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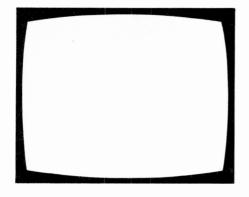
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TELEVISION

June 1984

Vol. 34, No. 8 Issue 404

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BACK NUMBERS

Some back issues are available from the Post Sales Department, IPC Magazines Ltd., Lavington House, 25 Lavington Street, London SE1 0PF at £1-20p inclusive of postage and packing.

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

417 Leader

418 Servicing the Körting Chassis 9

John Coombes

Körting's first CTV chassis to use a chopper power supply and transistor line output stage was designed to drive the PIL, 20AX or 30AX tube.

423 What's Up Doc - 2?

Les returns for the verdict, while the flood of broken

Les Lawry-Johns

domestic electronics continues unabated.

424 Long-distance Television

Roger Bunney

Reports on DX reception – what little there was this month – and news from abroad.

426 Scope Component Test Unit

David Botto

A simple unit that enables the scope to be used to show on the screen the condition of diodes, transistors, thyristors, zener diodes, LEDs, capacitors and resistors.

429 VCR Clinic

Reports on VCR faults from Steve Beeching, T.Eng. (C.E.I.), Derek Snelling, Hugh Allison, Les Harris and M.S. Barakat.

431 TV Fault Finding

Reports on TV faults and servicing from Jim Rainey, Malcolm Burrell, George R. Wilding, John Coombes and M.S. Barakat.

432 Improved Replacement Modules

Tony Thompson

Many of the weaker sections of older sets can nowadays be replaced using improved modules from sources other than the original manufacturer. A review of some of the useful modules at present available.

434 HV2000 Sync Adaptor Unit

John Hammond

The Sony HV2000 video unit is a useful and cheap method of switching between cameras. It can be used only with a Sony colour/monochrome camera combination however. This simple circuit enables any monochrome camera that requires HD and VD pulses to be used.

435 Next Month in Television

436 TV Test Pattern Generator, Part 2

Tony Jenkins, G8TBF

The encoder, modulator and power supply sections of the generator.

438 Teletopics

News, comment and developments.

440 VCR Servicing

Mike Phelan

A run-down on common faults experienced with the 3V24 portable machine.

442 DX Amplifier Unit

Roger Bunney

A comprehensive modular unit that incorporates Band I/II/III and u.h.f. amplifiers, gain control, masthead amplifier powering and a distribution amplifier. Complete with integral power supply.

444 Letters

446 Service Bureau

447 Test Case 258

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THYRISTOR CONVERGENCE POTS

 5Ω , 10Ω , 20Ω , 30Ω , 50Ω , 100Ω , SS106 (BT106) 75p each 3 for £2.00, 10 for £5.50 200Ω , 1K. 8 of one type £1.00, 8 of each type £6.00.

Z44 TO3 Mounting kits (BU208) 8 for 60n **Z45** TO220 Mounting kits (TIP33) 10 for 60p **Z46** TO 126 Mounting kits (BD 131) 12 for 60p **Z47** Pack of each Mounting kit. All include insulators and washers £1.50 3a 1000v Diodes (IN5408 type) 8 for £1.00 **Z48** Brushed Aluminium Push Button Z49 Knobs, 15mm long × 11mm Diam. Fit standard 31mm square shafts 10 for £1.00 7.50 Chrome finish 10mm × 10mm Diam 10 for £1.00 as above Aluminium Finish. Standard Fitting Slider Knobs. (Decca) Z52 Decca "Bradford" Control Knobs Black and Chrome. 4" Shaft 8 for £1.00 7.53 Tuner P/B Knobs, Black and Chrome. Fit most small Diam Shafts, ITT, THORN, GEC etc. 8 for £1.00 Spun Aluminium Control Knobs (ITT) 4" Shaft, suitable for most sets with recessed spindles 8 for £1.00 14 Pin DIL I.C. Sockets 16 Pin Quil I.C. Sockets Z.55 12 for £1.00 **Z56** 12 for £1.00 **Z57** 16 Pin DIL TO QUIL I.C. Sockets 10 for £1.00 Z58 22 Pin DIL I.C. Sockets 10 for £1.00 7.59 B9A Valve Bases P.C. Type 20 for £1.00

V.C.R. BATTERY PACKS.

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

THORN "VIDEOSTAR" 3V25/26 Nicad pack. Type VA214. Also suitable for J.V.C. etc. Brand new and boxed. £20 each, 3 for £50.

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.

