accounts for some 35 per cent of the UK market, down from a level of 65 per cent two years ago. Pirate cassettes with a street value of over £1m were seized in the UK last year. It seems that the pirates have moved to the continent, where they are said to be supplying some 70 per cent of the W. German, French and Benelux markets.

A somewhat contentious report on head wear with different brands of video tape has been released by 3M. The tests were not carried out under normal operating conditions, and the scale of the investigation was so small as to be statistically worthless. Measurements were made by comparing photomicrographs obtained using a scanning electron microscope before, during and after exposure of the sample head assemblies to the tape, the accuracy of the measurements being limited by the resolution of the photographs and the repeatability of the measuring operator. For what it's worth, Scotch, Maxell, Fuji and Memorex tapes all came out well.

The latest suggestion for entertaining bored pub-goers is the coin-operated video jukebox. The idea is that you get a three-minute film along with the music you select.

SONY'S MOVE

Sony (UK) have moved to a new head office in Staines, after fourteen years at Pyrene House Sunbury with offshoots at Slough and Andover. The new address is Sony (UK) Ltd., Sony House, South Street, Staines, Middx TW18 4PF (Staines 61688).

AVO'S LCR METER

An LCR meter, Model B183, has been added to the AVO range – it's very similar in appearance to the 2001 digital multimeter reviewed in these pages last February, being a hand-held, 9V battery-operated unit with LCD display. There are six inductance ranges from 2mH to 2H, seven capacitance ranges from 200pF to 200 μ F and seven resistances ranges from 20 Ω to 20M Ω . Measurements are made using a sinewave test signal at a frequency of 1kHz or 100Hz depending on the range selected by the eight-position slide switch. Price to the trade is £185 plus VAT.

TV EQUIPMENT

At an expected inclusive retail price of around £400, Fidelity's latest introduction, the AVS1600 audio/TV rack

system, should be a considerable success. The AVS1600 incorporates a 16in. colour set with remote control, eight preset channels, stereo sound capability and a spatial sound option to create a stereo effect through the separate, floor-standing speakers. It also incorporates a full monitor function for video and computer games sources via a 21-pin SCART socket, an anti-glare glass front and a headphone socket with volume control. The threewaveband tuner covers stereo f.m. plus MW and LW with synthetic stereo. The belt-driven record turntable glides in and out from behind an automatic flip-up inspection window at the touch of a button. Above this is the cassette recorder which can record from any of the other items including the TV set. The amplifier provides 8W r.m.s. output per channel (24W total music power) and can be used with all the other items including the TV set. Its features include dynamic noise reduction on all inputs, headphone and microphone sockets, and a comprehensive set of controls. The speakers are of the bass reflex type, with separate tweeters.

Ferguson and ITT have both introduced infra-red remote control versions of their 14in. colour sets. The Ferguson 37141 is fitted with the TX90 chassis and has voltage synthesis tuning with station memory.

The first Luxor models fitted with the new SX9 chassis (see article in our January issue) have now been released. These are the 22in. 5636 and the 26in. 6736.

FOCUS ADJUSTMENT

A new method of focus adjustment is being introduced at ITT's Basildon plant. It's based on the use of a meter to measure the light output from the tube phosophor in a way quite different from that employed by an ordinary photometer. A property of this measured light output has been found to coincide with optimum focus.

CRT REBUILDING EQUIPMENT

The Faircrest Engineering Ltd. range of c.r.t. rebuilding equipment is now being distributed by V.N. Barrett and Co., Ltd. of 1 Mayo Road, Croydon, Surrey CR0 2QP (01-684 9917). The company can supply all the equipment required for reprocessing both monochrome and colour tubes and in addition offers a full training scheme.

CCTV SYSTEM

Frowds Ltd. (4 Northarbour Road, Cosham, Portsmouth, Hants PO6 3TJ) have introduced a sophisticated CCTV surveillance system using a fully weatherproofed camera that can be fitted with various types of tube. The circuitry incorporates refinements to maintain performance over a wide range of lighting conditions, and an optional built-in telemetry system enables the camera to be remotely controlled via the coaxial cable at up to 1.7km.

PHILIPS-GRUNDIG

Further details of Philips' plan to take control of Grundig (see page 177, February) have been announced. The scheme is a complex one in which Philips, while achieving effective day-to-day control of Grundig, will actually end up with a smaller stake in the company – a reduction from 24.5 per cent to 22.9 per cent. Philips will first take over a further 7.1 per cent of Grundig's nominal capital, but at the same time a group of banks led by Dresdner Bank will take over a block of Grundig AG profit participation rights certificates which will later be converted into ordinary voting shares, leaving the banks with a 27.5 per

cent interest in Grundig. The aims of these moves seem to be to satisfy the W. German Federal Cartels Office, provide Grundig with fresh investment funds, and ensure that joint Philips-Grundig administration is achieved whilst maintaining Grundig's operational independence. A Philips' nominee is to become chairman of the Grundig board of management on the retirement of Dr. Max Grundig, who will be 75 on April 1st.

HDTV

A new volume, "Compatible Higher-Definition Television", has been published by the IBA as the twenty first in the series of occasional engineering texts that have been provided as a service to broadcast engineers and students since 1972. The profusely illustrated 48-page book reflects interest in the development of TV systems capable of

providing significantly higher quality colour pictures than are possible using any of the present broadcasting standards. In particular the argument is put forward that the MAC system proposed by the IBA and accepted by the government for satellite TV broadcasting is also capable of providing higher definition displays with a wider aspect ratio. The suggested E-MAC (extended-definition MAC) system would make optimum use of the information handling capacity of European satellite channels to give results at least comparable in quality with the HDTV system proposed and developed by NHK (Japan), without incurring the severe bandwidth and non-compatibility problems inherent with the NHK system.

Enquiries about the book should be sent to the IBA Engineering Information Service, Crawley Court, Winchester SO21 2QA.

VCR Clinic

Ferguson 3V36

A Ferguson 3V36 was sent in by a dealer from another dealer, with a vague account that there was a servo fault and that the dealer of the first part had apparently contacted Ferguson who had suggested replacing the servo board. The dealer of the second part didn't know whether this had been done. So it was up to us to play "spot the fault", a game most readers in service departments will have played when customers or sales staff can't be bothered to give any more comprehensive details than "faulty".

The first symptom encountered was a spotty picture not unlike that caused by a dirty video head, but with my luck it would turn out to be more complicated. Andy was optimistic however and got on with cleaning the heads (regular readers will note Andy's promotion to Head Cleaner). This, amidst cries of "told you so", did little good, so the replay f.m. signal was checked. Only one output was evident, and the drum flip-flop signal was only a single pulse instead of the usual symmetrical squarewave. Misadjustment of the drum PG pulse level control R459 was the cause of the incorrect waveform, and after setting up the drum and capstan servos normal record/playback functions were restored. Great, on with the covers.

That was when Andy decided to check the still frame performance. The tape stopped dead in its tracks with a very spotty picture, showing that the frame advance circuits were not operating to give a clear picture. If that wasn't bad enough, we couldn't get back into play. In fact we couldn't select anything or even switch the machine off to standby. The little red lights for stop, fast forward etc. followed the buttons, but the operate light stayed on. The only way to restore operation was to unplug the machine at the mains supply. It then worked normally until we selected pause, when it again locked out.

Measurement showed that the microcomputer IC201 was holding the capstan motor forward/reverse selector IC206 fully off. In a vain attempt to restore operation, I applied a full reset to the microcomputer chip by earthing pin 22. Surprise, surprise, everything then worked correctly, including the still picture circuit. So the noise bar and anti-bounce potentiometers could be set up, giving a very good still frame. Andy remarked that one of our own customers had had the same problem, and that unplugging

Reports from Steve Beeching, T.Eng. (C.E.I.), Derek Snelling and Mike Phelan

the machine for a while at the mains had cured it. I wonder if this is a problem? Great, on with the covers.

Andy then suggested trying picture search and the timer before the machine went out. It was unlikely that picture search would be faulty, as it would have shown up whilst we were doing other things, but we tried it. Clang. Off with the covers. Selecting picture search is simple. The picture then broke up into horizontal lines which got bigger until there were no lines at all, indicating that the heads were not whizzing round. The safety circuit then operated and the tape unthreaded.

Various checks were made, including connecting one of the inputs (pin 12) to the servo operational amplifier IC406 to earth when picture search was selected. This stopped the drum servo. We're getting somewhere! The circuit back to pin 6 of the main servo chip (IC403) was then followed through (see Fig. 1). During playback there's a squarewave here. It was still present in picture search, but the output from the integrator (R456 etc.) was absent. R456 had a voltage at the IC403 end, but not at the IC406 end. Something was earthing the servo output between IC403 and IC406, and that something was IC405. By isolating pins 10 and 11 of IC405 we found that when pin 12 went high pin 10 would be earthed by an internal fault within the i.c. So the chip was changed to a CD4016.

Great. Now I can put the covers on. At least the timer worked!

Mitsubishi HS700

Some Mitsubishi repairs this month. First a common fault with the HS700 portable. The symptoms are intermittent play with excessive rewind speed and possibly tape dam-

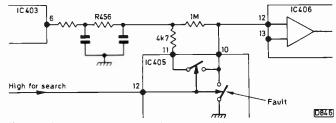


Fig. 1: Picture search fault, Ferguson 3V36.

age. This is caused by the small pinion wheel that drives the take-up spool. It's a push fit on the motor spindle, and has a tendency to come off slowly (see Fig. 2). Eventually the point is reached where it fails to mesh with the take-up spool. The result is intermittent play as the take-up spool stops rotating when the teeth slip. The drive from this motor is also used to provide back tension and some control of the other motor's rewind speed, so when there's failure to engage rewind becomes a bit frantic. The cure is to push the cog fully home and seal it in place with red paint.

Another common fault with Mitsubishi machines is intermittent failure to erase the previous sound recording. The cause is the plugs and sockets that connect the erase head to the bias oscillator: the official cure is to remove these and solder the wires directly to the full erase head and the board. We've had the fault about eight times in the last few weeks.

D.S.

Mitsubishi HS303

The problem with an HS303 was an intermittent clock. Every so often the clock display would blank out – if it reappeared it would be flashing, as though the power had been disconnected. Checks showed that all the power supply lines to the clock board were correct, but when we came to the clock chip the "init" pin was at 10.5V instead of 4.7V. This pin is fed from the 12V rail via the tantalum capacitor C8F2 – the idea is that the capacitor charges at switch on, supplying the chip with a reset pulse. The capacitor was found to have a varying leak – when the voltage at this pin was high enough the i.c. would be held in the reset condition, blanking out the display. A new capacitor put matters to right.

Ferguson 3V23

The tuner/timer board seems to be responsible for various obscure faults in this model. In a recent case the machine did everything except rewind and fast forward - it wouldn't even acknowledge these commands. We connected an oscilloscope to pin 16 of the serial-to-parallel converter IC38 to check whether the serial code was arriving from the keyboard. It was. The 8-bit parallel outputs were also correct, i.e. in accordance with the truth table. These go via inverters in IC33 to the data selector i.c.s, so checks were carried out in this area. We found that bit D3 was permanently low after IC33 – it should be high in the rewind and fast forward modes. Five of the bits, which carry remote tuner/timer commands, go to the tuner/timer board as well as to the data selector i.c.s. The next logical step therefore was to disconnect this board by pulling out the interconnecting plug. Magic - we now had rewind and fast forward. The fault on the tuner/timer board was a short-circuit in one of the TA57 transistor array i.c.s. M.P.

Ferguson 3V35/3V36

We've had a few faulty Ferguson 3V35/36s recently. In the first one the cassette couldn't be ejected. After studying the operation it became apparent that the flap on the front of the machine wasn't opening to let the cassette out, though the eject mechanism was doing its best to push the cassette through, flap or no flap. We eventually discovered that the cog which operates the flap had tripped out of mesh. This apparently happens on these

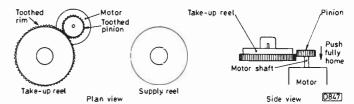


Fig. 2: Pinion wheel trouble with the Mitsubishi HS700.

machines for no apparent reason, and the cog has been modified in production to prevent the fault.

Unfortunately in its efforts to eject the tape the machine had, unknown to us, bent the loading switches. This had no immediate effect, but a couple of weeks later a call came that the machine "switched off on prerecorded tapes". Sure enough it worked perfectly on my cassette and all the customer's cassettes, but switched off after a few seconds when a prerecorded tape from the local library was inserted. This cassette couldn't be blamed since it apparently worked on a neighbour's machine – and they'd had the same trouble with another cassette from the library.

On removing the top of the machine I found that the take-up spool wouldn't rotate with the prerecorded cassette in position, hence the switch off. This in turn was because the cassette wasn't going down the last quarter of an inch – it fouled the loading switches that had been bent by the previous fault. Why this cassette and not the others? The cassette was found to be about a millimetre longer, front to back, than the others – it was of the type where the flap is a different colour from the rest of the cassette.

The next machine was a 3V35 with a noisy take-up clutch. Replacement cured this – it appears to be of the same type as that used in the 3V29/30.

Finally, if someone attempts to insert a cassette in one of these machines when it's switched off (at the operate button) and uses sufficient force a small plastic pip can be broken off. We've had only one instance of this so far, but the problem is sufficiently common for Ferguson to have modified these machines in production – more than twice the force is now required to cause damage. One hopes that users will check that the machine is switched on before this point is reached.

D.S.

Ferguson 3V29

The colour was good with playback of a prerecorded tape, but on its own recordings the chroma was very noisy and broke up into horizontal lines. A check on the signal at the input to the colour converter (pin 16 of IC401) showed that it was of excessive amplitude. Clearly the preceding a.c.c. stage (between pins 1 and 17) was operating at maximum gain. A check at pin 3 then revealed that there were no burst gate pulses, and on moving back we found that L407 in the ringing circuit was open-circuit. M.P.

Ferguson 3V29

This machine had really fast search – in fact it was faster than the rewind speed. The supply to the reel motor goes via Q2, which is in turn controlled by Q16. This transistor receives commands at its base via diodes D15/16/17. Both transistors were being turned on hard – in fact the voltage at the base and emitter of Q16 was about 15V. The diodes were tested first but proved to be o.k. That left Q16 which was found to have a $1k\Omega$ leak from collector to emitter.

All About Field Strength

Harold Peters

The set produced a snowy picture, the old Labgear field-strength meter read the incoming signal as $700\mu\text{V}$ and the BBC's field-strength map showed us to be on the 60dB $\mu\text{V/m}$ contour. In the workshop the signal generator had to be set at 1.5mV to produce the same effect. Was it a poor signal, a dud tuner or both? Nothing seemed to tie up, or didn't until we chanced upon the BBC Engineering Information Department's sheet 2017, "Good TV reception, the professional way", which cleared up a lot of misconceptions for us. The following article is based on information given in this sheet.

What to Expect from the TV Set

To produce a good picture, today's colour set needs a clean input signal in excess of 1mV but not above 5mV. Below 1mV, snow begins to appear and gets progressively worse. Above 5mV, intermodulation between the sound and vision signals and adjacent channel signals produces patterning.

A plot of the signal-to-noise performance of typical receivers is shown in Fig. 1. The curves are the average taken from several samples. For a noise free picture, a ratio of 40dB at the standard viewing distance (four times picture height) is expected. Since most people view at a greater distance than this, they will find a signal-to-noise ratio of 36dB perfectly acceptable.

You will notice that the older type of set that uses a diode vision detector is less noisy than the current genera-

tion of TV sets that use synchronous detectors. Notice also that colour noise appears earlier than luminance noise. This is due to the double superhet effect with the chroma signal – the 4.43MHz chroma demodulators beat with the higher frequency component of the incoming signal, converting this to a more visible and annoying lower frequency. This h.f. noise is not visible in the luminance signal as it's removed by the 4.43MHz subcarrier trap. The chroma noise problem is worsened by the fact that only a small proportion of the total transmitter power is used for the chroma signal. You are in fact watching a very low power transmission radiated from the same mast as the luminance signal.

Some useful key points are shown in Fig. 1. Teletext errors begin to show at $150\mu V$, the colour drops out at 35- $50\mu V$, and sync is lost at $10-15\mu V$. Faults apart, the only adjustment that materially affects performance is the a.g.c. crossover control. This sets the signal level at which a.g.c. is applied to the r.f. amplifier stage in the tuner. Most of a set's self-generated noise is produced in the tuner's mixer stage, so to minimise this the r.f. amplifier is run at full gain until the crossover point at 1mV is reached. As the input signal rises above 1mV, the r.f. gain must be held in check by the a.g.c. circuit in order to prevent mixing taking place as well as amplification. Most r.f. stages overload and start to intermodulate (mix) at about 30mV, but what is not always appreciated is that this is the sum of all the signals received, the r.f. stage being wideband tuned. In the average receiver situation, this means the presence

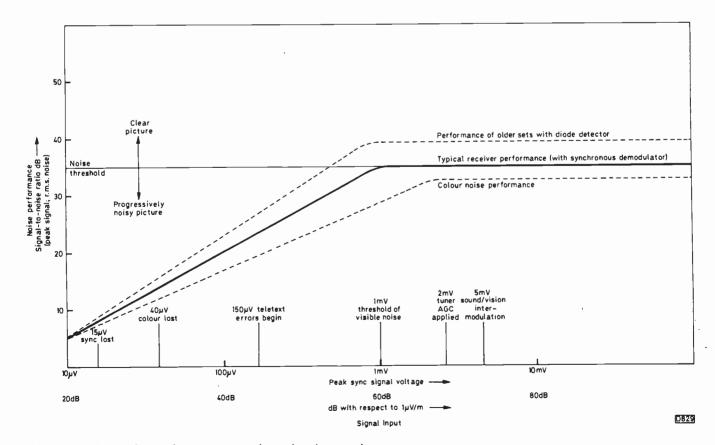


Fig. 1: Receiver noise performance at various signal strengths.

of four programmes with vision and sound: 30mV is the sum of four 5mV vision signals and four 2mV sound signals, so overloading will take place at some 5mV of wanted signal. The more signals there are, the earlier the a.g.c. crossover has to be set. With the advent of VCRs and TV games units, the ideal setting is coming to be around 2mV. But 2mV of what?

Measuring the Signal

Today's average colour set has as many as seven automatic control circuits whose action depends on some part of the composite vision signal, so there's little point in applying a known amount of plain r.f. signal from the generator. The answer you'll get will not be the same as that shown by the picture. During the line sync period however the transmitter is radiating at full power regardless of the scene (see Fig. 2). This is the reference point to which all signal levels are referred: thus the 1mV (etc.) we've been quoting is "the r.m.s. value of the sync tips of a composite vision signal appearing across a terminated load". In our case the terminating load, i.e. the TV set, presents an impedance of 75 Ω .

Signal generators, even if you can modulate them with a video signal, are misleading because their output is calibrated in e.m.f. – the voltage that appears across the unterminated (open-circuit) output terminals. To get this output into the set you have to connect a coaxial lead and then connect the set as the termination, so the true output drops to half (-6dB) of what is shown by the output indicator, i.e. for the set to receive 1mV of signal the generator needs to be set at 2mV (see Fig. 3). The Philips series of pattern generators adopts a more realistic approach: their attenuators, though a little vague, do indicate the signal level appearing at the set.

Field Strength

Having dealt with workshop signals, we'll consider the situation outside.

Broadcasters have a totally different approach to signal levels. Their interest is in ensuring that there is an adequate level of signal available at your location. This open-circuit field strength is measured in microvolts per metre (μ V/m) of free space – in other words the amount of signal picked up by a one metre long rod suspended in the signal path. It takes no account of the tuning effect of the rod, so some conversion is needed.

The BBC practice is to make measurements using a logperiodic aerial, whose response is substantially flat, mounted on top of a 10m pole, i.e. at the chimney level of an average house. The measurement is made using an accurate millivoltmeter, and all known errors are corrected. The boundary of a primary service area is the $60dB\mu V/m$ contour on the map, i.e. 60dB above $1\mu V/m$, or 1mV/m to us (see Table 1). As propagation varies

Table 1: Basic dB μ V/m to voltage conversion.

dB μ V/m	Voltage	Voltage dB μ V/m			
20	10μV	70	3·2mV		
30	32μV	74	5mV		
40	100μV	80	10mV		
48	250μV	88	25mV		
54	500μV	90	32mV		
60	1mV	94	50mV		
68	2·5mV	100	100mV		

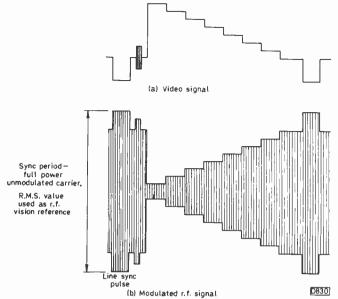


Fig. 2: The sync pulse is the reference point to which all signal levels are referred. Note that 1mV r.m.s. = 2.83mV peak-to-peak seen on an oscilloscope.