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Line output transformer for RBM823A \$4.25 each, 3 for \$10.00
RBM823A ITT VC200 4P/B Transistor Tuner. Suitable for some Pye
and Philips sets. 3 hole fixing £2.75 each
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5 button type £4.00 each, 4 for £12.00
UHF Modulator UHF out Video in, Ch. 36.
2½"×2"×½" complete with 9 foot coaxial lead and plug.
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VDR rod £2.00 each, 3 for £5.00
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and plug. £3.00 each
GEC 2010 Transistor Rotary Tuner with AE, SKT, and leads £1.95 each, 3 for £5.00
Bush CTV 25 Quadrupler type Q25B equivalent to ITT
TU25 3QK £3.00 each, 2 for £5.00
Focus VDR Rods 24"×4". Suitable for GEC,
Decca etc. 75p each, 3 for £2.00
Grundig UHF/VHF Varicap Tuner for 1500GB, 3010GB.
£12.50 each, 3 for £30.00
EHT Cable 30p per metre, 10 metres £2.50
4.433 Mhz CTV Crystals 70p each, 3 for £2
75Ω 24 Loudspeaker 60p each, 4 for £2
6 MHz sound filters, ceramic 3 pin
"TAIYO" type 50p each, 3 for £1.00 PYE CT200 Control Knobs 8 for £1.00
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LC1043-05 LC1043-06	8.40 8.40	On/off gen. purpose 4A G8 on/off 1	75 LOTS OF NEW THIN		KT3 posistor Mains electrolytic 225/25 380V	1.50 2.50	Philips G8 knobs sm/lg 90° transductor	5(2.6(
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322	7.20	Thom Tx 9/10 1 GEC 2040	06 No. 3 9.50 No. 13	11.11	Luminance chroma panel 2003 IF module	24.00 14.95	390K frame 470K line contr Focus control Thom/GEC	ast 1k5 eacl 1.8
341 nom 1691	9.50 17.90	Thom 1501 push 2	90 NO. 6 11.08 NO. 1		U321 IF module	13.50	Thom 9000 focus unit	3.2
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PUSH BUTTON ASS.		1½"×½", 2"×½", 2"×¾" Rank drive cams	35 C12 computer cass	32	Power panel	10.60	Thom Tx10 focus cont.	9.0 1.9
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lectrolube Adhesive lectro-Mech lubricant	62 1.49	40W Iron XSTC 10	50 Bell Wire (100m)	5.00 00m) (2	TVT 80/80 A-Z/2Ñ-2S (pair) LIN IC Books (data only not	7.50	Battery Plug Thorn TV's Coax Plugs	each 1
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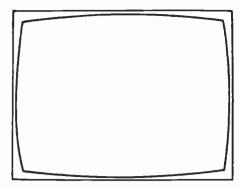
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DY802	0.88	Type AC127	0.30	BC108	0.10	BC302	0.32	BD244A	0.65	BF258	0.30	BT101/300	1.15	BYX36/150	0.22	TÍP32	0.40	2SC1507 0.63
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ECC82	0.65	AC132 AC141	0.55	BC114 BC115	0.12	BC323	0.10	BD436	0.68	BF270	0.30	BT106	1.50	BYX55/350	0.29	TIP34A TIP41C	0.72 0.46	2SC1909 1.20 2SC1923 0.30
ECC83	0.75	AC141K	0.40	BC116	0.12	BC327	0.14	BD437	0.76	BF271	0.26	BT108	1.30	BYX55/600	0.33	TIP41C	0.46	2SC1945 2.88
ECC84 ECC85	0.65 0.90	AC142	0.26	BC117	0.22	BC328	0.14	BD438	0.75	BF273	0.18	BT109	1.18	BYX71/600	1.18	TIP47	0.60	2SC1953 0.74
ECC88	0.95	AC142K	0.48	BC118	0.17	BC337	0.12	BD439	0.68	BF274	0.32	BT116	1.25	BYZ12	0.42	TIP110	0.88	2SC1957 0.76
ECF80	0.95	AC151	0.45	BC119	0.30	BC338	0.12	BD507	0.48	BF323	0.92	BT119 BT120	3.62 3.60	C106D E1222	0.80	TIP2955	0.60	2SC1969 2.88
ECH81	0.75	AC152	0.45	BC125 BC140	0.12	BC350 BC440	0.14	BD508 BD509	0.53 0.54	BF336 BF337	0.26 0.26	BT121	3.02	E5024	0.40	TIP3055	0.60	2SC2028 0.73 2SC2029 1.00
ECH84	0.75	AC176 AC176K	0.28	BC140	0.42	BC441	0.30	BD505	0.48	BF338	0.26	BT138/600		GET872	0.48	TIS43	0.32	2SC2078 1.05
ECL82	0.75	AC187	0.26	BC142	0.30	BC461	0.32	BD517	0.56	BF355	0.42	BT151/560		17744	0.04	TIS88	0.40	2SC2091 0.73
ECL86	0.98	AC187K	0.40	BC143	0.30	BC547	0.12	BD520	0.66	BF363	0.82	BT151/300	R 1.15	ITT2002	0.11	TIS90 TIS91	0.25 0.28	2SC2098 2.90
EF80	0.65	AC188	0.28	BC147	0.08	BC548	0.12	BD699	1.25	BF367	0.24	BTY79/400		ME0402	0.20	ZTX108	0.12	2SC2122A 3.20
EF86 EF183	1.60 0.75	AC188K	0.40	A or B	0.10	BC549	0.12	BD707	0.88 2.35	BF371 BF422	0.27 0.38	BU100A BU104	2.30	ME0404/2 MEU21	0.24	ZTX109	0.12	2SC2166 1.20
EF184	0.75	ACY40	0.88	BC148	0.08	BC550 BC550C	0.18	BDX18 BDX32	2.35	BF450	0.38	BU105	1.20	MJ400	1.25	ZTX212	0.28	2SC2314 0.80 2SC2335 1.50
EH90	0.94	AD142 AD143	1.10	A or B BC149	0.10	BC557	0.12	BF115	0.32	BF457	0.33	BU105/02	1.56	MJ2955	0.90	IN4001	0.05	2SC2749 2.70
EL34	2.50	AD143	0.96	BC157	0.10	BC558	0.12	BF117	0.54	BF458	0.36	BU108	1.80	MJ3000	1.98	IN4003	0.05	2SC2752 0.60
EL84	0.69	AD161	0.42	BC158	0.10	BCX34	0.27	BF119	0.82	BF459	0.44	BU124	1.75	MJE240	0.60	IN4004	0.06	2SD234 0.64
EL509	5.50	AD162	0.42	BC159	0.10	BCY70	0.15	BF120	0.38	BFR39	0.22	BU126	1.25	MJE340	0.54	IN4006	0.07	2SD348 3.30
EM87	2.55	AD161/AD1		BC160	0.30	BCY71	0.17	BF123 BF125	0.40 0.42	BFR40 BFR41	0.22 0.22	BU133 BU204	1.80 1.35	MJE370 MJE520	0.88	IN4007	0.07	2SD986 0.62 2SK134 3.80
EY86/87	0.67	AF106 AF114	0.48 2.10	BC161 BC168B	0.30	BCY72 BCZ10	0.18 1.68	BF125	0.42	BFR51	0.30	BU205	1.30	MJE2955	0.99	IN4148 IN5400	0.05 0.12	2SK134 3.80 2SK135 1.90
EY500A	1.65	AF115	2:10	BC169C	0.12	BCZ11	1.45	BF152	0.16	BFR61	0.32	BU206	1.70	MJE3055	0.70	IN5400	0.12	3N126 1.90
PCC84 PCC85	0.50 0.65	AF116	2.10	BC170	0.14	BD124P	0.80	BF154	0.23	BFR62	0.28	BU208	1.55	MPSL01	0.28	IN5405	0.16	3N211 2.52
PCC89	0.74	AF117	2.10	BC170B	0.12	BC130Y	0.68	BF157	0.40	BFR88	0.34	BU208A	1.63	OA47	0.10	IN5406	0.18	3SK45 0.76
PCC189	0.85	AF118	0.85	BC171	0.10	BD131	0.34	BF158	0.22	BFR90	1.72	BU208/02	2.05 1.75	OA90 OA91	0.08	IN5408	0.20	CONVERGENCE
PCF80	0.75	AF121	0.62	BC171	0.10	BD132 BD131/BD132	0.34	BF159 BF160	0.24 0.23	BFT41 BFT43	0.38	BU326S BU407	1.75	DA95	0.09	IS920	0.08	POTENTIOMETERS
PCF86	1.25	AF124 AF125	0.48	A or B BC172	0.08 0.08	BD135	0.32	BF167	0.30	BFW10	0.79	BU407D	1.80	DA200	0.06	2N697	0.55	5, 7, 10, 15, 20, 50,
PCF200	1.95	AF126	0.48	A or B	0.12	BD136	0.36	BF173	0.25	BFW44	0.76	BUX80	3.70	OA202	0.15	2N706A	0.33	100, 200, 500W
PCF801	1:45	AF127	0.48	BC177	0.20	BD137	0.36	BF177	0.42	BFX29	0.28	BUY20	1.75	OC25	2.10	2N2904 2N2906	0.28	38p each
PCF802	0.85	AF139	0.68	BC178A	0.22	BD138	0.38	BF178	0.30	BFX30	0.30	BUY69A	2.60	OC26	1.70	2N2926G	0.10	SPECIAL OFFER
PCF806 PCL82	1.20 0.90	AF178	0.68	BC182	0.09	BD139 BD140	0.38	BF179 BF180	0.32 0.35	BFX80 BFX84	3.56 0.24	BUY69B BY101	1.98	OC28 OC29	1.50 2.47	2N3053	0.10	30, 120, 270, 470,
PCL83	2.50	AF239 AF279S	0.68 0.75	A,B or C BC182L	0.09	8D144	1.60	BF181	0.35	BFX85	0.26	BY118	1.10	OC35	1.75	2N3054	0.56	all at 20p each
PCL84	0.90	AL100	2.50	A.B or C	0.09	BD145	1.82	BF182	0.32	BFX86	0.26	BY122	0.68	OC36	1.75	2N3055	0.45	CAPACITORS
PCL86	0.98	AL102	1.88	BC183	0.09	BD150A	0.51	BF183	0.32	BFX87	0.26	BY126	0.12	DC42	0.72	2N3702	0.10	
PCL805/		AL113	2.20	A.B or C	0.10	BD159	0.65	BF184	0.32	BFX89	0.65	BY127	0.10	OC42K	1.40	2N3704	0.10	Metallised Paper 2n2F 1500V DC 60p
PD500	3.75	ASY80	1.75	BC183L	0.08	BD160	1.65	BF185	0.32	BFY50	0.21	BY133 BY135	0.16 0.25	OC44 OC45	0.72 0.58	2N3708	0.10	2n2F 600V AC 24p
PFL200	1.35	AU110	1.40	A,B or C BC184L	0.12	BD165 BD175	0.45	BF194 BF195	0.08	BFY51 BFY52	0.21 0.21	BY164	0.25	OC71	0.50	2N3772 2N3773	1.90 2.70	3n6F 1700V DC 60p
PL33 PL36	1.50 1.45	AY102 BA102	4.32 0.34	A,B or C	0.10	BD182	1.00	BF196	0.10	BFY57	0.40	BY179	0.66	OC72	0.52	2N3904	0.16	4n7F 1500V DC 60p
PL36	0.85	BA110	0.67	BC207	0.15	BD183	1.10	BF197	0.10	BFY90	0.90	BY182	0.87	OC81	0.68	2N3906	0.16	10nF 1000V DC 22p
PL82	0.75	BA121	0.40	BC208	0.16	BD184	1.20	BF198	0.14	BFY90S	1.34	BY184	0.40	OC200	2.46	2N5294	0.48	10nF 500V AC 80p
PL83	0.65	BA129	0.38	BC212	0.09	BD201	0.72	BF199	0.16	BR100	0.20	BY187 BY189	0.72	OC202 ORP12	2.20 0.85	2N6107	0.71	15nF 300V AC 30p 22nF 300V AC 32p
PL84	0.75	BA 148	0.16	A,B or C	0.10	BD202	0.87	BF200 BF222	0.26	BR101 BR103	0.44 0.58	BY 189	4.75 0.44	R2008B	1.50	2N6126	83.0	100nF 1000V DC
PL95	2.00 1.20	BA154 BA155	0.08	BC212L A.B or C	0.08	BD204 BD222	0.80	BF224	0.20	BRC4443		BY199	0.47	R2010B	1.52	2\$B337	1.60	46p
PL504 PL508	2.40	BA156	0.08	BC213	0.09	BD225	0.86	BF224J	0.16	BRY39	0.38	BY206	0.24	SHG1.5	0.40	2SC1172		470nF1000V DC 85p
PL509/5		BA157	0.28	A or B	0.10	BD232	0.45	BF240	0.20	BRY56	0.42	BY207	0.24	TAG1/100	1.40	2SC1173 2SC1302	Y 0.82 1.40	HV Disc Ceramic (†)
PY88	1.80	BA164	0.14	BC213L	0.10	BD233	0.60	BF241	0.20	BRY61	0.86	BY210/400		TAG3/400	1.78	2SC1226	0.84	1kV 1.5nF 18p
PY500A	2.40	BB104B	0.52	A or B	0.10	BD234	0.62	BF244	0.26	BSS17	0.56	BY210/600 BY210/800		TIC44 TIC45	0.45	2SC1279	0.50	8kV 10, 47, 56,
U26	1.90	BB105B	0.30	BC237 BC238	0.11 0.12	BD235 BD236	0.63	BF244A BF244C	0.28 0.24	BSS27 BSX19	0.92	BY223	0.30 1.20	TIC46	0.45	2SC1306	0.92	82, 100, 120, 150,
UCH81 UCL82	0.90 1.70	BB105G BB110B	0.48 0.42	BC239C	0.12	BD237	0.65	BF245A	0.28	BSX20	0.34	BY227	0.26	TIC47	0.70	2SC1307	1.40	180, 200,
6J5GT	1.75	BC107	0.10	BC251	0.12	BD238	0.56	BF254	0.15	BSX59	0.62	BY229	0.30	TIC106A	0.70	2SC1413.		220pF 30p
6SJ7	2.20	A or B	0.12	A,B or C	0.14	BD241	0.60	BF256	0.40	BSX76	0.29	BY238	0.68	TIP30A	0.46	2SC1444	1.45	270, 300pF39p
30FL12	1.60	1		BC301	0.30	BD243A	0.80	BF257	0.32	BT100A/	02 0.94	BYX10	0.24	TIP31C	0.54	2AC1449		10kV 1nF 67p