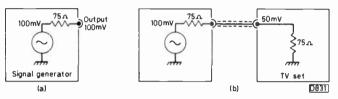


Fig. 3: Signal generators usually indicate their output as an e.m.f. at a certain impedance, as shown at (a). In use, the generator will be terminated by the TV set. The e.m.f. then becomes a voltage of half the value (-6dB) stated on the generator.

throughout Bands IV and V, there is a variation from 58dB μ V/m on ch. 21 to 64dB μ V/m on ch. 68.

Relating Field and Signal Strengths

Field strength is related to signal strength by the factor λ/π , where λ is the wavelength. On average this works out as follows:

0.2 (-14dB) in Band IV (aerial group A);

0.15 (-16dB) at the lower end of Band V (aerial group B);

0.12 (-18dB) at the upper end of Band V (aerial group C/D).



The Manor Supplies signal strength meter.

To this has to be added the aerial's gain, which is typically 11dB for a standard Yagi array. We then have to subtract the downlead loss (10m of low-loss cable introduces a loss of -3dB) and another 6dB since the field strength is an open-circuit e.m.f. while signal strength is the voltage at the set.

The following two examples will make this conversion business clear. You'll then be able to use the BBC table (see Table 2) with ease.

(1) A London BBC-2 signal at a standard installation. Field strength 3mV/m.

$3\text{mV/m} = 70\text{dB} \mu\text{V/m}$, i.e. 70dB above	
$1\mu V/m$.	+70dB
Receiving aerial gain (standard Yagi)	+11dB
Downlead loss (10m cable)	-3dB
Conversion factor 0.2 (ch. 33)	-14dB
Less 6dB for set termination	-6dB
	58dB

i.e. 58dB above $1\mu V/m$, or $790\mu V$ input at the set.

(2) A weak Channel 4 signal in Norfolk. Field strength $500\mu\text{V/m}$.

$500\mu\text{V/m} = 54\text{dB }\mu\text{V/m}$	+54dB
Fringe Yagi array	+17dB
Downlead loss	-3dB
Conversion factor 0.12 (ch. 65)	-18dB
Less 6dB for set termination	-6dB
	44dB

i.e. 44dB above $1\mu V$ or some $200\mu V$ at the set.

Satellite TV

The same principles apply to satellite signals, but the quantities are different. Since the incoming signal is collected by a dish, which has area rather than length, square metres replace metres. And because the transfer of the signal from the dish to the set doesn't suppose the use of 75Ω coaxial cable, watts are used instead of volts. The term field strength is replaced by P.F.D., or power flux density, and the dB ratios are $10 \times \log P1/P2$ instead of $20 \times \log V1/V2$ as before. P.F.D. is thus expressed in dB W/m².

Think of the signal collected by a perfect dish of area 1m² (1 12m diameter) and you'll see how convenient it is to stick to the chosen units. You'll want to be able to relate these s.h.f. signals to the u.h.f. ones with which you're familiar, and once more a worked example will make this clear.

The Russian Gorizont 7 satellite, which took over recently from Gorizont 4, has a P.F.D. in this country of about -120dB W/m², in other words one picowatt per square metre. Not a lot! Now watts = V²/R (or Z), and Z, the transfer impedance of a dish, is given as 377Ω (120π) per m² of free space. So we have $1\text{pW} = \text{V}^2/377$. Crossmultiply, V = $\sqrt{(377 \times 10^{-12})}$ or $19.4\mu\text{V/m}^2$ which looks a lot better!

Similarly the OTS signal P.F.D. of $-118 dB \ W/m^2$ works out at $24.4 \mu V/m^2$ and the projected BBC/ITV DBS signal P.F.D. of $-103 dB \ W/m^2$ works out at $137.5 \mu V/m^2$.

EIRP

Satellite signal strengths are often given in terms of E.I.R.P. (effective isotropic radiated power), in other words how many watts beamed our way leave the satellite.

To relate E.I.R.P. to P.F.D. you have to subtract the path loss, which is proportional to the square of the distance between yourself and the satellite, plus 0.5dB for losses on route (more if it's raining hard). So the lower the satellite is to the horizon, the greater the path loss.

Noise

Noise performance is even more important with satellite TV than it is at u.h.f. Everything in the chain contributes to it – even the dish, which picks up noise from the ground and from outer space to pass on to the set. For satellite purposes, noise figures are given in degrees Kelvin. Zero °K is absolute zero, and the reference temperature of 290°K corresponds to a room temperature of 17°C.

To convert noise in °K to dB, the following formula is used:

$$dB = 10 \log (^{\circ}K/290 + 1).$$

From this, 1dB corresponds to 75°K and 3dB to 290°K. Noise figures, if given in dB, would give a very optimistic indication of performance. Hence the use of °K.

Because of the use of f.m. for satellite video transmission, the signal-to-noise ratio required is much lower than for our a.m. u.h.f. signals. For results comparable to the 36dB previously quoted, a satellite signal need have only a 10dB carrier-to-noise ratio. Pictures are in fact quite watchable down to a ratio of 6dB, when colour is lost. What counts, as with f.m. stereo radio, is the noise threshold. This is the level above which no further improvement can be seen or heard. Also the fact that f.m. noise is triangular, i.e. worse at the higher frequencies (which accounts for the hiss going when you switch the radio from stereo to mono).

With f.m. TV, up to 3dB improvement can be obtained by reducing the receiver's bandwidth from 30MHz to 15MHz at the expense of some loss of definition and the appearance of "sparklies" on transients, an effect with which video engineers will be familiar.

So with an expected DBS receiver gain of around 110dB and a predicted BBC/ITV satellite signal strength of −103dB W/m², it looks as if there will be some 7dB to play with. Allowing for an aerial efficiency of about 55 per cent., most of us should get by with an 0.6m diameter dish. The moral seems to be to save your old dustbin lids – they might come in useful.

Measuring Signal Strength

When it comes to readily available equipment for measuring signal strength we come into a grey area, a need crying out to be filled. Most aerial riggers known to the writer treasure their ten year old Labgear meters like gold. The broadcasters' gear is well beyond our reach and is totally uneconomic unless used full time.

On the face of it all you have to do is to calibrate the a.g.c. voltage of a standard i.f. strip and you'll get an indication proportional to the incoming signal strength. Not so. The average i.f. strip takes about half an hour to settle down, during which time any meter linked to the a.g.c. line will show a gain reduction of as much as 6dB. This can be tolerated in the workshop if the warm-up time occurs before work starts, but a better tool is the writer's panoramic monitor (see *Television*, November 1971) which shows the instant state of all four vision and sound carriers in the local group simultaneously.

The Siemens S43202MC signal strength meter has the right idea, at around £1,500. It has a small oscilloscope

Table 2: Terminated signal voltages in known signal fields.

Field strength in dB referred to 1μ V/m. Signal strengths are terminated voltages assuming a downlead length of approximately 10m, taking account of the λ/π field strength/signal strength conversion factor.

Aerial		Field strength/signal strength conversion						
	Gain dB	65dB	70dB	75dB	80dB	85dB	90dB	95dB
Group A		Î						
Log-periodic	8.5	330μV	590μV	1mV	1.9mV	3·3mV	5.9mV	10mV
Standard Yagi	11	440µV	790س√	1.4miV	2.5mV	4.4mV	7.9mV	14mV
High-gain Yagi	15	700س√	1.2mV	2·2mV	3.9mV	7mV	12mV	22mV
Fringe Yagi	17	880 µV	1.5mV	2.8mV	4.9mV	8-8mV	15mV	28mV
Group B		1 '	1					
Log-periodic	8.5	250μV	440μV	780μV	1.4mV	2·5mV	4·4mV	7.8mV
Standard Yagi	11	350µV	630μV	1.2mV	2mV	3.5mV	6⋅3mV	11mV
High-grain Yagi	15	550μV	980μV	1.75mV	3·1mV	5.5mV	9.8mV	17.5mV
Fringe Yagi	17	690μV	1.2mV	2·1mV	3.9mV	6⋅9mV	12mV	22mV
Group C/D		1		1				
Log-periodic	8.5	200μV	350μV	630µV	1·1mV	2mV	3·5mV	6-3mV
Standard Yagi	11	280μV	500μV	890µV	1.6mV	2⋅8mV	5mV	8-9mV
High-gain Yagi	15	440μV	√µ790 ل	1.4mV	2.5mV	4.5mV	7⋅9mV	14mV
Fringe Yagi	17	560μV	1mV	1.8mV	3-1mV	5⋅6mV	10-mV	17mV

tube to display the detected vision or sound signal, with a gap in the display in which a vertical bar can be moved up and down by adjusting an attenuator calibrated directly in dB above $1\mu V$. When the test set is on tune, the bar is at its maximum, and is then set to lay alongside the sync tips with the attenuator. The cursor then gives the terminated signal strength into the set in accordance with the definition we gave earlier. The electronics consist of a high quality tuner/i.f. strip, to which a.g.c. is applied, and a stable oscillator whose output is fed via a variable attenuator and displayed in the gap. Thus drift in the i.f. strip doesn't affect the calibration.

At the other end of the scale, an inexpensive kit is marketed by Manor Supplies. This consists of an a.g.c. indicator with a conventional i.f. strip. The meter reads from $100\mu V$ minimum to 10mV maximum on a logarithmic scale. An LED provides indication that a vision carrier is present – it lights up in the presence of field sync pulses, which are detected by a TBA550 i.c. Tuner a.g.c. is applied at over 10mV for overload protection. There's also the Unaohm EP730FM field strength meter which provides a c.r.t. panoramic display. Its cost is around £640 plus VAT. A test report by Eugene Trundle will appear in these pages shortly.

If you don't need a field strength meter, what other methods are available to enable you to calibrate a reciever or test set? As mentioned before, there is the Philips series of pattern generators - never spot on, but never far out. If you can get to meet any of the broadcasters' field strength measuring teams, they will usually be able to pinpoint a place close by where they've measured the field strength with precision. Alternatively you can check a batch of new receivers whose a.g.c. crossover point is given in the manual. Connect a meter to the tuner's a.g.c. line, check that the manual specifies a crossover at say 2mV of input signal, then feed the output from a signal generator to the aerial socket, increasing the input until the meter connected to the a.g.c. line just begins to record a measurement. That's the crossover point, and implies that you are feeding 2mV to the set. Take the average of as many sets as you can - factory people are always in a hurry, and this is a touchy adjustment to make.

It should seldom be necessary to those other than aerial

riggers to know the signal level. Your main interest lies in checking that with $800\mu V$ applied at the aerial input a 34dB signal-to-noise ratio (or a just snow free picture) is obtained on the c.r.t. The cheapest way of doing this is with a pattern generator of known output and a suitable Belling-Lee attenuator in series. There remains the need for something rugged for aerial riggers – and in due course a simple way of checking the 12GHz output just behind an 0.6 or 0.9m dish.



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Sensing out Faults

Tony Thompson

Just in case anyone's forgotten, our five senses are sight, hearing, taste, smell and touch. We use the first two constantly without giving them a second thought. As for taste, I can think of no occasion when I've licked a set into submission! It's a different matter with touch and smell however. The heated casing of a tripler, for example the Thorn 9000 type, will tell the tale to the fingertips of an engineer: as for the smell, that's an experience in itself – a really bad one will make your eyes water. This is not a very subtle piece of smell diagnosis, but with practice you'll find that you can sniff out too warm carbon and wirewound resistors, and sometimes leaky capacitors. Other wirewound components make their distress known as the varnished wire heats.

This sort of thing can save time in comparison with the testmeter before all else approach to servicing, enabling us at least to locate the area of the fault before delving in too deeply. In other cases our senses can provide confirmation, where our instruments and intellect already suggest to us the location of the fault.

Most experienced engineers do this sort of thing automatically. But to think about it can sharpen our minds and make the approach more useful. For the less experienced, attention to the signals our senses provide gives an insight into fault conditions rarely obtainable from technical college instruction.

Sense of Touch

The sense of touch is a great asset in TV servicing, but before I go any further a word of warning to the less experienced. Don't stick your fingers into a dead set without disconnecting it from the mains supply by removing the plug, and remember that an open-circuit dropper or h.t. wirewound resistor can leave smoothing and reservoir electrolytics fully charged, lying in wait for your finger. If in doubt, discharge the points you're likely to touch, using a resistor of say $1\,\mathrm{k}\Omega$ to chassis. It's not a good idea to bridge across with a screwdriver – amongst other things, the electolytic won't like the spark you'll make.

With these words of warning in mind, let's suppose you are confronted with a dead set. The fuses seem o.k., so you disconnect, discharge as necessary, and feel along the dropper sections or wirewounds with your fingers. If current has been flowing, you'll sense the warmth. If there's been excessive current, you'll burn yourself – so tap lightly. Where a dropper is known to be a continuous winding but one section is cold while the next along is warm, you've got your culprit. In cases where the dropper has split windings and one set seems normal whilst another is cold, at least you've a clue where to start. It won't pinpoint the fault to a defective dropper section, but will tell you that for reasons yet to be determined there's lack of h.t. or l.t. here. The fact that droppers are often responsible for the dead set condition is something to bear in mind.

Still on the subject of power supplies, a bridge rectifier with common encapsulation should not feel more than warm. One that's hot after the set has been on for only a short time is likely to have a short-circuit diode. Single h.t.

rectifier or heater chain dropper diodes should also take time to warm up and should never attain a temperature that's uncomfortable to touch.

Imagine a potential divider network where the junction between the two resistors reads either very low or zero voltage. If a resistance check is inconclusive you may go on to unsolder components, including transistors, to remove parallel paths. There is no way round this unsoldering, though it should be limited to as few items as possible in order to save time and to avoid damaging delicate print and components. Before you attack with the soldering iron however, lick your fingertip and touch the upper resistor. In power circuits even a carbon resistor should be slightly warm if it's conductive, though the test is inconclusive in itself.

A wirewound resistor that's passing current will be just warm. A too-warm resistor of either type tells you that there's a leak at the junction, especially if the bottom one is cold. In this event it's profitable to disconnect bypass electrolytics for resistance checks or to suspect the valve or transistor being fed. A cold upper resistor on the other hand could well be open-circuit, or maybe of greatly increased value.

This example of the potential divider is just one of a number of checks that can be quickly carried out by hand, and I readily admit that diagnosis of this sort is likely to contain a goodly sprinkling of very likelies, probablies and possiblies. This doesn't detract from the usefulness of the exercise however. The chief benefit lies in saving time, enabling you to get to the source of the trouble before seeking additional information. There are also some instances where sensing methods reign supreme.

Line Output Stage Checks

Triplers have already been mentioned, but there's more to add on this subject. A tripler should run cool: a hot spot, especially localised on the casing, is a sign of trouble. A warm spot on the other hand cannot definitely be regarded as showing up a fault. This is a grey area where experience must be your guide. There are several variables such as the design of the tripler, its location within the set and the time it takes to warm up. It's fair to say that a tripler which heats up in a few minutes at most is likely to be faulty. Remember that, though rare, an internally shorting c.r.t. can result in a heavy current flowing via the tripler, giving the quick-heat symptom.

The best check is to disconnect the c.r.t.'s final anode connector, drape it carefully away from sensitive areas and the chassis, then run the set. This avoids placing a strain on the line output transformer etc. A neon tester held near the connector (don't touch!) will light up if there's an a.c. field present, confirming the tripler's demise. Keep the tester away from the line output transformer's field or you'll get a false reading.

The line output transformer is another touch-sensitive component. Take the no e.h.t. condition. If the line output stage uses valves, you'll have already ascertained whether they are being driven by making top cap spark checks and perhaps by switching off and touching the valve envelopes.

Where the line output valve and the boost diode are both cool, a finger check on the line output valve's screen grid feed resistor is a good test – it's likely that the stage is not being supplied with h.t. if all these items are cool.

If the valves etc. feel more or less o.k., try touching the transformer. I repeat – disconnect the set before doing any of this. If the transformer is cool, it's likely to be all right. Note the word cool, not cold: transformers vary, as do their operating conditions, but a warm transformer, especially one that warms up rapidly, is a bad sign.

This test works the same with transistor line output stages – touch the output transistor, which should be warm but definitely not hot. A very hot one suggests an internal short-circuit. In cases where all three major items in the line output stage – transistor, transformer and tripler – are overheating, the most likely cause of the trouble is the tripler, since a short-circuit transistor or shorting transformer will place no strain on the tripler (there are occasions when a faulty transistor will upset the transformer). When in doubt, it's always worth disconnecting the tripler at its input from the transformer: an internal fault can cause excess current in the stage even when the tripler's e.h.t. output is to all intents and purposes disconnected – triplers usually feed networks that remain in circuit when the c.r.t.'s final anode is disconnected.

What Valves Can Tell Us

There are some other useful points to remember about valves. We can always "test" a valve of the output type for evidence of stress: the sight of a dull, spreading redness on the anode structure is the telltale sign here. In such cases it's prudent to look before you touch, to prevent sore fingertips. Such problems are often apparent even before the set's back has been removed, as the overheating valve will singe the dust on its envelope.

Video output valves run hot or very hot. If cool they are either at fault or not receiving an anode or screen grid supply, or just possibly the cathode circuit is open. This also applies to colour-difference output valves, though these should run warm. A cool one gives the clue.

Valves used for other functions, i.e. in the i.f. stages and as oscillators, don't lend themselves so easily to this kind of testing, the results at best being inconclusive.

Remember that valves are active devices of an inherently fragile nature, and are thus the most likely cause where a fault occurs, particularly in a hard working output stage. Modern valves don't seem to be as reliable as those in days gone by.

Transistor Video Output Stages

With transistor RGB output stages, fingertip checks on the heatsinks or, where possible and perhaps more accurately, on wirewound load resistors, aids diagnosis. These items should all be warm.

Listening for Faults

There are many ways in which our hearing helps with fault finding, the obvious one being no sound. Take field collapse. If you can hear the field output transformer buzzing and can increase this buzz by adjusting the height control, you've immediately narrowed down the cause of the collapse to a few items at the output end of the field timebase – the scan coils, secondary components around the transformer, or an open-circuit connection between

the two. All this without lifting a test prod!

Sound distortion at low volume levels, clearing as the volume is increased, points towards a faulty loudspeaker – one with an off-centre speech coil. Gently pressing the cone whilst the set is working will prove the point.

Audible whistles from wound, cored components such as line output transformers can be very annoying, though nowadays it's mostly the case that components other than the line output transformer whistle – at an annoying submultiple of the line frequency. Gentle pressure on suspects with an insulated prod will help to identify the offending part: tighter core clamping or a dab of sealant may then help. Otherwise the cure must be replacement. The effect is due to magnetostriction: the core buzzes in sympathy with the coil's field. It follows that air-cored components cannot suffer from this malady. Some mains transformers are notorious for buzzing, which the customer often mistakenly attributes to the loudseaker.

A dead set with a heavily buzzing mains transformer is a warning of possible excessive load on the h.t. supplies or, less likely, a leak such as a faulty electrolytic in the power supply.

In Conclusion

We use our senses in many diverse ways when fault finding: the back of the hand brushed across the c.r.t. face to sense the presence of e.h.t.; sniffing for ozone when we suspect corona discharge; touching i.c.s to see if they are warm when they shouldn't be (other than specific output types, they should remain fairly cool – a hot one is definitely a sign of trouble); taking the temperature of a decoupling capacitor which we know should be cold; or looking for the split in the casing of a mains filter capacitor that's saying "change me, don't waste your fuses". Ours is a sensitive trade. Use yours to the full, read the signs, and maybe you'll be the next one to apparently possess an ability that others speak of reverently as a gift.

Book Notice

BEGINNER'S GUIDE TO VIDEOCASSETTE RE-CORDERS by Eugene Trundle, published by The Butterworth Group, Borough Green, Sevenoaks, Kent TN15 8PH at £4.50.

Q & A: VIDEOCASSETTE RECORDERS by Eugene Trundle, published by The Butterworth Group (address above) at £2.65.