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A Flat Patch

Right now there seems to be growing pessimism on one front (cable TV), a deathly hush on another (DBS), and a subsidence in the frothy marketing conditions that characterised another (video) until recently. All this despite signs of increased economic activity in the UK. The world of TV appears to have got out of step with the rest of the economy: it peaked while most other sections were in the doldrums, and has now turned rather flat.

Two reports on cable prospects have appeared recently. Management consultants McKinsey see a bleak and unprofitable future if reliance is placed mainly on entertainment. Just how unprofitable can be seen from the following quotation: "total operating losses under optimistic assumptions will, for a 100,000 home franchise, reach £10 million by the late 1980s, never to be recouped". That and other conclusions follow a fifteen month study.

McKinsey consider that the prospects would be very much better if greater emphasis was placed on cable as a medium for providing a number of services – in particular by incorporating telephony services from the outset. This seems strange. Why should laying expensive wideband cable to do what the current telephone lines do quite adequately make such a difference? The McKinsey researchers seem to think it would however. They suggest that telephony could add 40–45 per cent to total system revenues, making it possible to break even – by 1994! This is of course all a matter of conjecture, and there's no reason why we shouldn't hazard our own guess. We'd say that entertainment is primarily what people want and are prepared to pay for, and that if entertainment

can't be relied upon to make cable pay, the prospects are dim indeed.

McKinsey comment that much work has been done on the office of the future but little on the home of the future. Unless we all turn into robots, we'd suggest that the home of the future is likely to be much as it is today, though hopefully providing greater comfort. The cat was rather let out of the bag officewise in a recent *Financial Times* survey on office automation. Ms Emma Bird, a senior consultant with an electronic office specialist firm, was quoted in this as saying that "managers generally say that the introduction of plans to acquire new technology can go ahead if significant staff savings or gains in productivity will result: in practice, such hard justifications are rarely achieved." If the great information technology revolution is so hard to justify in the office, how much more difficult will it be to justify it in the home? So much for all that home banking and so on. When it comes to the use of the computer in the domestic setting, one can't help but feel that it will be like the VCR – people selecting their own uses/programmes without need for a cable link to some central computer system. In fact entertainment is what home computers are at present mainly used for!

The other report on cable comes from CIT Research, an independent UK market research company. This organisation last published a study on pan-European cable prospects in late 1982. Its new study sharply downgrades growth forecasts – it now expects that at best 19.5 per cent of European households will be linked to cable TV by 1992 – the previous forecast was 27 per cent. Its conclusion is that cable TV will be a commercial failure in W. Europe unless government policies are radically changed, warning that most new cable systems planned under existing policies will lose money or be only marginally profitable – if they ever begin operating at all – and will find it hard to attract subscribers quickly. There is of course no particular reason why governments should leap in to assist something that doesn't seem to be wanted.

should leap in to assist something that doesn't seem to be wanted.

It's interesting that CIT Research's conclusions seem to be the opposite of McKinsey's. CIT Research comment that "too much emphasis is being placed on the design of the cable systems themselves and too little on the production of commercial programmes to be carried on them." Further, "there's little sign of a demand for interactive services providing information – except for details of television and radio programmes which could as easily be obtained from the press: most of the interactive services envisaged for cable could as well be provided on existing telephone networks."