Our friend Eugene Trundle, who writes regularly for this magazine, has been busy! I read the beginner's guide through from start to finish and found it an excellent technical introduction to the subject. It cleared up a number of points about which I'd been uncertain, which is always to me proof of a book's usefulness. Don't be put off by the "beginner's guide" bit – it goes into the subject in enough depth to meet the needs of technicians.

The Q and A doesn't go into the subject in quite the same depth, being intended for "salespeople, bosses, prospective VTR owners, equipment reviewers and technical people whose present knowledge is in other fields". It's main concern is nevertheless the techniques used in VCRs.

Both books cover the three formats at present in use. I have no hesitation in recommending them to readers who want to get their teeth into the subject.

J.A.R.

Letters

GRUNDIG GREMLINS

Mick Dutton provided a comprehensive list of faults experienced with the Grundig CUC series chassis in the February issue (page 202). One component not mentioned however was R646 (270k Ω) in the power supply – it's the equivalent of R165 in the later Thorn TX9 chassis, mentioned in my letter last month. In the Grundig chassis it goes open-circuit, with the result that the chopper transistor goes short-circuit at switch on.

On the theme of Grundigs, the h.t. smoothing resistor R607 (91 Ω , 17W) in the 1510 has a habit of disintegrating. It also forms part of the excess current limiting arrangement (see Fig. 1). This works as follows. The mains rectifier thyristor Ty604 is triggered at its gate via the RC network R615/C611. In the event of excess current the voltage at the junction of R607/R608 will fall and transistor Tr612 will conduct, short-circuiting the gate and cathode of the thyristor which is thus cut-off. The circuit is designed to trip at approximately 8Hz, R608 going opencircuit in the event of a sustained overload.

Our experience has been that in the event of failure of R607 it's necessary to replace the following items for a no-comeback repair: Ty604, Di604, Tr612, R614, Di614, the main smoothing block C607/608/616/617 and of course R607.

Some time back we had this fault and replaced the components listed above. The set was given a soak test but after two hours R607 again disintegrated. The fault was eventually traced to the screened wire that couples the line drive to the gate of the flyback thyristor Ty501. This wire is routed below the power resistors, and had carbonised at this point, thus upsetting the operation of the thyristor line output stage. Since then it's been our policy always to check this length of wire visually and if in any doubt to replace it.

Brian Francis, Tech. (C.E.I.), Plympton, Plymouth.

SHARP C2072

A Sharp Model C2072 came in for repair recently, the symptoms being as follows: during bright scenes the colour would disappear, accompanied by a loud whistling at a frequency which seemed to be below the usual 15.625kHz. There would also be severe line pairing and picture break-up, particularly at the edges. The symptoms would still appear, but much less frequently, if the contrast and brightness controls were turned down to give a dark, washed-out picture.

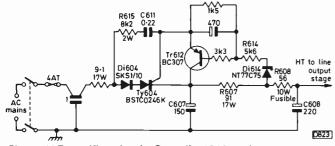


Fig. 1: H.T rectifier circuit, Grundig 1510 series.

The customer told us that the set had started to go wrong about a year ago, but he could restore the picture to normal by either changing channels or turning the brightness down. As the problem had become progressively more frequent, he decided to have the set repaired. Another engineer had quoted £95 to replace the chopper and line output transformers, the tripler, and the chopper and line output transistors, but the customer decided to seek a second opinion.

We recalled that similar symptoms occur with the Thorn 9000 chassis when the 90V supply smoothing capacitor C715 deteriorates. The Sharp C2072 is not quite the same – it uses a series chopper circuit to produce a 120V h.t. line – but it seemed worthwhile trying the h.t. smoothing capacitor C717, which is a 47 μ F radial electrolytic rated at 200V. We extracted it and sure enough the telltale sign of a faint white powdery deposit was present near one of the leads. A replacement 47 μ F, 250V electrolytic immediately restored normal operation. Incidentally the faulty capacitor read all right on the meter – the best course is to check by substitution. We wondered what the other engineer would have done after replacing all those innocent components!

T. Barrett, London E17.

VIDEO AMPLIFIER TRANSISTORS

I've received several letters asking about the transistors used in the video amplifier circuit shown in my article in the February issue (Fig. 1, page 189). Any small-signal npn/pnp/npn transistors will do, but those actually used were two BC548s and a BC558.

Harold Peters, Oulton Broad, Suffolk.

METER REPAIR?

Many years ago, when Lisle Street was occupied by tarts and electronics shops rather than Chinese restaurants and blue movie shows, I bought a "faulty" meter for £1 from the collection of odds and ends on display outside one of the shops. It seemed to be in working order apart from reading 25 per cent low on all ranges. I was using it recently to check a faulty rear lamp on a vehicle parked on a slope: unfortunately the vehicle ran a foot or so down the slope and over the meter. The back of the case was shattered and the internal battery was squashed. Apart from that there appears to be little damage – and what's more the meter now reads accurately! D.B., Tunbridge Wells.

BEOVISION BLANKING MODIFICATION

Those readers who keep their old 2600 and 3200 series Beovision colour sets going may be interested in the following method of improving the field flyback blanking. The problem arose when I noticed teletext signals flashing at the top of the picture. It seems that the use of more lines for teletext results in their showing up on receivers that have either slow flyback or inadequate blanking. Rather than trying to speed up the flyback, I thought it would be better to attempt to improve the blanking.

The original circuit is shown in Fig. 2. After inversion by the strapped triode sections of two ECL84 valves the flyback blanking pulses are fed via a screened cable to the "earthy" ends of the tube's first anode decoupling capaci-

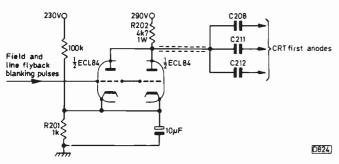


Fig. 2: Flyback blanking in the B and O 2600/3200 chassis.

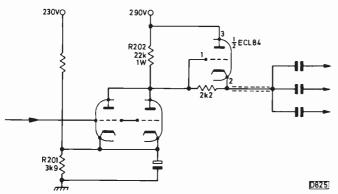


Fig. 3: Modification to remove teletext signals.

tors. One way of increasing the amplitude of the pulses would be to increase the value of the anode load resistor R202. Unfortunately this slows down the circuit's recovery time on the positive-going edges of the pulses, since the capacitance of the cable etc. has to charge via the anode load resistor. The result is a brightness gradient on the left-hand side of the screen.

Fortunately there's a third, unused ECL84 triode section – it's in the middle ECL84 of the colour-difference output trio. The circuit can easily be modified, on the back of the panel, to that shown in Fig. 3. Using a cathode-follower in this way ensures a quick pull up, the initial pull down being via the $2.2k\Omega$ resistor. Sufficient blanking pulse amplitude is obtained to blank out the offending teletext lines. There are no tracks going to pins 1, 2 and 3 of the cathode-follower, so the necessary connections can be made without having to "hack and bodge".

Note the change in the value of the bias resistor R201 from $1 \text{k}\Omega$ to $3.9 \text{k}\Omega$.

Keith Cummins, Shirley, Southampton.

LOPT TESTER

I've made up the line output transformer tester featured in your February issue (page 180), having etched a board and using components from the junk box. It works well, but the emitter-follower transistor Tr3 got warm – the whole board took 38mA on load (connected to a trans-

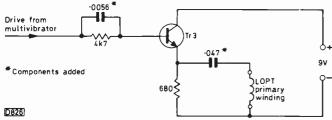


Fig. 4: LOPT tester modifications.

former), 8mA off load (with Tr3 cold). Adding an $0.047\mu F$ output coupling capacitor as shown in Fig. 4 provided the cure, the board taking 9mA on load with the transistors cold and the output reading unaffected. The addition of this coupling capacitor also saves Tr3's emitter resistor from being shorted out by either a faulty transformer or accidental contact between the line output valve anode/transistor collector lead and the negative lead of the 9V battery – this does Tr3 no good, and sometimes stops the circuit oscillating until switched on a second time.

Adding a small capacitor across Tr3's base resistor increases the output reading a little – the value I used was $0.0056\mu F$.

H. Owens,

N. Ferriby, Yorks.

HOMES WANTED

Due to shortage of space, I must jettison from my collection of vintage and semi-vintage TV sets and radio receivers three Murphy V310s and a V320. The V320 and one of the V310s are workers, the other two requiring new line output transformers. Any takers?

W. J. Knight,

532, Rochester Way, London SE9 1SQ.

SATELLITE/CABLE TV

I've been following recent editorials concerning satellite and cable television with very great interest. These two transmission systems make strange bedfellows, the first being the ultimate in providing wide geographical coverage, the second a strictly limited method of distribution. Much publicity has been given to their marriage recently, a TV service in one UK town receiving the satellite signals and passing them on to viewers via cables. Despite all the ballyhoo about the high technology involved, a dispassionate consideration of the scheme must lead one to the conclusion that it's the definitive example of the use of a sledgehammer to crack a walnut. Since the programme matter apparently consists of taped or filmed offerings, the object of the exercise could have been achieved at a tiny fraction of the cost by simply installing a VCR and maybe telecine equipment at the cable company's distribution centre. Indeed even more money could have been saved by ignoring cables altogether and employing a low-power local TV transmitter. Other reports have mentioned a pirate TV station, whose backers seem to wish to dispel the contrived belief that only the combination of a government agency and huge finance can make such services possible.

The objections to the use of cheap, purely local TV transmitters are two-fold. On the one hand the establishment wishes to preserve the present BBC/IBA control of public broadcasting. Satellites provide a means of getting round this, distributing technically foreign programmes. On the other hand all programmes sent out via the existing terrestrial transmitter network are in effect free to the viewer once he's bought his set and his licence, whereas cable distribution makes it possible to charge him for every minute of screen time he watches. There's nothing much wrong with this, provided it's optional and doesn't affect the quality of the present services. The danger is that if cable TV ever achieved the coverage desired by its promoters, it might well corner the market in popular TV material, leaving off-air viewers very much poor relations. It must not be forgotten that very large

areas of the country will never be served by cable, due to the sparse or scattered population.

The BBC would in this event hope to raise its licence revenue so that it could fight back, but what of ITV? Already saddled with the burden of financing Channel 4, faced with the growth of VCR use, and anxious to maintain viewing figures so as to sustain advertising revenue, the independent companies could find themselves very hard pressed. For the BBC and the IBA, either

separately or jointly, to finance a superfluous DBS service is in these circumstances as appropriate as a bankrupt third-world nation operating its own prestige air line. High technology is all very well, but not for its own sake. The BBC and the IBA have virtually complete coverage with their present transmitter network: they should swallow their pride and forget about DBS services.

Chas E. Miller,

Woodseaves, Staffs.

This Little Ting Here

Les Lawry-Johns

I suppose we all get a trifle confused over the various Bush models and chassis, and it's not till we take a closer look that our spirits rise or fall. So when these two rather elderly men puffed into the shop carrying a 22in. Bush colour set I immediately thought it was a late 823 chassis.

"There's a white line across the screen" said the tall one.

"No it isn't, it's a red line" said the short one.

"Fret not" I assured them, "'twill be put right in a trice."

The Bush Z718

I whipped the back off and my spirits fell. Seeing the swing down panel across the rear section I thought it was a T20. Then I saw the two line output transistors on the right-hand side and realised it was a Z718. My spirits fell further.

"Umm, it won't be put right in a trice."

"Don't worry. We've all the time in the world" said the tall one.

"Sure it's only a little ting" said the short one.

"That's because you don't have to find the little ting" I growled.

"Oh you'll find it in no time at all" he continued. "We'll just have a cigarette while you're doing it. Just carry on John"

Honey Bunch smiled and chatted to them about the weather while I delved into the field timebase. The transistors appeared to read right on a cold check, except for one of the output transistors, VT7. It gave a low reading from collector to emitter, the same on reversing the prods. Out came VT7, off its heatsink. In went a new 16905. Switch on and we had a nice, full-sized raster.

"There" said the short one, "didn't I tell you it was just a little ting you'd find in no time at all?"

I growled to myself something about what would happen to his little ting if he wasn't careful, then plugged in the aerial. No signals, just noise. None of the touch sensors were alight, so I touched the first one and dropped down the flap to tune it in. Wind the red pointer up and down but there was nothing except for a few flutters to reward my efforts. I then touched sensor two and with slight adjustment BBC-2 showed a news sheet. I felt better. Touch sensor three and the news sheet remained, even when I ran the number three red pointer up and down. It was still there in positions four and five, even though the pointers were in different positions. Position six could be tuned and I ran it up to BBC-1. Select sensor

two and BBC-1 is still present.

"You didn't tell me this lot was up the creek" I moaned.
"It's not up the creek" said the short one, "it's just a little ting here."

Whilst I was trying to read the tuner voltages on the connecting plug, looking for the tuning voltage in particular, he was spinning the little wheels and thus making me angry.

"See John, you have to get all these little pointers on the same line. Then they work."

I was fast loosing my cool.

"All right then, if that's all there is to it you can take the set away now."

"No need to get upset over such a little ting."

The tall one saw how the wind was blowing and intervened.

"Leave it to Mr. Johns, Paddy. It's not working right and he'll sort it out if we leave him alone."

"Yes, leave it to him to tink out."

I chose my words carefully. "That's what I'm here for, tinking tings out all day long".

Honey Bunch fled to the kitchen. I heard her talking to Ben. "He's out there tinking. He'll need a bath tonight or he'll be tinking tomorrow too." It didn't help. My logic, fragile at the best of times, had gone.

I removed the three nuts and took out the touch tuner panel, then accused the ETT6016 of buggering about. I took it out, having earthed myself to the live mains, and sustained a bleeding hand. "Calm down now. Try to think logically like ET does."

That little brass image still looks down at me, his finger pointing. Always pointing. Saying "you're not doing it right Les. Get the voltages right." But I didn't listen. I fitted another ETT6016 and what do you know – the neons started to work. They lit up when touched, and I was sure I was there. I wasn't.

Although they lit when touched, only six was tunable – and tuned the other five for God's sake.

Shorty moved in again. "It's this little ting here", pointing to the a.f.c. button. Out he moved, and ET's finger continued to point at me.

I checked the voltages against those given in the circuit. There should have been 188V at 9R39 on the touch tuning panel (Fig. 1). The reading was more like 30V – I'd previously taken this to be the tuning line, but it wasn't, it

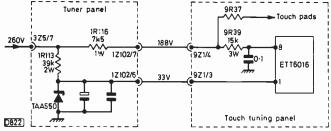


Fig. 1: Supplies to the touch tuning panel.

was the supply to the ETT6016. I traced the line back to the tuner panel, where I promptly got confused between 1R113 and 1R116. Like a fool I first accused 1R113, but it was 1R116 that was open-circuit of course. Replacing it restored normal channel selection and tuning.

Shorty looked at the faulty resistor. "Just a little ting . . .

Having disposed of the comedy duo, we can consider the circuit briefly. 1R116 takes 260V at one end and drops 72V, providing a 188V supply at the other end for 9R37 and 9R39, the latter feeding the ETT6016. Hence the crazy behaviour when this supply is absent. I should have gone straight to it. Like you would, but I don't tink like you.

Sparko's Return

I was just settling down for five minutes' read of the magazine when the door crashed open and in fell Mr. Sparks. Till that moment he'd been carrying his Thorn 8500. "Nice of you to drop in" we greeted him.

"Get this bloody set off my foot, Len" he bawled.

First it's John from Paddy, now it's Len from Sparko. What it is to be well known.

So I lifted the set off his foot and he hopped around like a wounded kangaroo.

"Why do I have to bring this bloody thing to you each time? Why can't you call out like civilised people do?"

"Because I'm too lazy and don't want to work too hard, that's why. Now what do you want me to do for you?"

"Just fix it for me Len. I don't care how much it costs as long as it's not more than a fiver."

I ignored that because Sparko never argues about the

bill. Mind you he does like to stop and watch and murmer every now and again "thank gawd it's not me with my hand in there."

So we took the back off, plugged the set in, and switched on. A blurred picture with no sound appeared. We switched off and checked the speaker, which was o.k. We then removed the power panel which, as you know, is where the MJE340 audio output transistor VT701 lives. It had base-emitter leakage, so out it came. I looked in my little drawer marked MJE340 and took one out. It was of entirely different construction, and I stared at it in disbelief. The one from the set was of the TO126 type, like the BD131. The one in my hand was of the TO220 type. The base and emitter leads were reversed, so it had to go in on the reverse side of the heatsink to get the connections right. When fitted, the sound was loud and clear, so the voltage rating was right. Later investigation proved that the transistors in the drawer should have been marked MJE340K (30W rating). Ho hum.

The blurred picture didn't respond to adjustment of the focus control, so the e.h.t. rectifier unit came under suspicion (the built in resistor goes high in value). Smiling at Mr. Sparks, we removed the suspect unit and fitted a new one. The focus was now good and the sound loud and clear. "Did you say a fiver Sparko?"

"Just joking Len."

Hallo Stan!

Hardly had Sparko left than Mr. Murray walked in. He's been coming in for seventeen years.

"Hallo Stan, how's your luck?"

"My name's Hilda Mr. Murray . . . "

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VCR Servicing

Part 27

Mike Phelan

The 3V24's capstan servo has provision for still frame and slow motion, the latter by remote control. We'll look at normal record and playback operation first.

Capstan Servo

A block diagram of the capstan servo is shown in Fig. 122. It's a dual-loop arrangement, i.e. with both speed and phase control. The speed control loop uses a VC1029, as in the drum servo, but this time operating at 126Hz. If the capstan speed increases, the voltage at pin 10 of the VC1029 falls. There's no inversion in the motor drive amplifier, so the capstan motor speed falls to compensate for the initial rise. Stable conditions are obtained at about 3.8V. The phase control loop is mainly contained in IC1, where the 32.768kHz oscillator is shared with the drum servo.

On record, the only need is for close control of the speed. So the phase control loop compares the 21Hz trapezoid derived from the crystal oscillator with the 21Hz pulse train obtained by dividing the FG signal by six. Test point TP5 is included to enable the trapezoid and pulse to be viewed simultaneously. The error voltage of about 4.5V at pin 25 goes positive to decrease the motor's speed, because the inverting input of IC15 is used. C101, C102, R223 and R224 form the loop filter.

On playback the oscillator and divider produce a 25Hz trapezoid which is gated by the amplified pulses from the control head. The pulses are passed through monostable multivibrator IC6 which provides a delay of about 20msec.

In record and playback (also audio dub) two sections (S1 and S2) of IC14 are closed because pins 5 and 6 are high (inverter X40's output is high). S3 and S4 are both open. The loop filter is thus in operation. In stop, fast forward and rewind, X42 turns the motor off. In search fast forward, search rewind, slow and still D40 or D41 conducts, S3 and S4 close, and X40 opens S1 and S2. This removes the phase error voltage from the motor drive input, connecting the latter to the junction of R225 and R226 instead to give the correct free-running speed. This point is also connected to the junction of C101 and C102 in the loop filter to maintain the charge on these capacitors - otherwise the lock-up time on returning to normal play would be excessive. If the off-tape control pulses are lost during playback (or audio dub) D39 conducts, producing the same effect, i.e. S3/4 closed and S1/2 open. Severe hunting would occur if it were not for this.

Fig. 123 shows the control pulse detector circuit. During playback and audio dub, C99 and D38 d.c. restore the pulses, biasing X38 on. The after-load switch is closed, biasing X9 on. C100 charges to 9V, holding X39 and D39 off. The servo then works normally. If the control pulses are interrupted, due to mechanical shock for example, C100 discharges, X39 turns on, D39 receives forward bias and the servo switches to the free-running condition. We don't want this part of the circuit to operate in record, when servo control is essential. This condition is met by supplying the emitter of X39 from the PB 9V line.

Though the motor is stopped via X42 in the stop, fast forward and rewind modes we want the free-run condition to maintain the charge on the loop filter. The after-load switch is open in these modes, so X9 is off. X39 is still powered from the PB 9V line however, so D39 conducts to give the free-running condition.

Still and Slow Drive

The still and slow capstan drive system is shown in Fig.

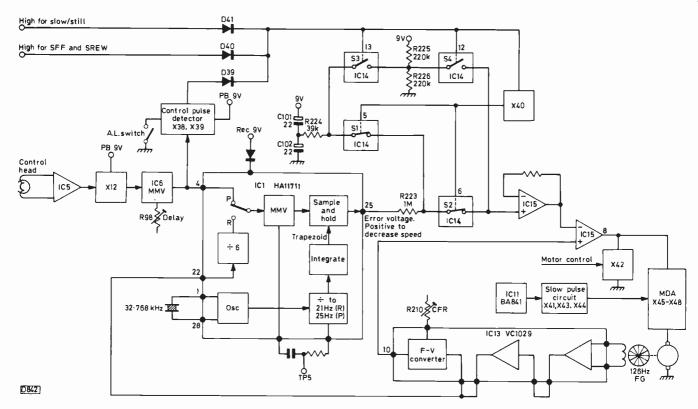


Fig. 122: Block diagram of the capstan servo.

124. It may look a bit complicated, but is not too bad if split into two sections. As in the previous machines we've dealt with, a BA841 i.c. is used for slow motion/still frame capstan control, though the circuit is less complex than that used in the 3V23.

In modes other than playback, record, audio dub and shuttle search, X42 is on, removing the control voltage from the motor drive amplifier by turning off D45. This turns X45 on and the Darlington X47 off, stopping the motor. X46 and X48 are used in slow/still as a brake, normally being off. D46 ensures that X47 is off when X46 is on, otherwise the 12V rail would be shorted out.

When D45 is off, we can drive the motor with a slow pulse as in the 3V23 – a large amplitude pulse to overcome the inertia, followed by a smaller pulse. D33, D34, X33 and X34 form an OR gate to supply 9V to the slow-pulse network in the slow or still modes. Pin 30 of the BA841 is the FF2 output – we don't use FF1 here. Pin 30 goes high to move the motor, low to stop it. During normal running it's high, so that X41 is on and X43 is off: the path to chassis via X41 forward biases D45 and X45, closing the servo loop.

The internal workings of the BA841 have been dealt with in previous articles on the 3V23 and 3V16. Suffice it to say that flip-flop FF2 is set by the drum FF signal and reset by the control head pulses, so that the tape stops at an exact position with reference to the latter. The process is repeated four times, as the tape position at the start of the process is indeterminate. For slow motion further single pulses are generated to drive the capstan, the interval between the pulses being set by the slider control on the remote hand unit.

When still is selected (or the camera trigger is released), X42 turns on, stopping the motor, and FF2 resets. FF2 next sets, turning X41 on and X43 off so that R229 supplies X45 with some 9V. The motor starts. X44 is off at this point, because when FF2 sets X36 is turned on, triggering the monostable connected to pin 26 of IC11. This gives a high at pin 27 after 18msec, turning on X44 and reducing the drive pulse to 2·3V due to the network

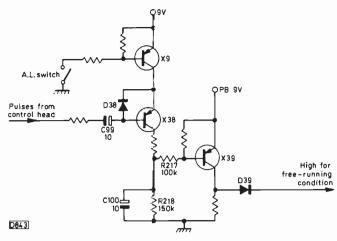


Fig. 123: The control pulse detector circuit.

R229/R243. The pulses at the collector of X36 are also applied to the vibrate circuit in the drum servo to minimise sideways movement of the picture in slow motion. The tape moves until a control pulse arrives from the tape. This resets FF2, turning X41 off and X43 on, X46 and X48 conducting to brake the motor. R189 and R191 adjust the width of the slow pulse.

Pin 37 of the BA841 provides dummy field sync pulses, as in the 3V16, one of the pulses being user adjustable to minimise jitter.

Edit Start System

Before leaving the capstan servo to look at the reel servo we must explain the edit start system. If you read the articles on the 3V23, you will recall that when record pause is selected the tape winds back by approximately 30 fields and then stops. When restarted, the capstan goes into the playback mode to lock to the previous recording's control pulses, the record capstan reference (FG) being synchronised to the control track pulses by resetting the counter before the record mode is entered. In addition, if

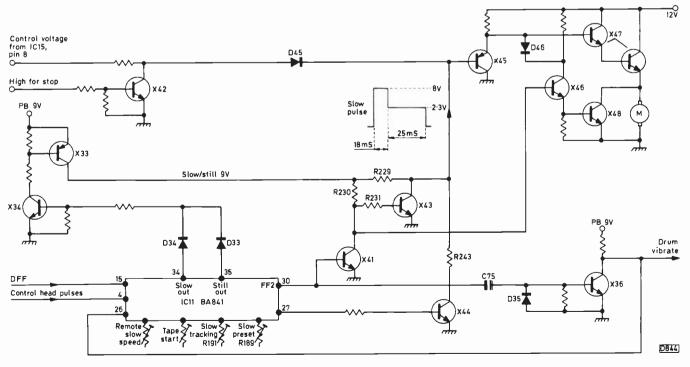


Fig. 124: Still and slow drive system.

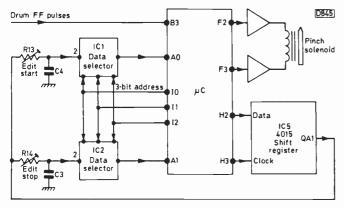


Fig. 125: The edit start system.

the signal is interrupted, as will happen with channel change or possibly when editing out adverts, the drum servo relocks to the sync before the machine recommences recording. The system is complicated but gives perfect edits

A very much simpler system is used in the 3V24 (see Fig. 125). The circuit may not make much sense at first glance – there appear to be only two extra presets and capacitors. It works like this. If the tape is stopped at a precise point in time with reference to the incoming signal

(say when the drum FF changes state, as this is locked to the field sync) and is restarted at the same point, the control track pulses should be evenly spaced – they are derived from the field sync pulses. Adjustments are required because pinch wheel movement takes a finite time. This movement must be kept to a minimum, typically 0.1mm clearance from the capstan to the pinch wheel in pause.

On the next positive-going excursion of the drum FF signal after record pause has been selected, IC5 produces a high at QA1. The microcomputer i.c. sorts this out. It coincides with the end of the ch. B head trace. Because of the presence of R14 and C3, input 2 of IC2 does not go high immediately. When it does, the data fed to A1 tells the pinch solenoid to release.

On pressing the play button or operating the camera trigger to restart the tape, the opposite sequence occurs – the microcomputer waits for the drum FF to go positive, QA1 then goes low, C4 discharges through R13, the input to IC1 goes low, the output to A0 changes and the pinch solenoid is re-engaged.

R13 and R14 are adjusted for the same delay at stop and start, subject to variables such as solenoid inertia and variation in the high and low logic threshold levels for IC1 and IC2.

We'll deal with the reel servo next month.

The B & K 467 CRT Tester/Reactivator

Eugene Trundle

Fear of tube failure has been a dominant worry ever since the start of domestic TV services, and was if anything stronger in the monochrome-only era. It's probably been the main reason for the British habit of TV rental – only recently has there been a trend away from this. It's true to say that in 1984 few TV sets, either monochrome or colour, justify tube replacement on economic grounds. The reasons for this are the increasing cost of transport and labour, the diminishing (in real terms) price of new sets, and the fact that good second-hand sets are plentiful. I for one am reducing my expensive stockholding of spare tubes!

Over the years there have been any number of boosters, jackers, reactivators and rejuvenators, call them what you will, all serving the purpose of staving off the day of the picture tube's demise. Constructional projects and reviews of such devices have often appeared in these pages. All work on the same basic reactivation principle – passing a heavy forward current through the diode formed by the tube's cathode and control grid in order to disturb and break up the cathode's emissive surface. The operation can be likened to removing the skin of a rice pudding by bringing it to the boil! The process is rather crude, and needs to be carefully controlled to avoid stripping the emissive coating from the cathode's nickel surface.

Many early reactivators were rather heavy-handed in this respect. Some were probably responsible for killing almost as many tubes as they rejuvenated, especially when used by clumsy or inexperienced hands. Boosters vary in their degree of sophistication: I've come across most types, both gentle and brutal, in my servicing career.

The advent of colour saw the introduction of new types, basically similar but with gun-switching facilities and often clumsy base connector boxes to cater for the different pinning arrangements used in different tubes. Many of

these early boosters could not easily cater for the new tube types introduced in recent years – I never did find one that could do much for a Sony Trinitron tube, even with a suitable base socket in use.

Our faithful workshop reactivator gave up the ghost some months ago, and we took the decision to pension it off rather than patch it up again. Eleven years' service is not a bad record, and we've certainly had our money's worth during this time. Whilst looking at what's now available I found that the choice is somewhat limited. The main contenders come from Leader and B and K – Japanese and American respectively. The latter is far more expensive, but after enquiring among several satisfied users I decided to try it out.

Features

The 467 is much more sophisticated than other tube testers/reactivators. The array of dials, lights, buttons and knobs is reminiscent of a helicopter's flight deck, and impresses the customer no end! The instrument is built into a tough polyethylene attache case, with carrying handle and lead storage. The operating panel is revealed when the lid is opened. There are three moving-coil meters at the top, one for each gun of the tube under test. The operating controls and indication lamps are grouped beneath these meters in a logical layout – setting controls on the left, checking and restoring controls on the right. A pocketed flap in the lid holds the operating instructions and set-up charts. Behind this there's a foam-moulded storage tray for the various base adaptors for monochrome and colour tubes.

The three meters enable the emission and warm-up times of the three guns to be assessed simultaneously. Each meter serves two purposes, so that the heater,

control grid and mains voltages can also be read accurately. The heater voltage (0-14V) is set by a switch and a potentiometer: 2A is available at up to 7V, 600mA beyond. Neon bulbs provide interelectrode leakage indication and, unusually, a continuity check to the focus electrode. Another uncommon feature is the "life test" which gives a prognosis at the press of a button. There's a remove-short facility for shifting grid-cathode leaks, and the rejuvenation process is available in two forms – a gentle clean-and-balance operation, or the more thorough type of routine. Each of these is a special timed process, as we shall see.

Testing Methods

There's not space here to provide a detailed account of the instrument's unique operating principles, so I'll confine myself to a brief description of the main functions.

In the emission test mode the tube's three guns are individually and sequentially addressed by a clocked digital logic system. Each gun is pulsed about twenty times a second, the peak current for each gun being indicated on its own meter. This pulsing technique allows a digitally-programmed first anode voltage regulator to set the cut-off point for each gun, even with a common anode assembly or the first anodes strapped together. During the tracking test, in which the gun characteristics are compared, the duty cycle of each gun is reduced and the resulting beam current indicated on the corresponding meter. Provided the best and worst guns have an acceptable emission ratio (less than 1.5:1), the meter indications will stay within the yellow tracking segments.

The life test is a useful feature. It works by reducing the heater current by fifteen per cent – achieved by switching primary taps on the mains heater transformer. If the emission of all guns remains satisfactory under these conditions, it can be assumed that the tube has at least a year or two's life left.

Interelectrode leakage is indicated by five neons, one each for the cathodes, heater and commoned grids. Because of the sequential gun-addressing system, the position of any leak, including intercathode ones, can be ascertained. Shorts between grid and cathode are blown clear by a capacitor discharge initiated by the removeshorts button. A further neon is used in the focus electrode continuity test. This detects an open-circuit by reducing the first anode voltages and looking for an increase in the current flowing via the focus electrode. The increase is sufficient for the neon to strike, and by observing the emission meters during this test an open-circuit focus electrode in a strapped triple-gun assembly can be detected.

Reactivation

So we come to the B and K 467's main feature, its rejuvenation process. To prevent rupturing the cathode and thus ruining the tube, the current flowing during and also the duration of the "blasting" process must be precisely controlled. Two levels of reactivation current can be used, a low one for the clean/balance process, which can be safely used with any tube regardless of its condition and value, and a high one for rejuvenation.

So far so good, but cathodes can vary enormously, not only regarding contamination and wear but also in physical shape and size. Modern tubes use tiny quick-heat cathodes with a small emissive surface, whereas most monochrome and delta-gun tubes have large cathodes with a considerable coated surface area. Plainly each case calls for a different degree of blasting, and the problem is to ensure that justice is done in all cases without over cooking things.

The 467 achieves this by making the cathode itself the arbiter of its treatment. The heater current is first automatically increased to bring the cathode to an abnormally high temperature. The heater is then turned off and the rejuvenation current is simultaneously applied. A heavy current flows initially, but as the cathode temperature drops so the current falls, soon decaying to zero. This means that a large, robust and thermally inert cathode will get (and withstand) a sustained rejuvenation cycle, whereas the more fragile Trinitron and quick-heat cathodes will be restored without being wrecked.

Use and Performance

To test any monochrome or colour tube, reference is first made to the set-up chart. This lists virtually all known tube types and gives the approximate heater voltage and adaptor socket number. Once the correct adaptor has been fitted the test procedure is fairly simple, involving initial setting of the heater, grid and first anode voltages, followed by the emission test and then push-button checks on the tube's various conditions. This becomes routine after using the instrument a few times, and I soon learnt the adaptor types and procedures for the limited number of tube types I have cause to test. It was necessary to order one optional extra adaptor, for the small Trinitron tubes, but all the other tubes I encounter are catered for by the six adaptors that come with the instrument.

The auto-timing feature made me feel more at ease when rejuvenating tubes, and as far as I can see the only way to wreck a tube would be to continually repeat the rejuvenation process until the cathode finally died – this would call for a conscious and determined effort! The instrument will not do anything for heater-cathode leaks (neither will any other I know of), but on the one occasion that I encountered a cathode-grid leak the remove-shorts procedure revealed all – in the red picture, since the short was in the red gun.

I was very pleased with the results of the reactivation process. Given that the tube has all three heaters alight and no mask or screen defects, a useful and long-lived boost can almost always be obtained – unless the tube is completely worn out or has been previously over cooked by another reactivator. Certainly this is the first instrument I've come across that can give a new lease of life to a Trinitron tube: I've dealt with several of these successfully, and only one (about twelve years old) subsequently died. I believed (and still do!) that Trinitron tubes are manufactured with some sort of anti-jack characteristic in their cathode coatings...

The life test and tracking check facilities enabled me to get a pretty good idea of the condition and performance of the tube under test, and a reasonable indication of how long it could be expected to last. This is particularly useful for those testing ex-rental or second-hand sets before buying them. I chose not to use the little guarantee cards packed with the tester for dispensing to the happy owners of tested and rejuvenated tubes!

As with any tube tester, it's important to unplug the set under test from the mains supply, and in particular to discharge any e.h.t. from the anode cavity of a tube being treated. The test procedure necessarily turns on the guns,

whereupon a conductive path is established to the tube's final anode. This conductive path will raise the instrument (and the operator!) to whatever e.h.t. level was stored in the Aquadag coating. Nasty...

I dismantled the instrument to assess its quality and the workmanship. The bottom deck consists of a fibreglass board containing a pair of 7400 series logic chips, ten transistors, lots of resistors and an army of diodes and rectifiers. Surprisingly, a lone valve sits on this board, a 12BH7A double triode. Elsewhere are a couple of heavy mains transformers and the potentiometers, pushbuttons and meters associated with the operating panel.

From long experience of commercial tube testers I find that the weak spots are the set-heater potentiometer, the function switch and particularly the multicore test cable and its terminations. I carefully examined all these items in the 467. The heater potentiometer is very beefy, rated at 12W, so I wouldn't expect any problems here. The function switch has scores of connections and would be difficult to change, but it looks reliable – a similar switch in my old tester has given no trouble during its many years' use. The test lead is terminated in a way that prevents stress or fatigue at either end, while the multipin flying plug (into which the base adaptors fit) looks rugged – it needs to be! I suspect that the most commonly used base sockets will eventually wear out, but these are available as spares at about £8 plus VAT each.

I'm told that all spares are available, in or out of guarantee, from the importers (address at end). They also

carry out guarantee service during the first year and operate a free updating service (on request) for new tube types as they appear. As new base adaptors become necessary, these will be made available from the same source.

Conclusion

In conclusion, the instrument is now a feature of our workshop. Three hundred and sixty pounds plus VAT is a lot of money, and there's less here than in £360's worth of new colour TV set. There are many reasons for this however - and you can't rejuvenate tubes with a CTV! It may be difficult to justify the expense in a situation where the instrument won't get a lot of use, say in a one-manband concern. In a busy workshop where a lot of servicing is carried out however my opinion is that the instrument is worth every penny! In an organisation such as mine it will probably pay for itself in a very few months. One of the crosses I have to bear is taking decisions on whether to continue maintenance contracts on old sets. The possession of this instrument has lately tipped the balance in favour of renewing many border-line contracts I might not have agreed to continue before. Let that speak for itself!

The B and K Model 467 is available to the trade at around £360 plus VAT from Radio Supplies Components Ltd., PO Box 27, Hartlepool, Cleveland TS24 7BR (telephone 0429 75750) and from various wholesale distributors.

TV Fault Finding

Reports from Richard Roscoe, John Coombes, Tony Thompson and M.S. Barakat

A Plague of Portables

Down here beyond the Tamar, the tempo of service life alters subtly as the days lengthen and temperatures rise. Triplers and line output transformers are packed up and put away ready for next winter's onslaught of dampness and mains surges. In their place are set out the weapons for the summer campaign: fuses, diodes, thyristors, mains droppers and smoothing capacitors to deal with our warm weather foe – the annual Plague of Portables.

Each year swarms of summer visitors, or "Emmets" if you're stuck behind one in a country lane, descend on our county carrying with them all they think they'll need for a fortnight of fun. Along with the caravan, kids, dinghy, dog, brolly, bucket and spade, a large number of them bring the portable from the bedroom or kitchen. Unfortunately they rarely bring the instruction book, which they've never read anyway, so connecting the set to the car battery the right way round is a matter of luck for them – and work for us. Hence the fuses, diodes, etc.

Some get through this first hurdle only to falter at the next. They find that the set hasn't taken kindly to being torn from its warm, comfy shelf, pitched into a bucking caravan with a motley assortment of household items, driven 400 miles and then plugged into an alien power supply. Years of reliable service are wiped out at a stroke in an orgy of dry-joints, drifting tuner potentiometers, dirty presets or other, more expensive, acts of vengeance. The latter also come our way, usually on the last day of the family holiday. Like the Ferguson Colourstar portable we had to deal with recently.

It was a Model 3756, with 14in. screen, and had gone

dead the night before. This proved to be because the 1.6A mains fuse had blown, which is not an uncommon occurrence with these TX9 sets. Often there seems to be no cause, and Thorn have introduced several modifications to combat the problem, including an improved reservoir choke (L65), type 90D3-028-002, and over-voltage sensing zener diode (W85), type 02V4-718. So we decided to try a new fuse and if all seemed well advise the customer to consult his local dealer. We needn't have worried. The fuse popped off immediately, and a meter check at the mains bridge rectifier showed that two of the diodes were short-circuit. In went four new 1N4007s just to be safe. This caution was wasted because the next fuse went the same way. This time the regulator thyristor SCR1 (Y1044) was short-circuit, so in went a replacement for that. Bang went the next fuse.

By this time we were getting a bit worried. Apart from anything else, we'd only one 1.6A fuse left! So we did what we should have done in the first place and checked the resistance between the h.t. line and chassis. Not surprisingly there was a short, so we began to disconnect likely culprits. It wasn't the line output transistor, and it wasn't the crowbar thyristor. It turned out to be W77 (BY210-400), the "efficiency diode" in the power supply. Having made doubly sure that there were no further measurable shorts we tried our last fuse. Success! The set burst into life after the customary TX9 heart-stopping pause.

Another colour portable we've seen quite a bit of is the Hitachi CPT1471/CPT1473. They've all had the same fault. Indeed it's one of the few things akin to an old-

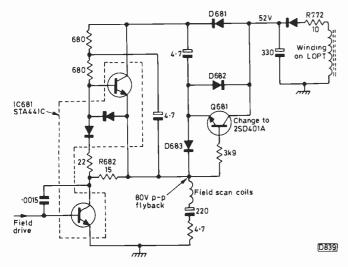


Fig. 1: Field output circuit, Hitachi CPT1471/CPT1473.

fashioned stock fault we've come across lately. The symptom is no results, sometimes intermittent but usually permanent. The first thing to do is to check Q681 (2SC1213A) in the field output stage (see Fig. 1). If this is faulty the following steps will have to be taken. Replace Q681 with the more robust 2SD401A. Also replace the switch-mode power supply chip IC901, type STR6020, part number 2366451 (it's a safety component). Hitachi say that when faulty this chip can produce excessive output, which leads to the demise of Q681. In addition, we would strongly recommend replacing R772 (10 Ω), even if it seems all right. This is the surge limiter in the rectifier circuit that produces the supply for the field output stage and is also a safety component, part number 0119514. Hitachi comment that if R682 (15 Ω) fails the STA441C field output chip will also have failed, but we haven't had one go yet.