Thumbs down it seems for cable. When it comes to DBS, the reason for the present

Thumbs down it seems for cable. When it comes to DBS, the reason for the present hush is perhaps best summed up by a quote from Lord Thomson, chairman of the IBA, who commented during a recent speech at the Anglo-German Chamber of Commerce in Munich that "the economics have turned out to be chilling". This is the reason for ITV and the BBC suggesting a joint effort to try to get a UK DBS service going. The plan is that the BBC would have a 50 per cent interest in the venture and the ITV companies along with other outside commercial interests the other 50 per cent, the IBA being given the job of finding outside investors and recommending them to the Home Office. At the time of writing this the government has yet to give approval to such a deal, which would involve an extra eight years' guaranteed franchise for the ITV companies regardless of whether they participate in the scheme. The decision rests with the cabinet, and is likely to be introduced as an amendment to the Cable and Broadcasting Bill during the second reading.

Finally the video market. As figures quoted in Teletopics show, the momentum has come to a halt, with VCR sales/rentals stabilising and disc player sales failing to take off. There are one or two points that seem worth making on the technical front. The increasing dominance of the VHS system makes the introduction of 8mm equipment look like being a very long term affair, while solid-state imagers seem to be out for the time being. As regards digital TV sets, the advantages are hard to see – just think of all those watts wasted in AD/DA conversion.

Servicing the Körting Chassis 9

John Coombes

The Körting Chassis 9, which was introduced in 1979, was designed to drive several different types of tube – PIL in the 20in. size, and 20AX/30AX in the 22 and 26in. sizes. It was used in a range of models with serial numbers 40,000, 41,000 and 59,000, e.g. the 22in. Model 59571 and the 26in. Model 59671. There's a main vertical panel into which a number of subpanels are plugged – the arrangement is shown in Fig. 1.

A self-oscillating chopper circuit (Siemens type) provides various regulated supplies, also mains isolation. See Fig. 2. The line output stage employs a BU208 transistor and an e.h.t. tripler. It requires a 150V h.t. supply with the 20AX tube, 155V with the 30AX - this is set with R623 on the chopper panel, at minimum brightness. Though they all look similar, different line output transformers are required with the different tube types. The tripler also differs, due to the different focus voltage requirements of the 20AX and 30AX tubes. A diode modulator is used for EW correction, driven by a BU125S transistor. The correction waveform is produced by an i.c., type TDA1082. See Fig. 4. The field timebase consists of a TDA1170 followed by a three transistor driver/output stage. There's also an output stage flyback voltage doubling circuit. See Fig. 3. Sync separation and line generation are carried out by a TDA2591 i.c. In later versions a different subpanel with a TDA2576A i.c. is used.

On the signals side there's a single i.c. (TDA2541) i.f. strip and a three chip (TDA2560/TDA2522/TDA2530) decoder. The RGB output stages are of the complementary symmetry type (BF715/BF716 or BF869/BF870 transistors). There are two alternative sound modules. The basic one uses a TBA120U intercarrier sound chip followed by a TDA2611 audio chip that provides an output of 3.5W. For up-market models there's a board with TDA2790 and TDA2030 i.c.s delivering 15W and incorporating bass and treble controls.

No Sound or Raster

In a set of this type, the no sound or picture symptom can be caused by many things. First check the 3·15AT mains fuse Si601. If this is open-circuit, check the mains filter capacitors C601 and C603, the mains bridge rectifier G601 and the rectifier's protection capacitors C609-612.

If the mains input circuit is o.k., check R634 (1M Ω) and D632 (1N4007) in the chopper's start-up circuit. R634 can also be responsible for intermittent failure to operate. It was subsequently reduced in value to 470k Ω . Next check for dry-joints on the chopper transformer Tr601 and the chopper panel, then check the rectifier panel where the usual offenders are the 150/155V rectifier D651 (BY299) and its reservoir capacitor C651 (47 μ F). They tend to go short-circuit.

If everything is in order up to this point, it's necessary to pay closer attention to the chopper circuit. Check for voltage at the collector of the BU326A chopper transistor T622. If this if missing, check the continuity between pins 7 and 1 of the chopper transformer. If voltage is present, check the chopper circuit fuse Si621 (1.6A). If this is open-circuit, check the chopper transistor and the switch-

off thyristor Th621 (BR303) for being short-circuit. These two items must be replaced in pairs.

If the power supply seems to be all right, move on to the line timebase. Check the 12V supply to pin 1 of the TDA2591. If missing, check the filter resistor R434 (120 Ω) for being open-circuit. If R434 is o.k. and the voltage at pin 1 of the i.c. is missing or low, suspect the i.c. With the TDA2576A the supply pin is 16 and the filter resistor R453 (56 Ω , 1W). With both boards there should be 17.5V at pin 6 of the panel.

Next check the line driver stage. There should be 150/155V at pins 9/10 of the line output subpanel. If there's no output from the driver, check the feed resistor R1005 $(1.8k\Omega)$ for being open-circuit and its decoupler C1003 $(0.047\mu\text{F})$ for being short-circuit. If necessary check the transistor (T1001, type BD232) for being short-circuit or feaky. Check for dry-joints at the pins of the line driver transformer U1001. On rare occasions you may find that the primary winding is open-circuit.

The most likely cause of a dead line timebase is failure of the BU208 (T1002) line output transistor however. It usually goes short-circuit, and in this event R1008 (1 Ω) in its base circuit is likely to be open-circuit. If the line output transistor is all right, disconnect the lead from the line output transformer to the tripler. If the set then bursts into life either the tripler or the transformer is faulty. It's usually the tripler.

Tripping

If the set is tripping, ensure that the line output stage h.t. voltage is correctly set (test point U4) for 150V or 155V depending on tube type. Adjust with R623. If R623 cannot be adjusted for the correct voltage, check transistor T621 (BC557) and zener diode D621 (BZX83C7·5) in the chopper control circuit. If the h.t. voltage is varying,

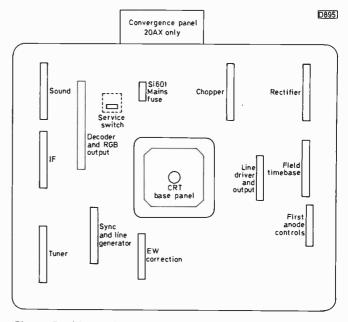


Fig. 1: Positions of the subpanels on the main board.

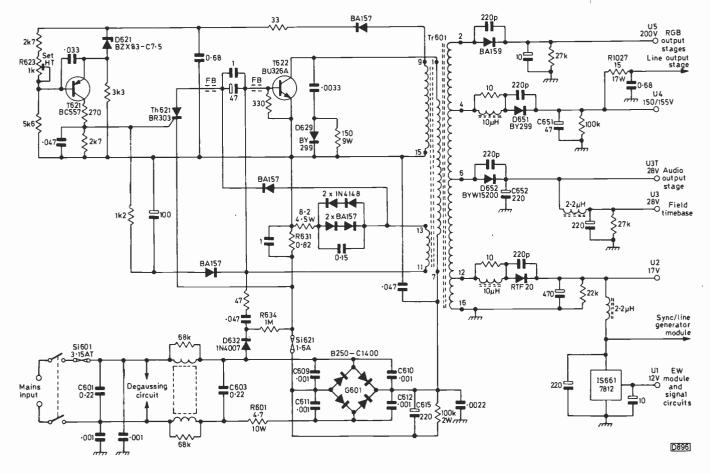


Fig. 2: The power supply circuit.

check the condition of R623's carbon track.