The bulk of the summer portables we have to deal with are little monochrome ones of course. They come with all kinds of weird and wonderful names on the front, though their backsides tend to be much the same - not unlike their owners we sometimes think. One of the more interesting faults we've had recently concerned a GEC 2114 Junior Fineline which had normal sound but a blank, noise-free raster. Now the fact that the sound signal, which is tapped from the collector of the final i.f. transistor, was all right would tend to throw suspicion on the video circuitry. Everything here was o.k. however. As the more experienced of you will know, the intercarrier sound signal often gets through despite the i.f. strip proper being faulty. In this instance voltage checks proved that the final i.f. transistor was not conductive, due to its 120Ω emitter R.R. resistor R122 being open-circuit.

Amstrad CTV2000

We've had another case of no sound or raster with one of these sets. The STR451 switch mode power supply chip IC502 should produce 103V at pin 2. The fault was due to C509 (0.0033μ F, 1.6kV) which is connected to one end of the chopper transformer's secondary winding (T501). J.C.

ITT CD652

This set (CVC25 chassis with CMC60 remote control system) was stuck on channel one. We checked through the i.c.s in the control circuit and found that the command

went missing between IC3 and IC4. Replacing these two i.c.s failed to provide a remedy so I decided to check round IC3 with a meter. Unfortunately no pin voltages are given on the circuit, so guesswork is required. Pin 9 was found to read 16V, which was clearly wrong (see Fig. 2). The $1M\Omega$ resistor R21 is fed from a zener diode stabilised 8-2V rail while C5 is connected to an 18V line. So either C5 was leaky or IC3 was at fault. We'd already eliminated IC3, so a check was made on C5 which was found to read $80k\Omega$. Replacing this restored all functions to normal.

GEC C2110 Series

This 20in. solid-state set had come in for repair through the trade, the symptom being low gain. The picture had a washed out look, like me first thing in the morning... There was no observable graininess however, so I didn't suspect the tuner. Also the sound was o.k. One clue came when I removed the aerial, because instead of the expected visible and audible noise there was a blank raster and silence. Something was clearly amiss in the i.f. strip, so the next step was to check transistor voltages. This brought us to the emitter of the final i.f. transistor TR102 (BF197) where the reading was way out at more than 9V instead of 2.8V. The cause was found to be a severe leak in C113 (see Fig. 3). Replacing this restored full contrast and an excellent picture.

Thorn 9000 Chassis

This set had flyback lines all over the picture and a distinctly tubey look about it. Increasing the contrast tended to produce slight smearing. The next thing I noticed was that the brightness control had been set well down to keep the level correct. This led to a check on the c.r.t. voltages, where the first anodes were found to be at around 1kV instead of 700V. The cause was R722 $(2.2M\Omega)$ in the first anode supply potential divider network having gone high in value. Incidentally, if you get one of these sets with the complaint of flashovers (a hell of a crack at that) and the e.h.t. is correct it's probably the tripler – the casing tends to break down. I've had similar trouble with the 8500 recently.

GEC C1401H

For a grainy picture with noisy sound, first check whether the programme indicator light is a little dark. If so check for 33V at connector F5. If there's no voltage at this point R334 $(10k\Omega)$ is probably open-circuit.

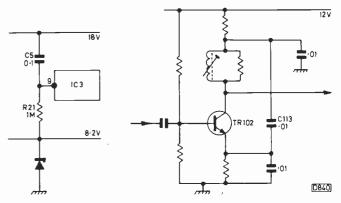


Fig. 2 (left): Channel sticking, ITT Model CD652. Fig. 3 (right): Final i.f. stage, GEC C2110 series.

Long-distance Television

Roger Bunney

January was disappointing with regard to reception though dramatic in respect of winter fury. We have news of at least four aerial structures being damaged. During hurricane force winds Arthur Milliken (Wigan) lost his complete system (though his XG21s may be repairable). Both Cyril Willis (Ely) and Robin Crossley (Dunstable) report bent poles, but perhaps with most dramatic report comes from David Martin at Shaftesbury, Dorset. A guy on his 30ft mast snapped: this was followed by collapse of the mast when an anchoring bolt sheered, and destruction of the aerials. Fortunately the structure missed nearby buildings.

Tropospheric reception has been poor, which is hardly surprising in view of the weather. The Quadrantids meteor shower produced increased signal pings throughout Band I, with isolated bursts in Band III, January 4th being particularly active. Much of the MS activity occurred during the day, allowing positive identification of many of the signals. There's been some Sporadic E activity, the log being as follows:

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8/1/84 TSS (USSR) chs. R1, 2; ORF (Austria) E2a.
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9/1/84 TSS R1.

11/1/84 NRK (Norway) E2.

12/1/84 RAI (Italy) 1A, B; JRT (Yugoslavia) E3; RTVE (Spain) E2, 3, 4; RTP (Portugal) E3.

16/1/84 RTVE E2, 3, 4.

18/1/84 JRT E3, 4, RTSH (Albania) C; ORF E2a; RTVE E2; TVP (Poland) R1, 2; TSS R1.

2/2/84 RTP E3.

A glimmer of light during the winter gloom has come from Jim Maden (S. Africa) who confirms that ZTV (Zimbabwe) ch. E2 Gwelo is still in operation – he's received the station recently via SpE.

Following recent 405-line transmitter closures, Band I is relatively clear for many enthusiasts. This is especially so in E. Anglia now that Tacolneston Ch. B3 is off air.

A further sixty experimental amateur 50MHz transmitting licences have now been offered. Reports on any interference from this source on chs. E2/R1 during the coming season would be appreciated. Simple filtering should remove most problems, but those experiencing difficulties (or solving them!) are asked to write in!

News Items

France: The fourth channel Canal Plus has started to transmit an identification slide and a half hour film giving details of the service. Paris, Rhône-Alpes, Provence and the Côte d'Azur will be the first areas to receive signals. A twelve-hour daily service is expected to start on November 1st, with mainly films.

S. Africa: A TV service (BOP-TV) has been started in Bophuthatswana. Details: ch.E37 vertical, 200W e.r.p. directional, modified PM5544 test pattern.

Spain: The authorities have closed down the pirate Band III transmitter at Fuenjirola, South Spain. It had been relaying the GBC (Gibralta) service.

Australia: The Aussat DBS is due to be launched next year. The two main spot beams will be used for the national ABS service. Lower-level broad beams will be used as a means of distributing commercial services to local stations.

Radio Amateurs: Mention has been made in previous columns of the possibility that the spectrum 50–52MHz will be allocated to ham use. No specific date for such an allocation has been officially announced and in a letter the RSGB general manager/secretary David Evans writes that "any view expressed as to a future allocation to UK amateurs at 50MHz is purely speculation".

New EBU Listings

The height of the Maasser el Chouf, Lebanon mast has been increased from 45m to 70m. Transmissions are on ch. E4 at 60kW e.r.p.

Considerable reductions in e.r.p. are given for various Syrian Band I transmitters – Abou-Kamal and Nabi-Saleh (both ch. E3) 400W instead of 400kW and Hassake (ch. E4) 95W instead of 35kW. I suspect that previously supplied information was incorrect – similar changes are given for a number of Band III transmitters.

1984 Meteor Showers

The main 1984 meteor shower dates are as follows:

Quadrantids January 1st-6th.

Lyrids April 19th–25th, peaking on the 21st/

22nd.

May Aquarids May 1st-10th, peaking on the 5th/6th.

Delta Aquarids July 15th-August 15th, peaking on July

28th/29th.

Perseids July 25th-August 20th, peaking on

August 11th/12th.

Orionids October 16th-26th, peaking on the

20th-23rd.

Taurids October 20th-November 30th, peaking

on November 1st-10th.

Leonids November 15th–20th, peaking on the

17th-18th.

Geminids December 7th-15th, peaking on the

13th.

Ursids December 19th–24th, peaking on the

22nd.

Our thanks to George Spalding, Director of the BAA Meteor Section, for supplying these dates.

Ryn Muntjewerff

DX-TV reception by Ryn Muntjewerff at Beemster, Holland, has often been reported in this column. Ryn started – as so many do – after accidentally noting distant signals on his domestic TV set – in his case bull fights from Spain in the summer of 1961. After further reception he installed a roof-mounted mast and achieved some of the the first DX reception at u.h.f. In the spring of 1970 he erected a 22.5m mast for tropospheric reception, leaving a wideband array (chs. E2-R4) mounted on the roof for SpE reception.

Due to the exposed location, Ryn has lost several aerial systems, mainly as a result of the U-bolt/clamp section of the diecast housing of bell-type rotors snapping. To prevent this trouble Ryn now uses an alignment bearing on top and an internal sleeved pipe inside the mast atop the rotor.

His achievements in Band I have been remarkable, with reception from Australia (ch. 0), Korea (AFKN Seoul ch.

A2), Malaysia (ch. E3) and southern Brazil (Port Allegre ch. A2) - in total some 47 countries. His farthest u.h.f. reception has been from Pajala, Sweden (SR-2 on ch. E34).

At present he has double stacked group A, C and E Fuba XC391 arrays on the mast plus horizontally and vertically mounted Wise 24-element wideband Band III arrays and a nine-element Fuba v.h.f./f.m. array. Threeelement ch. E3 and ch. E4 arrays are mounted vertically and horizontally on the house along with a nine-element ch. E2-R4 BDXC system.

Satellite Location/Bearing Service

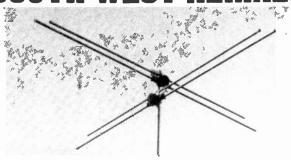
Neville Cresdee (14 Arminers Close, Clayhill, Gosport, Hants PO12 2HB) is now providing, on a commercial basis, print-outs for given locations showing all available TV carrying satellites. Here at Romsey for example some 48 craft are visible: at 4GHz, signals from some 20 craft should be resolvable using a small dish. These craft are underlined in the print-out, the more powerful satellites, such as the Gorizont series, being underlined in red. Explanatory notes, including satellite leasing information, come with the print-out. The service costs £10 and if there's sufficient interest additional information such as E.I.R.P. levels will be included.

From our Correspondents . . .

A letter from Brussels reports that both BBC TV services are now carried by the Coditel, Brutele and Radio-Public cable networks. The Coditel network provides 18 channels at 67 Belgian Francs annually. UK TV quality is "most satisfactory", though there have been occasional problems with the sound due to the need to change it from 6MHz to 5.5MHz. Reception of UK teletext has still to be tried. Our contact also reports that the TV5 ECS downlink service is in Secam, with an f.m. sound carrier at 6.5MHz. The terrestrial ECS downlink transmissions on ch. E56 in Brussels carry colour bars and the identification "CNCT Bruxelles".

Isik Yildirim (Turkey) is receiving signals from the 99°E Ekran satellite, though rather weakly, using a Fuba XC391D aerial and AKV145 junction box amplifier, a Teldis masthead amplifier and a standard v.h.f./u.h.f. Crown portable TV receiver. The latter has been fitted with an f.m. demodulator, and the results to date have been encouraging. It's now apparent that the side radiation from the Ekran satellite is very low in comparison with the high signal levels received in S. Africa from the

Ronald Exeter (Bishopton), whose DX signal detector/ alarm was featured last month, uses mostly home-built equipment for DX reception. His receiving system consists of a home-built tuner and parallel vision-sound i.f. strip, a tunable intercarrier sound channel, a vision detector and a quartz-locked resync and blanking unit based on a ZNA134 chip. The output is fed to a VCR for remodulation back to u.h.f. and finally goes to a Barco PAL/Secam colour set. The detector also drives a CMOS logic board for recording on the VCR - the resync unit maintains VCR servo locking, which would otherwise be upset by "messy" DX signals, while the blanking is inserted to prevent the VCR's clamp pumping in the presence of interfering beat signals. An experimental SAWF i.f. strip is under development: results obtained so far show that a weak ch. R1 vision signal (49.75MHz) can be viewed even when a very strong ch. E2 vision signal (48.25MHz) is present.



With the 1984 Sporadic E season nearly here, now is the time to consider new aerials for the Summer months. Our Band 1 wideband range covers 47-68MHz from a wideband dipole to a 4 element yagi, and omni directional/bi-directional switched options. South West quality ensures seamless hard drawn alloy tubing, all open ends plugged, bright Zinc plating and an overall high standard designed and made by DXers with the DXer in mind! Send an SAE for a leaflet describing this exclusive range. We even have TVDXing receivers both colour and mono!

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Left: The identification slide now in use by the French fourth channel Canal Plus. Centre: ATV reception by Ryn Muntjewerff (Holland) from Saintes, a distance of 871km. Power just 2W. Right: ATV reception by Robin Crossley (Dunstable) from G6HMS at Lincoln.

Mel Thurlbourne is back at Leighton Buzzard after several months' duty and DXing in the Falklands. Whilst there he received signals on chs. A2 and A3, but nothing in Band III or at u.h.f. SpE signals from Argentina have been identified: other signals await identification from photographs. Argentina had delivered ch. A7 PAL N transmission equipment for the intended Port Stanley TV service.

Robin Crossley recently moved to Dunstable, which by all accounts is a much improved location. He's using a wideband, 92-element Triax array at u.h.f., an eightelement Jaybeam ABM8 array for Band III, a four-element Band II array and crossed dipoles for Band I. Belgian f.m. radio is always present, in stereo, and an f.m. radio pirate (Skyline Radio) is heard daily on 103.6MHz at a distance of some 45 miles.

Amateur Television

Since I first started to mention ATV in this column several letters have arrived asking about reception. Transmissions are usually between 434-438 MHz, which in general terms is below the efficient operation of a group A or wideband array. For a start however it would seem best to press the normal DX-TV system into service. Experience shows that a stacked bowtie aerial system such as the Wolsey Colour King or Triax BB grid provides reasonable performance (in terms of gain and directivity) down to 435MHz. A group A Yagi could be adapted by using 13in. reflector elements - something of a compromise as regards efficiency, though this should provide reception of local ATV signals. If interest develops, a 435MHz array can be obtained - units are available in the Jaybeam and Tonna ranges. Since many ATV signals will be at a low level, a masthead amplifier is advisable - most wideband u.h.f. amplifiers will provide amplification at 435MHz.

One problem is that the use of a standard u.h.f. array and a wideband amplifier can result in overloading, particularly with local group A broadcast signals. Suitable bandpass (or bandstop) filtering should minimise this problem – the overloading usually occurs in the tuner's r.f. amplifier rather than at the masthead. I've used both Labgear and Wolsey wideband u.h.f. amplifiers satisfactorily at 435MHz.

Tuning over 434-438MHz is usually done with a standard u.h.f. tuner, possibly modified, or a frequency converter. Many u.h.f. tuners will cover the ATV band with no modification. The ET021, ELC1043 series, ELC2060 and the ELC2000 series will generally reach down to 435MHz at minimum voltage on the tuning line. If a particular tuner won't reach 435MHz, a slight increase in

the length of the mixer and oscillator tuned lines should be all that's required by way of modification. Many Japanese and Far Eastern portable sets tune down to 435MHz, as do certain VCRs. In view of the cheapness of surplus tuners, it's reasonable to obtain one and tweak it for maximum output at 435MHz.

The use of frequency conversion is simpler but more expensive. Upconverters that accept the 435MHz band and provide an output in the ch. 37/38 spectrum are available at about £30. They generally use bipolar transistors and if confronted with high-level group A signals can cause cross-modulation. I experienced this problem – the four local group A signals were at 40mV each. Use of a simple two-pole bandpass filter for 435mHz resolved the problem. Commercial converters are housed in diecast boxes and are untuned. ATV products are available from the following firms: Wood and Douglas, Aldermaston, Nr. Reading; Microwave Modules, Aintree, Liverpool; Fortop, Warrington, Stoke on Trent.

A standard system I receiver can be used. For those living near the south coast there's the bonus of French ATV signals, though a system L receiver (or converter) will be required. Many French amateurs switch to negative-going video when in contact with UK stations however.

The emphasis is on test card/pattern transmission, though increasing enthusiasm for computer graphics is evident. Call signs, often with details of the transmission site, are given: otherwise the "locator" is shown – this is a code number that refers to a European reference grid and is sufficient to identify the approximate source of a transmission. Camera operation is also extensive.

Communication with ATV operators is usually done at 144.75MHz, the main calling frequency in the UK. If you're not licensed and don't have a 144MHz transceiver, the cheapest way of monitoring this frequency is to use a Daiwa SR9 receiver. This has continuous coverage at two metres with provision for crystal control – crystals can be obtained for 144.75MHz and for each side of the calling frequency at a spacing of 25kHz. It's not essential to hear the ATV talkback, but this is helpful in deciding whether there's any activity and if so where it's from.

I'd be pleased to assist with any queries on ATV reception (include a s.a.e. for a speedier reply). Anyone with a strong interest in the subject should join the British Amateur TV Club (BATC) which publishes a regular journal and also three guide books. For membership details send a 9×4 in s.a.e. to Mr. B. Summers, 13 Church Street, Gainsborough, Lincs. In good openings, signals should be received at up to 500 miles. Let us know how you get on, with details of equipment, aerials etc.

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Requests for advice in dealing with servicing problems must be accompanied by a £1-00 postal order (made out to IPC Magazines Ltd.), the query coupon printed below and a stamped addressed envelope. We can deal with only one query at a time. We regret that we cannot supply service sheets nor answer queries over the telephone.

FERGUSON 3V22

A buzzing noise in the background on the sound has developed, increasing to a higher level when recorded programmes are played back. This sound is not so prominent with a commercial prerecorded tape. Tuning doesn't improve matters, except at the expense of the picture.

Remove the top and left-hand side of the machine, unsolder the two white leads from the servo (left-hand) panel, swing this out and clean both slide switches. Make sure that the switch bars *don't* go into the holes in the switches when replacing the board. If E-to-E buzz persists, try reducing the E-E level (bottom board).

TYNE 5224

The problem is line output transformer arcing – it's been rewound three times during the last six months. The last time the fault occurred R502 (820k Ω , 2W) associated with the tripler was found to be open-circuit.

It seems that either the h.t. is excessive or the line output transformer tuning is incorrect. Adjust P301 for 135V at C348 and if necessary replace C353 (5,100pF, high-ripple pulse type).

THORN 1525 CHASSIS

There's a weak picture that goes negative when the brightness control is advanced. I've tried boosting the tube's heater voltage but this hasn't helped. Can't find any references to this chassis.

The 1525 chassis is a variant on the well-known 1500. The symptom is not uncommon and is usually due to a fault in the video output stage. Suspects, in order of likelihood, are as follows: the video output transistor VT9 (a BF337 can be used); its collector load resistors R40 $(2\cdot 2k\Omega)$ and R41 $(5\cdot 1k\Omega)$; and the supply decoupler C38 $(12\mu F)$.

PHILIPS N1700

There is continuous flutter on prerecorded and recently recorded tapes, though the machine has recently been serviced, with a new pressure roller and belt amongst other things.

If the flutter is on sound, check the adjustment of R3 (capstan servo ripple) in the U320 module, using a scope or AVO and diode probe. If the flutter is on the picture, check that the tape is not wrinkling due to dirt on the guide near the audio/sync head and for severe wear in the latter – also check the head bearing for wear or lack of oil.

Finally adjust R2 (head servo ripple) in module U219. If neither ripple can be reduced to zero, the capstan or head motor could be faulty.

THORN 8000 CHASSIS

The problem with this set is vision buzz on sound. Is there a stock fault to check?

This chassis is not the best performer as regards vision buzz. First check C140 (47pF) in the quadrature tuned circuit, then carefully tune the coil (L110) for minimum buzz. If the buzz persists, check the intercarrier sound chip's supply decoupler C133 (80 μ F) and the ceramic input filter CF101. Finally try a very small (less than half a turn) adjustment of L102 in the i.f. passband filter circuit.

SONY KV1810UB

The trouble is pincushion distortion. The two controls VR585 (amplitude) and VR586 (bias) have been adjusted for optimum results, but there's still a half-inch bow-in at each side of the raster. VR585 is at one end of its travel.

The usual cause of this fault is that the coupling capacitor C585 (4.7μ F, 100V) between the field output stage and the pincushion correction circuit has dried up.

THORN 3000 CHASSIS

There's a good, clean monochrome picture but this becomes increasingly noisy as the colour is turned up. At the correct colour control setting the noise gives the impression of a poor level signal from the aerial, but the signal strength here is first class.