Next check the line output transistor which could be short-circuit or leaky, and the EW modulator diodes D1001 (BY223) and D1002 (BYX71-600R). Finally check the line output transformer and tripler by disconnection as previously described.

Focus Faults

The most likely cause of focus trouble is the control, which is mounted on the tripler. Less likely is the series resistor R1218 (1M Ω) on the tube base panel (this resistor is not present in all models), the spark gap FU1, or corrosion on the focus pin. A faulty tripler is another possibility. The focus spark gap can also be responsible for intermittent focus variations.

Collapsing Picture

A collapsing picture with the sound cutting in and out as the picture collapses could be tripping, see above, or a faulty line output transistor.

Line Timebase Faults

For line collapse check the output transistor, the scan correction capacitor C1021 ($1\mu F$ – check for being opencircuit or for dry-jointed leads), the scan coils, plugs and sockets, and for dry-joints on the linearity coil L1023. The linearity coil is the usual cause of line whatle – check by replacement.

For excessive width check whether the width control R396 is set correctly, then check D1002 in the diode modulator circuit and if necessary the line output transis-

tor, both by replacement. If there's evidence of ballooning, suspect the tripler.

For EW correction faults, check the modulator diodes D1001/2 and the driver transistor T371, then suspect the TDA1082 chip (IS371).

If the line shift control has no effect, check the control

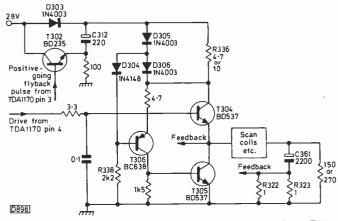


Fig. 3: Field driver and output stage. Output transistor T304 is on throughout the scan, the drive at its base (from the TDA1170 i.c.) being negative going. During the first half of the scan, coupling capacitor C361 charges via T304, D306 and D305. Towards the centre of the scan the current flowing via T304 is insufficient to keep D306 in conduction. The rising voltage at its collector then drives the emitter of T306 which begins to conduct, driving T305. The current in the scan circuit then reverses as C361 discharges via T305. T302 conducts during the flyback so that the voltage at the negative plate of C312 is 28V. During the scan, C312 is charged via D303. When T302 conducts, D303 is cut off and the supply to the output stage is doubled. T304 conducts during the flyback.

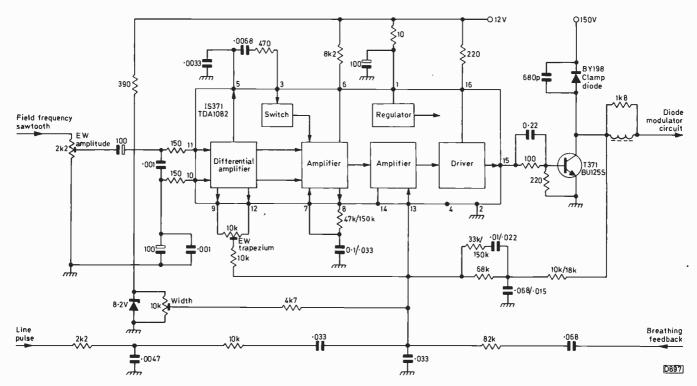


Fig. 4: EW diode modulator drive circuit. The switch stage in the i.c. is used to cut off the second amplifier during the field flyback.

itself and the resistor in series with its slider. With the TDA2591 these are R435 (47k Ω) and R438 (180k Ω) respectively. With the TDA2576A the control is R427 (100k Ω) and the series resistor R423 (100k Ω).

Field Collapse

In the event of field collapse, first check that the 28V supply is reaching pin 2 of the TDA1170 i.c. If the voltage is very low, suspect the decoupling capacitor C310 or the chip. If there's no voltage, check back to the rectifier panel: D652 (BYW15200) could be open-circuit or C652 (220 μ F) short-circuit. If the supply is correct, check the following items: the field output transistors T304 and T305 (both BD537); the height control R321 (100 Ω), and R317 (6·8k Ω or 5·6k Ω depending on model) which is in series with it; the scan coupling capacitor C361 (2,200 μ F); R951 (2·2 Ω) on the convergence board (20AX sets); finally, suspect the scan coils.

Sync Troubles

For no sync at all, check the TDA2591/TDA2576A i.e. For no field sync check the TDA1170, and C306 (0.01 μ F) for being short-circuit.

Signal Faults

If the sound is all right but there's a blank raster, check the TDA2541 i.f. i.c.

In the event of tuning drift, check that the 50V supply from the line output stage is not varying. If it is, replace D1039 (BA157). If the tuning voltage is varying, check R051 and R053 (both $2.2 \mathrm{k}\Omega$) and D05 (ZTK33) by replacement. If the tuning voltage doesn't vary, suspect the tuner unit.

In the event of the loss of one colour, check the appropriate first anode preset control for being open-circuit and the condition of its track, then check the

relevant output transistors. If necessary check the voltages around the TDA2530 matrixing i.c. The TDA2522 demodulator i.c. is a less likely possibility.

If the brightness level rises when the set has warmed up, check the TDA2560 chroma/luminance processing i.c. by substitution.

For no colour, first check the voltages around the TDA2522 demodulator/reference oscillator i.c. carefully. If necessary replace the i.c. Other causes we've had are the 8.8MHz crystal and dry-joints on the chroma delay line. The TDA2560 is a less likely possibility. If it's suspect after making voltage checks, replace it.

We've had several cases of Venetian blinds. In this event check the setting of the amplitude control R755 and the condition of its track, then check that the phase coils L706/7 are set up correctly. If still in trouble, check the chroma delay line by substitution.

Sound, No Raster

If sound is present but there's no raster, check the e.h.t. and first anode voltages. Absence of e.h.t. points to the tripler while absence of first anode voltage is normally due to R1031 being open-circuit. It may be $560k\Omega$ or $270k\Omega$ depending on model.

If the c.r.t. heaters are out but the line timebase is operative, check R1208 (2.7Ω , 2W) on the tube base panel.

No Sound

We'll deal with the basic sound module as we've not had much experience with the 15W one. In the event of no sound, check the following items: the loudspeaker for being open-circuit; the presence of the 28V supply at pin 12 of the sound module and the 12V supply at pin 7 – if 12V is not present at pin 11 of the TBA120U, check R504 (33 Ω) for being open-circuit; the two chips; the coupling capacitor C531 (220 μ F).

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What's Up Doc - 2?

Les Lawry-Johns

The indignities I suffered during the preliminary examination to find the cause of my lump and pains were described last month. I then had to await the X-ray appointment, which was twice postponed. During this time the problem got worse then started to improve. By the time I went for the X rays I was beginning to feel a bit of a fraud. On top of that I was hungry, because you're told not to eat or smoke after midnight on the previous day.

I arrived and reported. "Ah, Mr. Lawry-Jones. Will you just go through there, up there, turn right and take a seat?" So I went down there, through there and turned left, then asked someone for directions. I finally arrived where I should have been and sat down next to a man in a white robe and dressing gown. I thought he'd been cheating – there was this white mark around his mouth. A nurse then came and took me to a changing room where I had to put on just a white apron and a dressing gown. Next I had to take this drink, and realised what the white mark was. Barium meal. Made me appreciate what cathodes have to put up with.

When my turn came I went in and found all this interesting electronic gear. There was a monitor just beside the "inspection trolley", which was vertical. I was told to stand against it while the scanner was swung up against my stomach. This was followed by further indignities – why do they have to do so much pushing and shoving around? The man pushed a button and I was lowered to a horizontal position. Something was swung over and he said "don't breathe". I hadn't since the first bit, and was feeling rather puffed. Clonk went the machine and I was told to go and get dressed. I let my breath out with a gasp. "Can I breathe now?" "Of course, you fool. How did you manage to keep it up for so long?" "They call me windbag" I explained.

That bit over, the man who'd taken the pictures suddenly appeared and asked me to follow him. When we reached a secluded spot he told me he was going to talk about pain. If I was badly injured that would be ten. The dentist's drill would be five. Stubbing my toe one. Had I got the idea? What was the pain number when he pushed my stomach around?

"Zero" I said. He told me to go and I've not heard anything since. Perhaps I shouldn't have bothered.

Return to the Ranch

There was a man waiting outside when I got back to the shop. He started off before I'd even opened the car door. "That music centre you repaired last week . . . it's gone off again." I'd put my last pair of SN76003s in it and can't get any more. What a welcome! Inside there were more people waiting to tell me their troubles. No one wanted to hear about mine. Back to normal – but not quite. There followed three days of absolute agony as the barium meal clogged my innards.

What about the music centre with the SN76003 output chips? One was open-circuit and the other dead short, same as before. I studied the SN76023 and decided to try a couple of these with modifications to the feedback. Cut the print from pin 16 to the $100\mu F$ capacitor and add a 100Ω

series resistor, then add a $27k\Omega$ resistor between pins 4 and 16. It worked. But I won't be paid . . .

The 3000

The next patient was an old Thorn 3000 that was suffering from various ailments. All but one of these responded to quick treatment. What we couldn't get was reliable line lock. It seemed that there were no feedback pulses to the flywheel line sync discriminator circuit. We checked for dry-joints, then ensured that the feedback/integrating resistor R506 was intact. After this we decided to change the line timebase panel complete, to prove that the fault was on this and not in the sync separator circuit, which is on the video panel, or the interconnections. The fault was still present with the replacement panel fitted, so we chased through the wiring loom. This was intact and a replacement video panel failed to improve matters. I just didn't believe it. The field sync was perfect, but the line sync almost unlockable.

I fiddled with this, that and the other, then looked at a 3000 that was on soak test and working perfectly. I took the line timebase panel from this and fitted it in the set on the bench, removing our "reliable" test panel. Perfect lock. I shouted at the test panel and called it a traitor. A resistance check proved that R506 was not returned to the timebase earth at the transformer end – the earth lead was off at connection C on the e.h.t. transformer (T503). Only just off, so as not to call attention to itself. When resoldered, the earth connection was complete. Refitting the panel produced solid line lock.

Back to the original panel. Again no earth return path, this time due to a fault in the transformer. Scrape away the blue jelly and find the winding leadout disconnected from C. Two panels with the same fault condition. It could happen only to us?

A Moan

The PL802T solid-state replacements aren't what they used to be. The valves themselves are getting dearer and dearer – if you can get them at all – so we do use the T version. Of late the heater resistor section seems to keep springing open. The original versions didn't have this spring. After being let down on several occasions, we now make the spring an offer it can't refuse – we wrap a piece of wire around it prior to resoldering. Why the spring type is used beats me. Come back valves, all's forgiven.

Jenny's Visit

Jenny came in whilst I was busy with this music centre that wouldn't come apart. She's a nice middle aged lady who lives up the road. As an ex-hospital sister, she'd been interested in my problem. A strangulated hernia she called it, and commented that it would probably turn to gangrene. As I say, a real nice lady, now here to enquire about the X ray. So I told her about the barium meal and what it did to my guts and the effects on my piles.

"Oh yes it does happen. Take it easy and I'll be around

to help."

"Clear off and leave me be" I bawled, frightened out of my life.

The Music Centre

It was a Waltham music centre, and refused to be dismantled. Now when something refuses to come apart, I'm a firm believer that it knows best and doesn't have to be taken to pieces.

It's really that ET who stands above the desk and points

at me all day long. I swear he talks to me. That soft voice . . . "It doesn't have to come apart Les, just think for a moment."

Since the complaint was that the cassette section was making a funny noise (through the speakers), I decided that the record/playback switch needed exercise and cleaning. So I managed to squirt some Servisol on to the switchbank, then inserted a blank tape so that the button could be depressed a few times. Record stop, record stop, record stop. No more noise and no further action required. Thanks ET.

Long-distance Television

Roger Bunney

From the lack of reports from other enthusiasts and the fact that my own loggings, day after day, consisted of only MS pings (and these only average) I think we can say that March 1984 was just awful. The high-pressure system that persisted over March 7-14th failed to produce any activity, due in part to the penetrating easterly winds in the south. Sunday the 18th was relatively active, with short duration SPE propagation during the morning, mainly on chs. E2/R1/E3. There was a short SPE opening on the 24th, with RTVE (Spain) present on chs. E2/3 at high levels. Colour was good, with sports programming, till lunch time. The only other notable event consisted of auroral activity on the evening of the 27th, with signal reception on chs. E2/R1/E3. Perhaps the shortest log on record . . .

I've been clearing up the interference problems associated with my ATV transmissions at 437MHz. To date, all the households affected have either used a head amplifier or been coupled to a local distribution system. Suppression indoors has usually been sufficient, using a Teldis bandstop filter that provides a 34dB rejection at 435MHz. In one case it was necessary to fit a Labgear CM9034 group-pass filter between the aerial and a masthead amplifier, due to problems with the latter. This filter provides 30dB attenuation at 435MHz. The distribution system was dealt with by adding a front-end filter (in agreement with the operators).

New Products

A series of TV sound receivers has been introduced by Kingsbrook Marketing Co. Ltd. (92E Macadam Road, Earlstrees Industrial Estate, Corby, Northants NN17 2JN). In addition to a UK system I u.h.f. version there are others for v.h.f./u.h.f. reception including French TV. The receivers are aimed at the hi-fi enthusiast and have six push-button tuning (UK version anyway). The specification looks good, with features such as dynamic noise reduction. Prices range from around £100 to over £140 for a model with a built-in hi-fi amplifier. The tuner is a Mullard MOSFET type.

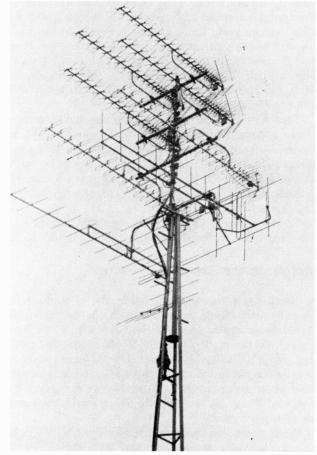
Garex Electronics (7 Norvic Road, Marsworth, Tring, Herts HP23 4LS) have expanded the range of accessories to go with the famed SX200 v.h.f./u.h.f. scanner. The H01 frequency converter gives coverage of the 96-108MHz band (or 88-108MHz to order). It's a downconverter for

in-series connection and costs £35. A converter for 200-400MHz is promised. A signal strength meter kit drives either a meter or bar LED display: this costs £13.75 (meter and stand assembly £16.50). Additional memory capacity (an expansion unit) is promised, also an auto a.m. selector for use as an airband monitor and a v.h.f./u.h.f. notch filter. Prices don't include VAT. The SX200 series has proved to be very popular with TV-DXers due to its 26-88MHz coverage – it's ideal as a video surveillance monitor, particularly on weak signals.

News Items

Holland: AFN-TV is now operating from Soesterberg on ch. E71, at some 25kW e.r.p. (vertical). The standard AFN-TV pattern and a "simple" test card F are used.