If the colour is locked, check transistor VT110 and the a.c.c. smoothing capacitor C173 $(2.5\mu\text{F})$ on the i.f. panel. If necessary, check the chroma amplifier transistor VT309 and the blanking diodes W316/7 on the decoder panel.

BUSH BM6514

The set is all right when first switched on, but the picture and sound deteriorate after ten-fifteen minutes, leaving a grainy picture and poor sound. Touching the aerial socket with a screwdriver restores the signals, but only for fiveten minutes.

The tuner is almost certainly faulty. Before replacing it, remove the sides and check carefully for dry-joints and solder blobs. A magnifying glass would help.

FERGUSON 3V31

Is it possible to convert the clock in this VCR to operate on a twelve-hour cycle?

You will have to gain access to the 08 display panel. Locate the display control chip IC401 (μ PD552C-079) and then link pins 40 and 41.

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TELEVISION APRIL 1984

COMPUTER USE

I intended to use a Sinclair ZX Spectrum with my Grundig 1645GB colour portable (GSC200 chassis). This set gives an excellent off-air picture but won't resolve the Spectrum computer's colour, giving a perfect monochrome display instead. A large-screen Philips set with manual tuning gives a very good colour display however.

Sweep tuning is sometimes a mixed blessing. If this is the trouble and the fine tuning buttons won't get a grip on the chrominance signal, some other means of getting the signal into the set will have to be found. First try an attenuator (say 6dB) in the aerial lead. Alternatively adjustment of preset RV on the vision i.f. module may achieve the desired result.



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Each month we provide an interesting case of television servicing to exercise your ingenuity. These are not trick questions but are based on actual practical faults.

A great deal of on the job training takes place in our workshop on an informal basis, depending on the workload and the suitability of the items in for repair. These days the emphasis is mainly on VCR servicing – we find that a "hands on" session is much more valuable (though more time consuming!) than a verbal or written description of symptoms, diagnosis, practical repairs and adjustments.

A suitable recent case consisted of a fairly new Sony SLC6UB VCR. Although it's a Betamax machine, the story to be told would apply equally to other types and models. The symptom reported was that the picture was rolling and juddering vertically. This was bad on library tapes, and intolerable with self-recorded tapes. E-to-E and direct r.f. picture reproduction were faultless. After a test to confirm that the symptoms were as described, the machine was given to a trainee to ponder over – with the proviso that he checks with his colleague before doing anything drastic, either mechanically or electrically.

Off he went with his scope, making a start at the video output socket. By examining the field rate waveform here he found that the E-to-E signal was perfect whereas the off-tape signals had bad deficiencies in the field sync pulse train and during the first few lines of the picture. These lines were of low amplitude and noisy compared with the video signal during the rest of the field period. None of the playback waveform was as clean and sharp as the off-air signals, and further checking showed that during playback of the machine's own recordings the field sync signals were virtually obliterated by noise.

After some thought our trainee decided to check the r.f. envelope pattern (from the head preamplifiers) during playback, and demanded an alignment tape for the purpose. This was refused as the remains of a chewed up alignment tape (a sad story we won't recall here) had only recently been enshrined. He was told that he was on the right lines and given a known good prerecorded tape with colour bars.

Access to the relevant test points on the RF4 board is not easy on this model as the AD6 and RF4 panels have to be half-cocked over the whizzing head drum. When the waveform was displayed however a significant dent in the envelope pattern at the left of each head's trace was seen. Knowing that the field sync pulse comes at the start of each head sweep, our trainee correctly surmised that this was the cause of the symptoms. Adjusting the tracking control made little difference to the envelope shape – it reduced in amplitude without changing shape much when the control was adjusted.

Careful head, drum and tape guide cleaning made little improvement, and after consulting the adjustment manual and with the approval of his colleague our man cautiously adjusted the tape entry guides, after carefully marking their initial positions by scribing, then counting turns. The result of all this was disappointing. Screwing the guides up and down gave a "Christmas cracker" effect at the left-hand side of the signal envelope, with corresponding mistracking bars on the monitored picture, but the envelope's round shoulder shape remained. The senior technician had a good idea all along what the trouble was – have you? We'll come back to it again next month.

ANSWER TO TEST CASE 255 - Page 271 last month -

The incredible situation described last month concerned a 22in. Tandberg colour set: the parts of the display that should have been red were blue, those that should have been green were red and the blue bits (!) came out green. Merely setting it out like this, and knowing that the tube's cathodes were being driven by the correct signals, gives the clue to the whole thing – especially in view of the fact that a purity error was present.

What our quack doctor had done of course was to grossly twiddle the purity rings, to a point where the beam landing was taking place on the wrong phosphor dots. Thus the red beam was bombarding the blue dots and so on. Thorough degaussing, alternating with purity adjustment, eventually produced correct purity. Adjustment of the drives and cut-off points then put the grey scale to rights. The root of the trouble seems to have been the proximity of the TV set to some large metal mass – our customer deals in scrap metal.

Our hope is that his friend with the screwdriver doesn't graduate to VCRs. The thought of taking our turn after him with say a Sony C9 is a daunting one. I hear that he mends lorries, oil tanks and chairs as well, which certainly indicates versatility...

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SAA 1024	2.40	TBA 396	1.70	UPC 1025H	3.70	BY296	0.25	BC253	0.11	R2029	1.90	ITT Petrick	0.95 0.60	110°	1.85
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SN 76226DN	1.60 1.20	TCA 270SQ TCA 640	1.90 2.60	UPC 1178C UPC 1180C	2.14 3.00	IN4148	0.03 0.13	BC558	0.10	TIP33B	0.75	1		SW150 SW154	2.2
SN 76227N SN 76532	2.00	TCA 650	2.40		1.62	IN5402 IN5404	0.13	BD131	0.30	TIP41A TIP41C	0.46 0.58		2.00	341134	2.2
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SN 76666N SN 76707	1.10 1.70	TCA 830S TCA 940	1.60 1.80		0.98 1.70	ZENERS		BD140 BD150A	0.60 0.70	TIP31C	0.48		S	Block 2A	0.2
TA 7061AP	3.60	TCA 4500A	2.00		3.60			BD207	0.70	TIP32A TIP32C	0.34 0.48		0.48	5A	0.2
TA 7063AP	3.50	TDA 1003	2.00		2.00	400MW		BD221	0.40	TIP33B	0.75	Thorn/GEC	0.48	Min Insulated Clip Red or	Croc
TA 7066P	3.90	TDA 1004A	2.20		1.70	2V4 to 75V 1.3W	0.10	OULLO	0.35	TIP41A TIP41C	0.46 0.58	G11	0.48	Black	0.0
TA 7072P	2.90	1	2.50		1.70 1.41	2V7 to 91V	0.18	BD233 BD234	0.53 0.38	TIP41C	0.58	11		Standard Cros	;
TA 7073AP TA 7074P	3.20 3.30	TDA 1170 TDA 1180	2. 8 0 2.10	1	1.41	100V to 200V		BD238	0.38	TIP42C	0.68		20	Clip	0.0
TA 7076P	3.30	TDA 1190	2.00	UPC 1204C	1.63	15 WATT		BD239	0.42	TIP100 TIP130	0.70 0.70		เบร	GEC Neon 3500 Cut out	0.1 2.0
TA 7089P	2.40	TDA 1327		UPC 1208C	2.00	BZV15C12R BZV15C24R	1.18 1.18	1	0.65 0.42	TIP2955	0.74	Diode Split	EHT	Focus Spark	2.0
TA 7093P	2.90		1.00		4.00	BZV15C30R	1.18	BD534	0.33	TIP3055 TIS90	0.55 0.90	lead	1.60	Gaps	0.1
TA 7108P TA 7117P	2.44 3.20	TDA 2002 TDA 2010		UPC 1212C UPC 1213C	1.34 1.53			BD595	0.55	TIS90	0.90	Emilicap	0.75	Rank Tuner	
TA 7117P	3.20 1.61	TDA 2010	2.40		2.70	BRIDGE R	ECT.	BD596 BD681	0.55 0.58	2N3055	0.73	10M Pack		Cams	0.0
TA 7129AP	3.20		2.20	UPC 1216V	1.99	B40	0.80		0.58	2SB350A	1.90	Cable	1.50	5yds PVC Tap	ле 0.1
TA 7130P	1.38			UPC 1217G	3.59	BY164	0.50		1.70						
TA 7137P	2.00			UPC 1218H	3.00	BY179	0.70	BF127	0.30	THYRIS	TORS		DIS	COUNT	S
TA 7139P TA 7146P	2.75 2.00	ł .		UPC 1222 UPC 1223	2.00 3.70		0.25	BF137 BF180	0.30 0.29	KONIG 15	/80 Univer	sal 2.47			
TA 7157P	3.20	1		UPC 1225	3.00		TORS	BF181	0.27	KDNIG 15	/85 Univer	sal 2.47	ORD	ERS OVE	R
TA 7171P	3.20	TDA 2560	2.05	UPC 1226	2.49			BF182	0.28	BR101		0.37	£50	IN VALU	JΕ
TA 7172P	3.30			UPC 1227	2.00		0.30		0.32 0.10			0.62	-23	5%	
TA 7176AP	3.00			UPC 1228H	0.90		0.30 0.36	DEADE	0.10 0.11			0.56 0.65		J /6	
TA 7193P TA 7202P	5.20 3.30			UPC 1230H UPC 1238V	3.60 1.90		0.30	BF196	0.13	BRY55		0.60	ORD	ERS OVE	-R
TA 7202P	3.30			UPC 1236V	2.20	1	0.30	BF197	0.13	BRY56		0.37	1		
TA 7204P	2.16		1.15	UPC 1250	2.40	AC187	0.30	BF190	0.16 0.18	שוום		0.90	£120	IN VALU	ノヒ
TA 7205P	1.40	TDA 2640	1.80		4.50	1	0.30	BF200	0.18	סטוום		1.55		10%	
TA 7208P	2.70		2.10		2.80		0.88	BF240	0.16			1.60			
TA 7210P	5.60		2.10 2.20		3.00 3.00		0.45 0.45	101270	0.30			2.00 2.00		er Value i	
TA 7222P TA 7223P	1.70 3.50		5.10	1	3.50		0.48		0.40 0.27	1		1.70	inclu	uding VA	Γ)
TA 7227P	5.10	1	6.50		3.70	_	0.60		0.32	DT112		1.85	VIDE	O LIEARO	
TA 7310P	1.70	TDA 3950	2.40	UPC 1363C	3.50	AU113	2.60	BF264	0.40	OT121		1.55		O HEADS	
TA 7313P	2.80	TDA 4600	2.10	UPC 1365C	5.00	BC107	0.10	BF273	0.13	2N4444		1.55	CHIS	EXCLUD	ヒレ