Belgium: The ch. E25 transmitter reported as being a Wavre replacement last month is in fact located in central Brussels, near the Botanic Gardens. The e.r.p. is 5kW and the station has been received by several DXers at various distances.



The impressive array of u.h.f. and Band III aerials on Ryn Muntjewerff's mast at Beemster, Holland. Details were given in the April issue (page 324).

A scrambled pay-TV service is being planned by RTBF, to start towards the end of the year, feeding cable networks and several low-power transmitters.

Eire: We've a sound cassette recording made in December 1983 referring to Nova TV, ch. 60, with a Dublin telephone number (606878). Reception reports are requested from viewers - the test transmissions apparently consisted of colour bars, with programe origination from video tape. Has any reader news of any progress with this station?

France: The new Paris ch. 1 (Band III) transmitter is in operation with test transmissions, normally from 1400-1800. These consist of the PM5544 test pattern with TDF identification at the top, RESEAU 4 at the bottom, cartoons and an identification slide. The cartoons carry their own sound, otherwise the TDF FIP radio programme is used. TF1 is radiated at 1200, with scrambling. All times are local.

Czechoslovakia: A new 1kW ch. R41 transmitter in Prague broadcasts the USSR Gorizont TSS-1 programme. The Czechoslovakian 66-73MHz f.m. radio band is to be closed, with a move to 88-108MHz by 1990 or soon after. A similar transfer is planned by Magyar Radio (Hungary). In recent years f.m. radios have been equipped for reception of both bands.

Satellite services: The Dutch Broadcasting authority NOS has decided to abandon plans for a DBS service via the ECS-1 satellite, on grounds of cost. The transponder allocated to NOS will be offered to private interests.

Miscellany

We understand that the French AFATELD DX-TV club has ceased operation for the present, due to lack of

The British Telecom Milton Keynes cable TV system mentioned last month has been closed down on instructions from the Department of Trade and Industry. The problem was interference centred on 144MHz. A different frequency will be used.

From our Correspondents . . .

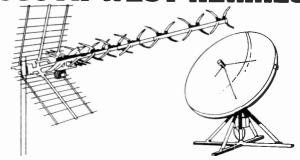
Not much reception, not many letters! Robert Copeman (Victoria, Australia) reports the loss of his aerial system when a severe storm, with winds up to 112km/hour, hit the Melbourne area on March 26th. Conditions there during March were similar to those in the UK.

Robin Crossley (125 West Street, Dunstable, Beds LU6 1SG) has for sale a Thorn 1690 chassis in excellent condition with the following modifications: ET021 tuner, 4-7MHz tunable sound i.f., r.f. gain control and video detector polarity switching. Price is £40 - if interested. write to Robin directly. His present aerial system consists of a wideband Triax Unix 92 aerial for u.h.f., a wideband eight-element array for Band III, and a wideband fourelement system for Bands I/II.

Correction

A correction is required to my mention of Belgian cable charges in the April column. The 67 franc charge refers to the equivalent of the UK British Telecom fee to the cable company, not the payment made by cable viewers. The subscriber charge was some 3,588 francs (about UK £45) in 1983, before the addition of BBC and TV5. The charge to the cable company is for the microwave link between the coast and Brussels.

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Scope Component Test Unit

David Botto

In view of the increasing complexity of present day TV sets and VCRs, anything that makes life easier for the service engineer is welcome. You'll find the component test unit described in this article one of the most useful and time saving instruments on your bench – it won't stand idly on a shelf. It can be used with almost any oscilloscope to test transistors, diodes, thyristors, zener diodes, capacitors and even resistors, the condition of the component being displayed on the scope's screen.

The component tester really proves its worth when checking semiconductor devices. The usual method of checking a transistor or diode is with an ohmmeter. This is quite good, up to a point: as engineers know from hard and sad experience however, it's not a method that's one hundred per cent reliable. With the scope component tester the slightest leakage or fault in a transistor or diode is revealed – the test method has proved to be completely reliable. With the exception of thyristors, there's a further advantage – only two test leads are required. This is a lot easier than juggling with three test prods to check a transistor.

Basic Principle

A knowledge of how the tester works will help in getting the best results from it. Fig. 1 shows a simplified circuit. An a.c. voltage is applied to resistors R-low and R-high via terminals A and B. Experiments have shown that the frequency of this a.c. input can be anything between about 25Hz and 20kHz. For convenience, the tester uses the 50Hz mains frequency. The scope's internal horizontal timebase is not used. Instead, the oscilloscope's external horizontal input (X input) is connected to point X. Point E goes to the scope's chassis and point Y to the vertical (Y) input. With the scope correctly set up, the screen display will consist of a horizontal line. This is because resistor R-high has an ohmic value several hundred times that of resistor R-low. If test points E and T are joined together, a vertical line will appear on the screen.

If a semiconductor junction, for example a diode, is connected across points E and T with the cathode to E,



External view of the unit.

the diode will conduct when the a.c. waveform is such that point T is positive with respect to point E. When the waveform swings negatively, the diode will cease to conduct. Fig. 2 shows the display on the screen. Reverse the diode and you get the waveform shown in Fig. 3.

Capacitors connected across test points E and T will produce ellipses of varying width depending on their capacitance value. A resistor produces a line set at an angle dependent upon its ohmic value.

Circuit

The complete circuit of the scope component test unit is shown in Fig. 4. Resistors R1 and R2 were not included in the original prototype but were added later. With no load connected to the transformer, the voltage across the primary winding is 240V a.c. When a load is connected to the secondary winding, the a.c. voltage across the primary winding is considerably reduced. The power applied to the component under test is thus limited, protecting small diodes and transistors.

Preset resistor VR1 controls the voltage applied to the scope's Y input while VR2 controls the voltage applied to the X input.

The battery and variable resistor VR3 (level control) are used for thyristor testing. A battery rather than a diode fed from the transformer is used to turn on the thyristor under test as this produces a good, clean waveform. The battery lasts a long time – almost its shelf life.

Construction

There's nothing critical about the construction – the photographs show the finished appearance and the internal layout. The small board used was designed to hold two i.c.s but proved to be ideal for use in the tester. If you decide to make your own board, the only point to watch is that the a.c. mains input circuitry is spaced well away from the rest of the circuit. An on/off switch was not included as we always unplug the tester when it's not in use – one could be incorporated as shown in Fig. 4. Fuses can also be added.

The screened leads that feed the scope's X and Y inputs were fitted with 75Ω BNC connectors, but this is not critical – fit connectors that suit the scope's input terminals.

The test leads have 4mm plugs at one end and mini or micro clips at the other end – these are very useful for making in-circuit tests.

It's a sound policy to apply a very thin coat of circuit varnish to the print side of the board when the basic construction has been completed. Then use a small brush to apply a thin coat of circuit varnish to all solder tags, joints, etc. This will help to ensure trouble-free operation in the long term.

Setting Up

Set the two controls VR1 and VR2 to the mid-position and the level control VR3 to its minimum position

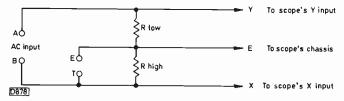


Fig. 1: Principle of the tester.



Fig. 2 (left): Diode off/on display.

Fig. 3 (right): Diode on/off display.

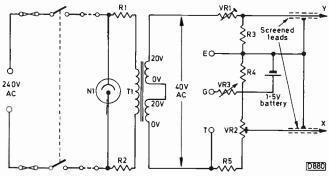


Fig. 4: Circuit of the test unit.