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		RRI T20 1.80 Thorn 8500 1.90	CAPACITORS Decca 200/200/400 350V2.70	Watt IRO to 10M (10	Decca 1830 5.9 Decca 2230 6.3
SERVISOL ————————————————————————————————————	PLUGS-SOCKETS	Focus Rods 1.10	Decca 400/400 350V 2.90	Pack) 0.18	Decca 80 6.3
Super Servisol 0.88		CAPACITORS	Decca 400/800 350V250V 2.90	1 Watt 2R2 to 10M (10 Pack) 0.39	Decca 100 6.3 GEC 1028 6.3
Freezer 1.04 Aero Kleen 0.86	black) 0.12 Phono Plug Metal 0.22	MIN PLATE CERAMIC	Philips 600 300V 2.50	2 Watt 4R7 to 10M (10	GEC 2040 6.3
Silicone Grease	Phono Line Skt 0.18		Philips 2200 63V 1.55 Philips 470 250V 2.00	Pack) 0.60	GEC 2110 6.3
aerosol) 1.10		1.8PF to 12,000PF 0.05	Philips 470 250\(2.00 \) Philips (G9) 600 300\(2.80 \)	DECICTORC	GEC 2200 6.2
Silicone Grease (tubes) 1.70 Foam Cleaner 0.92		10,000PF to 12,000PF 0.06	PYE 200/200/100/32 2.85	RESISTORS	Grundig 5011 6.:
Plastic Seal 0.96	DC Chassis Skt 2.1mm &	POLYSTYRENE 160V	PYE 600 300V 2.80 RRI 2500/2500 30V 1.20	(WIREWOUND)	ITT CVC 5/8 6.: ITT CVC 20 6.:
leatsink Compound 1.20	2.5mm 0.19 Coax Plug 0.15	10PF to 820PF 0.07	RRI 220 400V 2.90		ITT CVC 20 6.: ITT CVC 45 6.:
Golda Mop 0.75 Video 40 0.93	Coax Plug 0.15 Coax Coupler 0.15	10,000PF to 15,000PF 0.09	Thorn 150/160/100 300V 1.90	2½W/ OR22 to 10R 0.15	Korting 90° 6.5
uper 40 1.60	1" Mono Jack Plug 0.15	TANTALUM BEAD	Thorn 4700 25V 0.85 Thorn 1000 70V 0.70	5W OR47 to 6K8 0.15 7W OR47 to 12K 0.15	Philips 520 6.
dd 30p per can additional	" Stereo Jack Plug 0.27	.1MF 35V 0.16	Thorn 200/100/100 350V 2.85	11W DR1 to 18K 0.18	Philips 550 6.
ost	3.5 Mono Jack Plug 0.12 3.5 St Jack Plug 0.25	.15MF 35V 0.16	Thorn 175/100/100 400V 2.40	17W IRO to 6K8 0.24	Philips G9 6. Philips 570 6.
01050	≟" Jack Line Coupler	.22MF 35V 0.16	Thorn 400 400V 2.50	PRESETS	Philips KT3 8.
OLDER	Mono 0.22	.33MF 35V 0.16 .47MF 35V 0.16		FRESEIS	PYE 691/697 6.
	}" Jack Line Coupler Stereo 0.25	.68MF 35V 0.16	PUSH BUTTON	U-in-tel and Vartical	PYE 713 5 lead 6.
Mini Pack 0.35	1" Mono Jack Chassis	1MF 35V 0.16	UNITS	Horizontal and Vertical Standard and sub mid sizes	PYE 713 4 lead 7. PYE 725/731 6.
(ilo 18SWG 7.00	Socket 0.24	1.5MF 35V 0.16 2.2MF 35V 0.17	_	100R to 4M7 0.12	RRI 823 7.
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	3.5mm Socket 0.10	4.7MF 35V 0.18	Decca 30 6 way 7.80	MAINS DROPPERS	Tandberg TV2-2 6.
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		22MF 16V 0.24	GEC 2136/7 8.90	Decca 20 mono 1.35	Thorn 1500 5 stick 5. Thorn 3000/3500 7.
ntex 15W Iron 6.25	D.I.N PLUGS	MIXED DIELECTRIC	GEC 2112 Conversion 13.00	Decca 30 3R9 0.60 Philips G8 2R2 + 68R 0.84	Thorn 8000 4.
ntex 25W Iron 6.60	2 Pin 0.10		Hitachi 190 4 way 8.95 ITT CVC5 7 way 10.00	Philips G8 47R 0.50	Thorn 8500 6.
ntex 15W Bit 0.70	3 Pin 0.10	.01 1000V 0.24 .01 1500V 0.25	ITT CVC8/9 12.85	Philips 210 (no link) 1.10	Thorn 9000 7.5
ntex 25W Bit 0.75	4 Pin 0.14 5 Pin 180° 0.19	.022 1000V 0.28	ITT CVC20/30 6 way 8.00	Philips 210 (with link) 0.95 PYE 725 3R3 1.79	Telpro 561 7. Seimens Universal 5.
esolder Pump 6.00 ozzle 0.85	5 Pin 240° 0.19	.033 1000V 0.28	ITT CVC 25 6 way 8.50 Philips 520 11.00	UMc B69 68 L + 56R 1.40	TV11 0.
ntex Elements 15W &	5 Pin 360° 0.19	1 1000V 0.30 1 1250V 0.46	Philips 550 13.55	PYE 725 + 56R + 3R 1.55	TV13 0.
5W 2.50	6 Pin 0.23	.1 2000V 0.75	Philips G11 22.50	RR1 823 56R + 68R 0.85	TV18 0.
	7 Pin 0.23	.22 1000V 0.48	PYE 713 4 way 8.70	Thern 1500 1.55 Thern 1600 1.45	
NIXED PACKS	DIN HNE COCKETE	.22 1250V 0.60	PYE 715 6 way 13.50 PYE 725 (UHF-VHF) 13.50	Thern 3500 0.97	LINE OUTPUT
	D.I.N. LINE SOCKETS	.47 1000V 0.79	RRI 823 4 way 8.75	Thern 8000 1.20	
	2 Pin 0.11	8KV OISCS	RRI 823 6 way 9.50	Thern 8500 0.97 Thern 8800 0.97	TRANSFORMERS
lixed Dust Cores 0.70	3 Pin 0.22 5 Pin 180° 0.22	180PF, 210PF, 270PF, 330PF,	RRI T20 6 way 10.50 RRI Z718 6 way 9.50	Thern 9800 0.90	A
ransistor Mount Kit 0.70 yds Assorted Wire 0.50	5 Pin 240° 0.22	500PF 0.30	Thorn 3500 6 way 2.75	GEC 2110 0.85	Autovox 90° 9. Autovox 110° 9.
00 Capacitors 1.00	6 Pin 0.23	POLYESTER 250V	Thorn 8500 6 way 2.75	CONVERGENCE	Decca 1700 Mono 9.
00 Carbon Res 1.00	7 Pin 0.23	.01MF 0.06 .022MF 0.06	Thorn 9000 6 way 2.75	l	Decca 1830 9.
00 2½ Watt Virebounds 2.00	D.I.N. CHARAS	.033MF 0.06 .047MF 0.06	Thorn 1615 4 way 8.70 Telpro 4 way 8.50	COMINOES	Decca 2230 8.
2.00	D.I.N. CHASSIS SOCKETS	.068MF 0.06 .1MF 0.07 .22MF 0.08 .33MF 0.08	3.00	ED 70 100 100 100 100 000	GEC 2110 9. GEC 20AX (diode split) 12.
ECHA CDT-		.47MF 0.13 .68MF 0.13		5R 7R 10R 12R 15R 20R 50R 100R 200R 500R 0.38	Grundig 1500 mono 13.
EGUN C.R.T.s	2 Pin Switched 0.10 2 Pin Unswitched 0.12	1MF 0.16	FUSES	G8 Metric 10R 15R 20R 0.50	Grundig 5010 11.
,501 1741141117/	3 Pin 180° 0.22	MYLAR FILM 100V	. 5010	Thorn 50R 200R 0.50	ITT CVC5/8 10.
44 074V	5 Pin 180° 0.22	.001MF 0.06 .0022MF 0.06	00 4/0 /00 0	TUCDMICTORS	ITT CVC20 10.1 ITT CVC30 8.1
44-271X 32.00 47-342X 32.00	5 Pin 240° 0.23 6 Pin 0.23	.0047MF 0.07 .01MF 0.07	20mm A/S (10 Pack) 100mA, 160mA, 250mA 1.50	THERMISTORS	ITT CVC45 8.
47-343X 32.00	7 Pin 0.25	.022MF 0.07 .033MF 0.08	315mA 1.20	ļ	Indesit mono 10.
19-192X 32.00		.047MF 0.08 .068MF 0.09 .1MF 0.09 .22MF 0.13	500mA, 630mA, 800mA 0.95	PT34P 0.85 PT37P 0.85	Korting 90° 10.
51-110X 32.00 56-120X 32.00	O.I.N. PCB	.47MF 0.22	1A, 1.25A, 1.6A, 2A 0.95	PT37P 0.85 PTH451A 0.75	Korting 110° 12.
56-140X 33.00	SOCKETS	DISC CERAMIC 50V	2.5A, 3.15A, 4A, 6.3A 0.95 20mm Q/B (10 Pack)	VA1026 0.50	Philips 210 9. Philips G8 8.
56-500X 45.00	2 Pin Unswitched 0.25	.01MF, .022MF, .047MF,	160mA, 250mA, 315mA,	VA1104 0.60 GEC Dual 1.60	Philips G9 8.
66-120X 37.00 66-140X 38.00	5 Pin 180° 9.24 FM Plug 0.20	.1MF 0.04	500mA, 630mA, 800mA, 1A,	G11Transient VDR 0.42	Philips G11 12.
67-120X 38.00	FM Socket 0.19	S CORRECTION	1.6A, 2A, 3.15A 0.45 1¾" A/S (10 Pack)	_	Philips K30 14. Philips KT3 7.
60-120WR 14.00	AM Plug 0.20	.91MF G11 0.55	250mA, 500mA, 630mA 1.50	VALVES	Philips KT3 7.5 Philips 570 9.5
1-120WR 15.00 rriage £8.00 per tube +	AM Socket 0.19		800mA, 1A, 1.25A, 2A 1.50		PYE 691 P.C. 13.
T	DATTERY HOLDER	ELECTROLYTIC 25V	2.5A, 3A, 5A 2.30	30FL1 1.20	PYE 725 8.1
	BATTERY HOLDERS	10MF 0.08 22MF 0.08 47MF 0.09 100MF 0.09	250mA, 1A, 1.5A 0.60	DY86 0.75 DY802 0.75	PYE 731 8. PYE 169 10.
ERIAL ISOLATORS	HP7 2 per side, end to	220MF 0.15 470MF 0.22	2A, 3A, 5A 0.60	ECC82 0.75	RRI 640/793 11.
CHINE IGUENTURS	end 0.28	1000MF 0.33 2200MF 0.50	Mains Fuse (10 Pack)	PCF80 0.85	RRI 774 12.
	HP7 2 per side, side by	ELECTROLYTIC 40V	2A, 3A, 5A, 13A 0.90	PCF802 0.95 PCL82 0.85	RRI 823 11.
mm×40mm with 500mm	side 0.28 HP11 4 end to end 0.37	470MF 0.30 2200MF 0.70		PCL84 0.85	RRI T20 12. SABA 12.
ad 0.60 mm×65mm with 430mm	HP11 2 rows single		LOUDSPEAKERS	PCL85 0.95	SABA 12. Skantic 12.
ad 0.60	sided 0.37 PP9 Press Stud 0.10	ELECTROLYTIC 63V		PCL86 0.95 PFL200 1.20	Thorn 1500 20" 7.
ilips Plastic Moulded	PP9 Press Stud 0.10 PP3 Press Stud 0.10	1MF 0.08 2.2MF 0.08 4.7MF 0.08 10MF 0.08	8 × 5 16 ohm 2.98	PL36 1.25	Thorn 1500 24" 7.
pe for KT3 Chassis 0.80	0.10	22MF 0.11 47MF 0.12	6 × 4 16 ohm 2.60	PL504 1.60	Thorn 1591 10.1
	CRT-VALVE BASES	100MF 0.19 220MF 0.30	6 × 4 25 ohm 4.30	PL508 2.30 PL509 5.80	Thorn 1615 10.1 Thorn 1690/1 8.
DEO HEADS		470MF 0.42 1000MF 0.65	8 × 3 70 ohm 3.40 5 × 3 50 ohm 3.00	PY800 0.89	Thorn 9000 10.9
	T20 CRT Base 1.35	ELECTROLYTIC 100V	7 × 3½ 16 ohm 3.00	PY500A 2.30	Thorn 9600 10.0
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ISS Nat Pan 34.00	B7G Ceramic 0.55	2.2MF 0.10 4.7MF 0.10	Thorn 1590 large 4.00		
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shiba 39.00	B10B Ceramic 0.55	47MF 0.17 100MF 0.26 220MF 0.45 330MF 0.55	TUNERS		
		ELECTROLYTIC 250V		PACKING TO YOU	
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00KS		0.47MF 0.11 1MF 0.14	1043/05 7.95	DESPATCHED B	
_	Twin Bladed Bronze- Phosphor 0.25	0.47MF 0.11 1MF 0.14 10MF 0.28 22MF 0.31	1043/05 7.95 1043/06 7.95 U321 7.25	DESPATCHED B	Y RETURN AND
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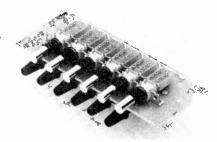
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AA117 0.090 BC157 0.055 BD222 0.310 BU108 1.000 DC20 1.800 TIP29C 0.250 3N.128 0.550 2SA473 0.370 28 pin 0.200 AA119 0.090 BC159 0.065 BD225 0.310 BU110 1.100 DC200 1.800 TIP30 0.160 3N.143 0.650 2SB4 0.250 40 pin 0.250			
4410 0000 DOISO 0000 0000 0000 0000 0000 0000 0000	PCL82 0.630	LM723 0.320	LED 5mm
AAT19 0.090 BC159 0.095 BD225 0.310 BUT10 1.100 DC200 1300 [1P30 0.160 [3N.143 0.660 [2\$B54 0.250 [40 pin 0.250	PCL84 0.500	LM741 Dil 0.150	YELLOW 0.100
AAY32 0.090 BC182 0.060 BD232 0.310 BU111 1.400 0CP71 1.000 TIP31A 0.240	PCL85 0.550		LED 5mm
ACIU/ 0.280 BC182L 0.060 B023/ 0.210 B0126 0.700 0RP12 1.000 11P32 0.240 119.514 0.020 3CD223 1.200 MAINTE	PCL86 0.550	Met 0.450	GREEN 0.100
AC120 0.170 DC103 0.000 DD230 0240 D0204 0.730 OFF00 1.000 11732A 0240 M4401 0.070	PCL805 0.550		GREEN U,100
1 MC127 0.130 DC103L 0.000 DC103 0.200 DC203 0.700 DR101 1.000 11133 0.300 MARCE 0.000 DC103L 0.0			BRIDGE
Panner Dane	PFL200 0.850		
ACIAN 0.200 DOOR 0.000 DOOR 0.000 DOOR 0.000 ROOM 0.000	PL36 0,800		RECTIFIERS
AC140V 0.220 BC3121 0.000 BD523 0.400 BU320 0.000 TTD42A 0.220 IN 4006 0.040 ECC83 U.430	PL504 0.950		1A/50V 0.160
AC153K 0.230 RC213 0.050 RD538 0.400 RU406 0.850 3A5500 1.100 TIP42C 0.250 IN.4007 0.050 25C1161 1.100 ECC84 0.400	PL508 1.900		1A/100V 0.180
AC176 0.180 BC213L 0.060 BDX32 1.000 BU407 0.750 Chizengalis and TIP47 0.400 IN.4148 U.UZU 2501721 1.500 CC65 0.400	PY81 0.700		1A/200V 0.190
AC176K 0.200 BC214 0.060 BDX65 0.800 BU408 1.000 SN76013N1400 TIP48 0.400 IN.5400 0.090 2.5C1279 0.240 ECH81 0.490	PY88 0.480	600 0.300	1A/400V 0.210
AC187 0.150 BC214L 0.050 BF180 0.160 BU500 1.100 SN76023N1.400 IIP49 0.400 IN.540 0.100 ZSC1306 1.000 ECH84 0.520	PY500A 1.600	BYX55/	1A/600V 0.230
AC187K 0.200 BC237 0.070 BF181 0.100 BU526 0.000 SN76033N1.500 TIP110 0.470 N.5402 0.100 2SC1307 1.000 ECL80 0.570 AC188 0.170 BC238 0.070 BF183 0.200 BY126 0.000 SN76033N1.500 TIP112 0.540 N.5403 0.110 2SC1500 0.350 FCL80 0.570		600 0.300	1A/800V 0.280
AC100V 0.700 BC200 0.450 BC204 0.200 BV123 0.000 SIV/BITUNU/UU TID145 0.450 IN/SAM 0.110 2.5C1320 0.230 ECL02 0.330	ZENERS	BYX55/	2A/ 100V 0.350
ACV18 0.480 BC201 0.180 BE185 0.200 BV133 0.000 SV70115 0.700 IN.5405 0.120 25C1969 1.300 ECL84 0.570	400MV	800 0.320	2A/200V 0.360
ACY19 0480 BC302 0.180 BF194 0.050 BY164 0.220 SN/526 0.900 TIP120 0.430 IN.5406 0.130 2SC2029 1.200 ECL85 0.570	BZY88 Range	BYX70/	2A/ 400V 0.420
AD142 0.600 BC303 0.180 BF195 0.050 BY176 0.850 SN/0227 0.800 TIP121 0.460 IN.5407 0.130 2SC2078 1.200 ECL86 0.490	2V7 to 39V0.060	500 0,290	2A/600V 0.540
AD149 0.450 BC327 0.060 BF196 0.060 BY179 0.350 T2800D 0.520 T1P122 0.470 IN.5408 0.130 2SC2122A 2.000 EF80 0.310	1.3W Zeners	BYX70/	2A/800V 0.580
AD161 0.220 BC382 0.060 BF199 0.060 BY182 0.320 TAGGG-60 0.420 TIP125 0.470 VOLTAGE 2SC2952 0.270 EF85 0.340		500 0.310	3A/200V 0.660
1 AUTO2 0.220 DC337 0.000 DF200 0.100 DT104 0.320 TAU321- TIF126 0.300 BEQUEATORS 25D234 0.370 EPRO 0.420	BZX61 Range	BYX70/	3A/400V 0.680
Mr. 124 0.250 0.050 0.050 0.160 0.160 0.160 200 0.720 11F127 0.300 300 0.720 11F127 0.300 300 0.720 11F127 0.300	2V7 to 39V0.120	800 0.360	3A/600V 0,780
AF125 0.250 BC557 0.060 BF258 0.100 BY196 0.200 TAG4443 0.760 TIP2955 0.340 7805 0.350 MB3712 1.500 EF184 0.530		BYX71/	6A/ 200V 1,000
AF127 0.250 BCY33 1.500 BF336 0.200 BY207 0.110 TAA550 0.160 TIP3055 0.340 7815 0.350 TA7205 1.500 EL34 1.900	MEMORIES	600 0.800	6A/400V 0,800
AF139 0.220 RCV24 1.500 RF337 0.200 RV223 0.720 TRA120S 0.450 TISS1 0.150 7818 0.350 (190575 1.000 FV86 0.310	2114 0.750	1	25A/100V 1,600
AF239 0220 BCV42 0200 BF338 0200 BYX10 0.150 TBA395 0.600 TIS90 0.150 7824 0.350 EY87 0.310	2716 2.200	İ	
AL112 0.700 BCY56 0.160 BF362 0.300 0.000 TBA396 0.600 TIS91 0.180 7005 0.350 ICS PC97 1.000	2532 2.900	LED	ELECTROLYTIC
AL113 0,800 BCY70 0.160 BF422 0.210 CA200 0.000 TBA520 0.750 7012 0.400 SDCMCTS PCCS 0.420	2732 2.900	LED 3mm	4700UF-16V
ASZ15 1.000 BCY/1 0.160 BY456 0.190 0.4000 4.700 BASSU 0.750 7015 0.400 0.55	2764 5.000	RED 0.050	CAN 0.200
ASZ17 1.000 BCY72 0.160 BF459 0.190 CA3240 0.900 TBA540 0.750 2N.2904 0.200 7915 0.400 8 pin 0.000 PCF80 0.500 PCF20 1.350	4116 0.750	LED 3mm	CAN 0200
AU110 1.000 BD124P 0.500 BFX84 0.200 C106D 0.230 TBA800 0.350 2N.2305 0.180 7924 0.400 16 pin 0.090 PCF8D1 1.100	6116 3,000	YELLOW 0.100	TRIPLERS
AV400 4 000 DD404 4 000 DD405 4 000 D44000 4 000 D44000 4 000	_M324 0.300	LED 3mm	LP1195
AY102 1800 BD124 1.100 BFX85 0.200 MC1327 0.700 BA810S 0.500 2N.2907 0.180 78L05 0.280 18 pin 0.120 PCF802 0.570 AY106 1.800 BD128 0.350 BFX87 0.150 MJ2500 1.000 TBA820 0.750 2N.2926 0.080 78L12 0.280 20 pin 0.140 PCF806 1.150	LM380 0.600	GREEN 0.100	(4000Ser) 2.250
BD131 0.250 BFX88 0.150 M.12501 1.100 TBA920 0.800 2N.3019 0.280 78115 0.280 20 ain 0.160 BCH200 1.000	LM381 1,000	LED 5mm	(4000381) ZZ30
BA145 0.100 BD132 0.250 BFY50 0.140 M12955 0.550 TBA950 0.800 2N.3053 0.180 74118 0.280 2010 0.550	LM709 Dil 0.300	RED 0.050	Į.
BANNO 0.100 BD133 0200 BP131 0.140 MJ3000 1.150 BANNO 0.300 2NJ3054 0.330 74L24 0.280	LIVI700 011 0200	1120 0.030	1
BA154 0.060 BD136 0.200 BFY52 0.140 MJ3001 1.150 TCA800 0.800 2N.3055 0.320 MJ3001 DCA800 0.800 2N.3055 0.320 DCA800 0.800 0		L	<u> </u>
I DOLOR OLD DOLOR COMPLETE COM	nd VAT at 15	%. Govt. Coll-	eges, etc.
Date of the Date o	ders accepte		
BB103 0.160 BD139 0.200 BF164 0.230 MJE340 0.250 1DA1412 0.000 2N.371 1800 LM323K 4200 Quotations g			
BB205B 0.240 BD144 0.900 BSX19 0.150 M F520 0.300 TDA2003 1.500 2N.3772 0.900 LM723 0.320			
[BC107 0.070 BD150 0.300 BSX20 0.150 M E2955Kn ann IDA2020 1.400 2N.3773 1.000 78HGKC 5,700 Iease and	ow 7 days for	,	
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BC115 0.100 BD166 0.300 BSX29 0.190 DA90 0.040 TDA2530 0.800 2N.4037 0.250 79GUIC 2.150 BC118 0.110 BD175 0.300 BZX76 0.180 AD91 0.040 TDA2532 0.750 2N.4443 0.760 79HGKC 6.700	IDATA	LTD	
BC148 0.110 BD175 0.300 B2X76 0.180 AU91 0.040 IDA2532 0.750 2N.4443 0.760 79HGKC 6.700 BRAP	NDATA	LID.	
BC141 0.190 BD179 0.320 BT109 0.900 0A202 0.070 TDA2560 0.700 2N 5061 0.200 JAPANESE	DIALAY DDE	CTON DOM	0
		FNGLAND),
BC143 0.190 BD201 0.330 BT119 1.000 CC29 0.800 TDA2640 0.800 2N.5296 0.300 2SA73 0.300 WEMBLEY.	MINDRESEX	, =100001100	
BC143 0.190 BD201 0.330 BT119 1.000 CC29 0.800 TDA2680 0.800 2N.5296 0.300 2SA73 0.300 WEMBLEY, U BC147 0.065 BD202 0.380 BT120 1.000 CC35 1.000 TDA2680 0.700 2N.6106 0.400 2SA104 0.320			
BC143 0.190 BD201 0.330 BT119 1.000 0C29 0.800 TDA2680 0.800 2N.5296 0.300 2SA73 0.300 WEMBLEY, I BC147 0.065 BD202 0.380 BT120 1.000 0C35 1.000 TDA2680 0.700 2N.6106 0.400 2SA104 0.320 BC148 0.055 BD203 0.420 BU104 1.000 0C45 0.500 TIP29 0.150 2N.6107 0.400 2SA108 0.220 Telephone: 0		& 904-11 1 5/	

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(minimum 12 words), box number 70p extra. All cheques, postal orders etc., to be made payable to Television, and crossed "Lloyds Bank Ltd". Treasury notes should always be sent registered post. Advertisements, together with remittance, should be sent to the Classified Advertisement Dept., Television Room 2612, IPC Magazines Limited, Kings Reach Tower, Stamford Street, London SE1 9LS. (Telephone 01-261 5846).



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4/84

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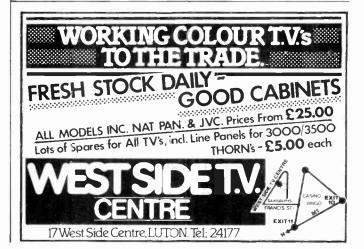
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ZF 43 10p	E 1611 25p E 5359 10p F 5444 10n	BYX 71/600 50p BYX 72/300 20p BYV 95B 10p	"C" Nicad "D" Nicad Duracell PP3 6
ZF 47 10p ZF 82 10p ZPD 3.9 10p ZPD 4.7 10p	E 5577 10p E 8018 25p E 9004 10p	BVY 95C 12p BYV 96D 10p BYZ 106 10p	* X * microphone/speaker Continental 2 pin plug with S * t mains lead (black & blue) 5 for 7 * Ferrite rod with LW/MW coils 5
ZPD 5.6 10p ZPD 10 10p ZPD 47 10p	E 9005 10p TIC 106a 30p TIC 116m 40p	BPW 41 15p BYW 56 2A/1000v 8p BZY 93c75 50p	Xcekute 5" bent nose plier £3. De-solder pump + 2 nozzels Plastic box for i.c.s with anti-static pad 6"×3"×½" 7
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Z714 RANK IF Panels 6MH	z 1	140/100	25p		
I C. SL437F	£3.00	470/100	20p	300+300/300 225+25/380	£1.00 70p
Z909B RANK IF Panels		2000/100	70p	200/100/100/350v	£1.50
Export 5.5MHz 2 I.C.'s		4700/100	75p		50p
TBA1205B TCA2705Q	£2.50	47/160	10p	500/500/25v 150/150/100/300v	75p
Z743 RANK IF Panel		800/160	50p	150/150/100/300v 200/150/150/300v	1.00
Export 5.5MHz 3 LC.s		.1/250 Pulse	5p		
TBA750+SC9504P+		G11 0.47/250	10p	ITT Panels	2200
SC9503P	£1.50	2.2 250v	10p	CMA 10	£2.00
Pye G11 Front panel with		3n3/250 A.C.	10p	CMA II	£2.00
transducer, pots, tuner pots, 6	pb	.39/250V	15p	CMA 30	£2.00 £1.50
switch+lead	£5.00	4n7/250 tested 5KV	25p	CMA 40	
GEC V/cap VHF/UHF tuner		22/250	15p	CMC 10/2	£5.00
1F+ sound O/P PC 7 0 6B3		47/250	10p	CMC 16	£4.00
(Export)	£12.00	100/250	20p	CMC 38	£8.00
GEC Line O/P PC 6∮9B3	£10.00	G11 470/250V	£1.75	CMC 45 CMC 47	£1.50 £1.00
GEC Power Supply		500/250	50p		
(Export)	£10.00	GEC600/250	60p	CMC 52 CMC 57	£15 £6.00
G11 dynamic correction pane	el £6	700/250	£1		
CVC 20 Front panel with slid	lers +	800/250	40p	CMC 58 CMC 59	£8.00 £8.00
mains input panel	£4	32/300	20p	CMC 67	£3.75
CVC 40 PUSH BUTTON A	SSY	4/350	5p	CMC 67/2	£4.00
with sliders: complete with la	mp	8/350	8р	CMC 67/2	£4.00
assy + pots	£14	12/300	10p		£10
CVC 5 Mains on/off + 5 por	ts £2	4.7M/350v	10p	CMD 12 CMD 32	£5.00
GEC Convergence ganel	£1	16/350	25p	CMD 32 CMD 33	£5.00
Universal Focus, Fits Pye, Th	orn	33/350	20p	CMD 33 CMD 40	£5.00
and Decca Units.		50/350	10p	CMD 40 CMD 41	£5.00
Large Type	75p	220/350	30p	CMF 25	£2.00
Decca Small	7 5 p	300/350	40p	CMF 23	
K I'3 Focus Unit	75p	400/350	50p	CMF 26	£2.00 £1.50
CVC 32 Focus Unit		10/375	l Op	CMF 31 CMF 40	£1.50 £2.00
Focus Rod	25p	22/375	15p		
G11 focus	£2.00	220/385	75p	CMH 10	£1.50
ITT Small for use with Split	_	330/385 CVC 820HT	60p	CMH 31	£1.00
Diode	50p	0.1/400	15p	CMK 12 (untested)	£4.00
TV11	50p	KT3 E/W .39/400	20p	CMK 30 (untested)	£4.00
Remo TV12SP	50p	.56K/400v	20p	CMN 20	£1.50
TV13	50p	4700pf/400	10p	CMN 21	£1.50
TV14	50p	.22/400	10p	CMN 40	£1.00
TV18	60p	8/400	15p	CMN 45	25p
TV20	£1.00	33/400 400/400	20p 40p	CMP 10 CMP 11	£2.00 £2.00
TV45	50p	394K/400V	20p	CMP 30	£2.00
Thorn 14/1500 rec slick 16 Button Key Pad I to 0 +	5p	220/450	40p	CMP 40	£2.00
#+ 4 blank (Cherry)	£3.00	.47/500	25p	CMS 11	£2.00
Condensers	13.00	0.1/600	15p	CMS 40	£2.00
470/16	6m	.047/600	15p	CMU 12	£10.00
1500/16	6тр 20тр	0.047/1000	10p	CMU 14	£8.00
3300/16	20p	0.01/1000	10p	CMU 30	£7.00
10000/16	25p	0,1/1000	10p	CMU 40	£7.00
15000/16	50p	.15/1000	20p	CMU 45	£5.00
3300/18	20p	.47/250V A.C.	10p	CMZ 30	£5.00
47/25	5p	.47/1000	50p	GMA 90	£5.00
470/25	5p	.001K/1250	10p	GMC 120	£2.50
680/25	5 p	0.0047/1500	10p	GMR 64	£5.00
1000/25 Radial	ПФ	.005/1500	10p	TMN 2	£2.00
1500/25	10p	.0105/1500	10p	VCA 20	£10 610,00
3300/25	20p	1n8/1500	15p	VCA 21	£10.00 £3.00
4700/25	25p	2n0/1500 2n2/1500	10p 15p	VMC 26 VMC 34	£5.00
5000/25	25p 2⊕p	G11.11000/1500	15p 15p	VMC 44 + 45	£4.00
3500/30 470/35		.01/1600	15p	VMC 51	£5.00
2200/35	6р 25р	G11.8200/2KV	15p	Hand Sets	
100/40	25 p	G11.8200/2KV 0.1/2KV	20p	Transducer Hand Set Insert	
220/40	.эр 5р	10n/2KV 3n9/2KV	15p	crystal, transducer, SAA 11:	
400/40	20p	3n9/2KV	15p	lead	£3.50
1250/40	20p	0.0015/2KV	10p	Thorn 4000 insert with 7	
1500/40	20p	5n2/2KV 6n2/2KV	10p	buttons	£5.00
2500/40	2.5p	20n/2KV	15p 15p	Decca RC 11	£14.00
1000/50	20p	20n/2KV 2n0/2KV	15p	Decca RC 12	£14.00
1250/50	25p	2n2/2KV	15p	G11 Infra-red full teletext	£19.00
2000/50	20p	7500pf/2KV	10p	C11 Ultrasonic full teletext	for
3000/50	25p	4n7/2KV	15p	G26c 674/02 and G22c	l
Infra Red and Ultrasonic G1	1 Teleter	t Decoder Panel	£30	66/02	£16.00
RANK & ITT Mains Remot			£1.50	Philips, 2 button	€8.00
RANK & IIT Mains Remot	e Switch	2865 ohm	£1.50	Rank, Infra-red	£10.00
RANK & ITT Remote Swite			£1.50	Dynatron-Full remote CTV	62.
G11 Mains Switch			50p	63, 64	£19.00
4 amp Mains Switch			25p	Philips full remote KT3, 160	
GEC Mains Switch 4 amp			30p	20C934; 7228/7324; K12 2	
KT3 Mainswitch			£1.00	797/IST 66K 1826	£12.00
THORN Rotary Mains Swite	n		50p	G11, Full remote top buttor assy.	£12.00
G8 Mains Switch			75p		
Thyristor 600/4 amp C106/2			24p	G11, Full remote repair ser	
GI1 Preh Red LED P/Butto			20p	(exchange unit) Philips infra red full remote	£12.00
RANK TOSHIBA Transduc	tors TPC	-2011	50p	Philips infra red full remote channel for 60 CP2605	£6.00
CVC 5 Mains on/off	+5/MIV F	est on Panal	£1 00	Philips infra red full remote	
+250K+100K+500K+50K Thorn 12 or 24 volt	TOUK I	ot on Panel convertor for portable	£2.00	channel for 60 CP2605	£12.00
Thorn 12 or 24 voit Γ/V	vanery		O Post £1	KT 3	£12.00
4 / Y			o romati	1 "	

Tuner Units	0=1:5=		SAA1176 £3.00	SN76003	£1.00	Transistors	
GEC or Hitachi 6 push button unit £12 ELC 1043/06 (AEG) £6	SENDZ co		SAA1250 £3.00 SAA1272 £3.00	SN76013ND SN76018 SN76008	£1.50 £1.00 £1.00	A1222 A1223 AC106	15p 15p 15p
ELC1043/05 Mullard £6.00 ELC1043 (Ex Panel) £3.75	63 Bishopsto Shoeburyness, ES	eignton, SEY SS3 RAE	SAA1276 £3.00 SAA5000 £1.50	SN76023N SN76033	£1.50 £1.50	AC121 AC124	15p 15p 15p
ELC1042 £5.00	SAME DAY S	ERVICE	SAA5000A £1.50 SAA5012 £5.00	SN76115 SN76131	50p 50p	AC128 AC137	15p 15p
ELC2006 £10.00	All items subject t No Accounts : No	Credit Cards	SAA5012A £4.00 SAA5020 £3.50	SN76141 SN76226	£1.00 £1.00	AC151 AC131	15p 15p
ELC2060 £7.00 Mullard 1043/05 on panel £5.00	Postal Order/Cheq Add 15% VAT, th	ue with order	SAA5030 £5.00 SAA5040 £3.50	SN76226 SN76227 SN76228N	60p £1.00	AC138 AC152	15p 15p
U322 (UHF) £4.00 V314 (VHF) £5.00	Add Postage fo	roverseas	SAA5040A £4,40 SAA5050 £3,50	SN76270 SN76532N	£1.00 £1.00 50p	AC153K AC142K	15p 15p 15p
U341 UHF £7.00 ELC1043/05 Thorn £5.90,	Southend. Tel. 0	702-332992	SAF1032p £2.50 SAF1039 £2.00	SN76544N SN76545	£2.00 £3.50	AC169 AC176	15p 15p
Small V/Cap Mitsumi UHF " £4.00	Open 9-1/2.30-6. GVMT + school headings add 10%	handling charge	SAS560 £2.00 SAS570 £2.00	SN76546 SN76550	£1.00 30p	AC176K AC178K	15p 15p
VHF £3.00 Portable & rotary Tuners Sanyo &	THORN 1400 4P.B. Mech, Tuner THORN 1500 4P.B. Mech, Tuner	BRC-M-200 40p	SA5660 £1.00 SAS670 £1.00	SN76552 SN76570	30p £1.00	AC179 AC186	15p 15p
Mitsumi UHF £5.00 NSF-UHF/VHF Varicap (old	THORN 1590 4P.B. Mech. Tuner THORN 3500 4P.B. Mech. Tuner	BRC 1330 75p	SAF1032P £2 SL901B £5,00	SN76620 SN76650	50p 50p	AC187K AC188	15p 15p
type) £10.00 Mosfit UHF/VHF (new	THORN 8000 4P.B. Mech, Tuner THORN 8500 4P.B. Mech, Tuner	BTT6016 £1.20	SL918 £6.20 TA7122 £1.15	SN76660 SN76620AN	40p 50p	AC188K ACY18	15p 20p
type) £10.00 SONY 1400KV Tuner unit £3.50	All new & boxed.	ВТГ6218 £1.50	TAA320A 50p TAA470 £1.50	SN76666 SN76707N	£1.00 75p	ACY21 AD143	25 p 50 p
FV Sound tuner kit for sound on your Hi Fi £9,50	L Amp 1600s 7p	BIT8224 £1.00	TAA550 25p TAA570 75p	SN76708AN SN76720	75p £1.00	AD149 AD161/162 p	50p pair 40p
Thorn Tuner PANEL with 6×100K pots + cursors NO	3 Amp 100v 7p Delay Lines	CA270CW 50p	ΓΑΑ611B £1.50 TAA621 £2.00	UA783P3C BT100A/02	40p 40p	AF139 AF181	25p £1.00
TUNER £1.00 U321 on panel ITT 40 £6.00	ΓΑU80 £1.00 DL20A 80p	CA920AE £1.00 CA1310 50p	TAA661 £1.75 TAA641 £1.50	BT138/10A BT146	70p 30p	AF239 AF367	25p 25p
Tuner unit VHS Sylvania G FR Videon MTS 900 £2.50	D1.600 £1.00 D1.700 £1.00		TA7117 50p TA7315AP 50p	ГВА540Q ТСА270	£1.50 £1.00	AL102 BC161	£1.75 30p
Thorn 3500 tuner panel with ELC 1043/05+pots £7.00	UDL11 30p KT 3 Luminence 75p	CA3094AE 50p CA3123 40p	TA7607AP 40p TA7609P 50p	TCA270Q TCA640	£1.00 £1.00	BD138 BD229	30p 20p
Mullard Video Modulator. Application, video tape recorders,	Luminance Delay Line (CVC 45) 10×630ma fuse 25p	CA3146 £1.00 CA3189 40p	ΤΒΑ120A 40p ΓΒΑ120AS 50p	TCA660 TCA270S	£1.00 £1.00	BD437/438 on heat sink	60p
TV cameras, video games, closed circuit T/V, C.C.I.R. system. Data	10×2A fuse 50p 10×3.15 fuse 50p Co-Ax Joint 12p	CBF16848 50p CD4510 30p	TBA120SA 40p TBA120B 40p	TCA270SQ TCA740	£1.00 £1.00	BD507 BD509	50p 30p
supplied. £10.00 VT 100 Sound Tuner Kit. TV.	Co-Ax Joint 12p Co-Ax Belling Lee Plug 12p Co-Ax Splitter £1.00	HA1196 40p	TBA120SB 40p TBA120SQ £1.00	TCA800 TCA830	£2.00 £1.00	BD510 BD517	30p 30p
Viosound. The latest design in low noise fitted with DNR, RF output	UHF Modulator CCIR £3.00 Infra Red Emitting Diode 20p	HA11223 40p	TBA120U 75p TBA120Q 30p	TCEP100 TCE120CQ	£2.25 £1.00	BD519 BD534	30p 30p
and audio £30.00	NE286H Small Neon Lamps GEC 5p	HEF4001 10p HBF4011AF 10p	TBA120C 40p IBA1441 £1.00	TDA440Q TDA1003A	£1.00 £1.00	BD535 BD544D BD562	30p 30p
Sylvania UHF VHF F6013 (Fits Rank) £6.00 Sylvania F6003 £6.00	Mullard 5 Watt Amps. LP1162 New 75p		TBA231 75p TBA395O 50p TBA396O £1.00	TDA1010 FDA1060A	£1.00 £1.50	BD562 BD610 BD646	30p 40p
Sylvania UHF F4720B £6.00	T.V. Tubes	M1024=SAA £2.00	ГВА396 75р	TDA1151 TDA1170	30p £1.00	BD676A	50p 30p
Sylvania VHF 9(0) £6.00 Decca Bradford Tuner 5 Button £4.00	12" A31/300 Hitachi £12 15" A38/170W Hitachi £8	MC476p £1.00	TBA440P £1.00 TBA1440C £1.00	TDA1190 TDA1327A	£1.00 £1.00	BD678 BD681	50p 25p
Small Funer DX 175-220MHz Auto Changeover £5.00	18" Hitachi PIL tube with scan coils £25	MC1330 75p	TBA480Q £1.00 TBA510 £2.00	TDA1412 TDA2010	50p £1.00	BD807 BD826 BD948	20p 50p 30p
9000 Thorn Tuner on Panel £7.00 D.P.D.I. switch Black knob:	Integrated Circuits AC76003 £1,50	MC1349 50p MC1352 £1.00 MC1358 £1.00	ΤΒΑ510Q £2.00 ΓΒΑ520 £2.00 ΓΒΑ530 £2.00	TDA2140 TDA2522 TDA2532	£3.50 £1.00 £1.00	BDX75 BDX32	20p £1,25
Chassis or PCB mount 4p each or 40 for £1.00	AC70003 \$1.50 AM251.S23PC 10p BAV40 40p		TBA530 £2.00 TBA540 £1.00 TBA550Q £2.50	TDA2540 TDA2541	80p £1.00	BF115 BF121	20p 20p
BFT43 10p 2SC2073	8p BC350 20p	MC14016 25p	TBA560CQ £2.00 TBA570 £1.50	TDA2575A TDA2590	£1.00 £1.00	BF127 BF137	20p 20p
BFT84 8p 2SC2122A BFW11 20p 2SC2229	£1.00 BC365 10p 15p BC384 10p	MC14069 15p MC14514 50p	TBA625 50p TBA641 £2,00	IDA2593 TDA2560	£1.00 50p	BF157 BF160	20p 20p
BFX29 30p 2SC7350 BFX84 25p 2SD180 TC	15p BC394 10p D3 80v/ BC413 10p	MC1748 80p MCM2114 75p	TBA651 £2.00 TBA673 £1.00	ΓDA2600 TDA2611	£5.00 £1.00	BF161 BF164	20p 60p
BFY50 15p 6A BFY52 20p 2SD200	15p BC414 10p £2.00 BC416 10p	MEM4956 £1.00 ML231 £2.50	TBA720A £1.50 TBA750Q £1.50	ΓDA2653 ΓDA2002	£1.00 £1.00	BF179 BF180	30p 20p
BFY90 25p 2SK30A BPW41 25p BC107 BRC116 40p BC108	10p BC440 30p 10p BC454 10p	ML236E £1.50	TBA780 £1.50 TBA800 50p	TDA2640 TDA2680	£2.00 £1.00	BF181 BF182	20p 20p
BRC116 40p BC108 BRX43 15p BC109 BRX48X 10p BC113	10p BC455 10p 5p BC456 10p 10p BC460 25p	ML238B £4.00	TBA810AS - 60p TBA810S - 60p	TDA2690 TDA2593	£1.00 £1.00	BF184 BF194	20p 10p
BRY56 30p BC114 BSS68 10p BC115	10p BC462 10p	MM5387 £1.00	FBA820 60p FBA890 £1.00	FDA3500 FDA3500	£1.00 £2.00	BF195 BF196 BF197	10p 10p
BS309 BS79 BS79 BS79 BS79 BS79 BS79 BS79 BS7	10p BC463 10p 20p BC478 10p 20p BC527 10p	MM5840 75p	TBA900 £1.50 TBA920 £1.50	TDA3560 TDA3571Q	£3.50 £1.50	BF197 BF198 BF199	12p 10p
BTY80 20p BC125 BSX19 17p BC126	10n 1 BC 532 19D	NE545B (Dolby) 75p	TBA920Q £1.50 TBA950 £1.50 TBA990Q £1.00	TDA9403 SN74LS 125AN SIL4516	£3.00 30p 50p	BF200 BF222	10p 20p 10p
BSX20 17p BC139 FT3055 30p BC140	10p BC546 10p 10p BC547 10p 30p BC548 10p	NE555 60p	IMS1000NL £4.00 FMS1943	SN16861 SN16862AN	50p 50p £1.00	BF224 BF238	15p 15p 20p
TCE82 30p BC141 2N930 5p BC142	25p BC556 10p 25p BC557 10p	OPT600 30p	(clockchip) £1.00 TMS9980 £4.00	SN16862AN SN16964AN SN29764	£1.00 50p £1.00	BF240 BF244	16p 40p
2N2221 8p BC143 2N2222 8p BC147	25p BC558 10p 10p RC559 10p	SAA611 £1.00	TMS9980 £4.00 TMS9901 £1.00 TMS2716JL £1.00	UA721 UA7300	40p 40p	BF245b BF256	20n
2N2906 10p BC148 2N3055 40p BC153	10p BC635 10p 10p BCX31 25p	SAA1020 £4.00	TMS3529 £1.00 FMS4014 70p	RGP30G MPSA14	10p 10p	BF257	10p 20p 25p 25p 15p 25p
2N3566 10p BC153 2N3702 10p BC157a	10p BCX32 25p 10p BD116 25p	SAA1024 £2.50 SAA1025 £2.50	TX-012 £1,00 TMS9902 £1,20	MPSA43 MJ13005	10p 30p	BF258 BF259 BF262 BF263p	25p 15p
2N3703 10p BC158 2N3705 10p BC159	10p BD124 50p 10p BD124 (metal) 60p	SAA1073 £3.00 SAA1074 £3.00	UPD2114C 4K RAM 400ns 75p	MJE511 MJE340	25p 28p	BF263p BF264 BF271	25p 15p 10p
2N3711 10p BC160/16 2N3583 50p BC171	25p BD130Y 25p 10p BD131 30p	SAA1075 £3.00	ULN2216 75p SN29848 50p	MJE660 MJE661	25p 25p	BF273 BF274	10p
2N3904 15p BC172 2N3906 15p BC173 2N4355 10p BC174	10p BD132/238 30p 10p BD135 25p	SAA1130 £2.50 SAA1174 £3.00	SN29770BN £1.00 SN29771BN £1.00	MJE3055 MJE2801	€1.00 30p	BF324 BF337	10p 25p 50p
2N4355	10p BD136 30p		SN29772BN £1.00 SN74107 £1.00	MJE2955 MJE13005	50p 30p	BF355 BF362 BF363	50p 30p 20p 15p
2N5296 40n BC187	10p BD140 30p 10p BD175 30p	5-5MHz 15p	SN74167 70p SN7472N 20p	Sanikron Diode SKE2G2/04	30p	BF363 BF367 BF391	15p 15p 15p
2N6099	10p BD1/6 25p 10p BD182 £1.00	6MHz 30p	SN75108AN £1.00 SN76001 £1.00			BF391 BF394 BF419	10p 30p
2N6130 50p BC213 2N6133 20p BC214 2N6318 20p BC237	10p BD183 70p 10p BD202 60p	Thyristors	3 Pin Blue Thermistor	TV Crystals	-	BF423 BF448	15p 30p 20p
2N6348 20p BC237 2N6399 10p BC238 2X 2N6099 on heat sink 50p BC250 2SA437 20p BC251	10p BD204 60p 8p BD221 20p 10p BD222 30p	B 106 Plastic 30p BT106 Metal £1,20	1 11111/ 20	P 1 122 4 10		BF450 BF458	20p 30p 30p
heat sink 50p BC250 25A437 20p BC251	8p BD228 30p 10p BD226 20p	BT100 Metal £1.20 BT119 £1.00 BT120 £1.00	20×TO5 Heat Sink £1.0	I 6M11a		BF459 BF468 BF469	30p 30p 30p
2SB407 Sanyo BC252 TO3 10p BC262	10p BD233 30p	BRC4443 75p	board £1.5	Large or small		BF470 BF480	20p 50p
2SB474 30p BC263b 2SB566 10p BC294	20p BD233 30p BD238 30p	Decca 80-100 60p 2N4444 £1.00	panel £2,0	GFC Power Panel	each	BF594 BF597	10p 10p
25C458 50p BC300 25C515 10p BC301	10p BD239 15p 30p BD243c 30p 30p BD244 50p	1.00	CVC 20 to 45 chassis 50	TV106 Thermistor	1.00	BF694 BF758 BF760	10p 30p
2SC732 10p BC303 2SC733 10p BC307	30p BD250a 30p	Thermistors VA1104 35p	Pots 10 k with Switch 25 Pots 47 k with Switch 25 Mullard Surface Ways			BFT34	30p 15p
[2SC1030 £1.00 BC309	7p BD253B 50p 10p BD331 20p	VA1104 35p HTP7266312 15p PTH451 AOR 15p	Filter RW 153P Colour	DIL - DIL	I.C. Holo	DIL - QIL 16 Pin × 10	£1.00
2SC1172A 10p BC327 2SC1173 10p BC328	10p BD332 20p 10p BD373b 20p	PT11451 AOR 15p PT37P Fits Pye & P134 20p Degausing Thermistor (bits	TV Filter 40 Mullard Surface Wave Filter RW 154 Colour	42 Pin × 5 28 Pin × 5	£1.00 £1.00	16 Pin × 10 18 Pin × 10 28 Pin × 4	£1.00 £1.00
2SC1311 20p BC328/338 2SC1419 20p BC337 2SC1546 20p BC338	B pair 15p BD416 25p 10p BD433 25p	most sets) 20p GEC Double Thermistor 75p	IV Filter 40		80p 70p 75p	8 Pin × 10	£1.00 50p
2SC1546 20p BC338 2SC1725 20p BC347 2SC2068 20p BC349b	10p BD437 25p 10p BD439 50p 10p BD501 30p	Mixed pack Panel mount LED + NEANS £1.50	P.C.B. £1.0	14 Pin × 10	70p 80p	QUIL - QUIL 16 Pm × 10	£1.00
		1	1	1	Р		