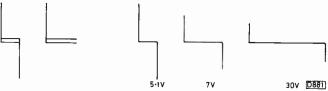


Fig. 5 (left): Double image obtained with a.c. coupling. Fig. 6 (right): Displays obtained with zener diodes.



Fig. 7: Silicon npn transistor displays. (a) Base-emitter. (b) Base-collector. (c) Collector-emitter.

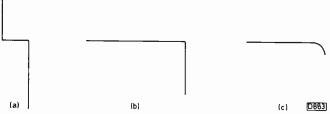


Fig. 8: Silicon pnp transistor waveforms. (a) Base-emitter. (b) Base-collector. (c) Collector-emitter.

(maximum resistance). Switch the scope to external X drive and set the Y input to the least sensitive d.c. range. The tester will work if an a.c. input is used, but with some scopes a double image may be obtained – see Fig. 5.



Fig. 9: Displays obtained with germanium transistors. (a) Base-collector. (b) Base-emitter. (c) Collector-emitter.

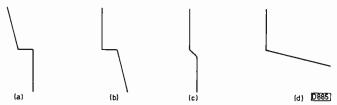


Fig. 10: Transistor fault conditions. (a)-(c) Leakage in a transistor's base-emitter junction or a zener diode. (a) In or out of circuit check. (b)-(c) Out of a circuit check. (d) Transistor base-collector junction or diode leakage, out of circuit check.

Adjust the scope's controls for a centred horizontal line with slight over scanning. Short test leads E and T to produce a vertical line, then adjust the vertical gain control so that the line just scans the screen. VR1 is included for fine setting if needed.

Checking Zener Diodes

A very useful feature of the tester is the ability to check zener diodes and measure their voltage ratings against the scope's graticule. You'll need about four or five zener diodes for calibration, with voltage characteristics between 5V and 38V. With the cathode connected to E and the anode to T, a zener diode gives the waveform shown in Fig. 6: the higher its zener voltage, the wider the horizontal part of the trace. By using the scope's horizontal gain control to keep the width correct, at the same adjusting the preset VR2, the zener voltages can be calibrated against the graticule divisions. VR1 and VR2 should then be sealed with a tiny spot of sealant.

Transistor Tests

To check an npn transistor, connect lead E to its base and lead T to its emitter. The waveform displayed should be as in Fig. 7(a). Transferring lead T to the collector should produce the waveform shown in Fig. 7(b). With lead E connected to the emitter and lead T to the collector, the waveform should be as shown in Fig. 7(c). It's not usually necessary to make emitter-collector checks in day-to-day testing.

Use exactly the same procedure with a silicon pnp transistor to get the waveforms shown in Fig. 8(a-c).

The transistors used in power supplies and line output stages produce the same traces except that the horizontal section is wider. Germanium transistors give waveforms similar to those shown in Fig. 9.

Field effect transistors of either the junction or MOS type cannot be checked and could be damaged if you try.

A short-circuit device will produce a vertical line, an open-circuit device a horizontal line. Some other fault conditions are shown in Fig. 10.

Checking Thyristors

To check a thyristor, connect the E test lead to the cathode and the T test lead to the anode. The display



Fig. 11: Waveforms obtained with a BT106 thyristor. (a) With VR3 at minimum. (b) Thyristor just starting to conduct. (c) Thyristor on. (d) Saturation.



Fig. 12: Testing a diode-thyristor combination. (a) Diode test only. (b) Thyristor turned on.

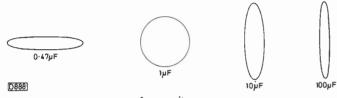


Fig. 13: Measurement of capacitance.



Fig. 14: Tests on LEDs. (a) Waveform for a small LED. (b) Waveform from a seven-segment LED.

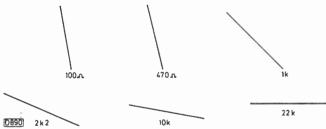


Fig. 15: Waveforms produced by various resistor values.

should then consist of a horizontal line. With the level control at minimum (maximum resistance), connect the

lead from socket G to the thyristor's gate. Some small thyristors, such as the TIC44, will then produce the waveform shown in Fig. 2. With larger thyristors such as the BT106, the level control must be turned slowly to obtain this waveform.

This test is also useful if you suspect that a thyristor is turning on too early or too late. Compare it with a known good thyristor of the same type.

On disconnecting the G lead, the horizontal line should reappear. Fig. 11 shows waveforms for the BT106.

The thyristors used in applications such as TV line output stages often have a diode incorporated in the same encapsulation, connected across the thyristor's anode and cathode. With the E lead to the cathode and the T lead to the anode, the waveform shown in Fig. 12(a) should be seen. This shows that the diode is o.k. Next connect the G test lead to the thyristor's gate and slowly turn up the level control. When the thyristor turns on, you'll see the waveform change as shown in Fig. 12(b).

Measuring Capacitance

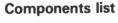
Capacitors with values between about $0.22\mu F$ and some hundreds of microfarads can be measured. With the capacitor connected to test leads E and T, an ellipse will be seen, the size depending on the capacitor's value – see Fig. 13.

Large value capacitors will produce an almost vertical line. With these, use either the scope's X times five (or ten) control or increase the setting of the X gain control. If you calibrate settings with capacitors of known value, you'll find this test extremely useful and reliable.

LED Tests

To test an LED, connect the E lead to the cathode (usually identified by a flat side or notch) and the T lead, with a 100Ω resistor in series, to the anode. The LED should light and the waveform shown in Fig. 14(a) should be seen. Reversing the leads will simply reverse the waveform – the LED will still produce light.

Seven-segment LEDs can also be tested. This test is particularly useful when one segment is not lighting. Is it due to the LED or the complex drive circuitry? Connect the E lead to the common cathode (or anode) connection and the T lead, via a 100Ω series resistor, to each segment

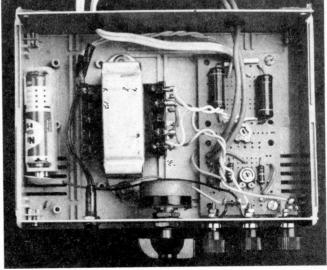


R1 4-7k 2W VR1 1k miniature horizontal preset
R2 4-7k 2W VR2 100k miniature horizontal
R3 1-2k 1W preset
R4 330k 1W VR3 3k wirewound potentiometer
R5 820k 1W

T1 RS 207-661 mains transformer.

N1 Tandy 272-708 or similar miniature 240V a.c. neon.

PCB Tandy 276-159 experimenters' board. Plastic case with feet – Tandy 270-9501 or similar. Two BNC 75 Ω connectors, RS, or as required. Battery holder and 1-5V battery – UM3 or equivalent. Screened audio lead, mini-clip test leads, etc. Three terminals, two red one black, Tandy 274-661. Optional: Double-pole on/off switch; two 630mA 20mm anti-surge fuses with holders.



Internal view of the unit.

connection in turn. The segments should light and the waveform shown in Fig. 14(b) should be displayed – an FND500 was used to get this trace.

Resistor Waveforms

The displays obtained when resistors of various values are connected across T and E are shown in Fig. 15. This test won't replace your ohmmeter, but is useful when making in-circuit checks.

In-circuit Tests

A helpful feature of the tester is its use for in-circuit tests. Many transistors, diodes, capacitors, etc. can be tested whilst still in circuit – disconnect the equipment from the mains supply of course! Also make sure that reservoir/smoothing capacitors and the c.r.t.'s final anode are discharged.

In some cases the waveforms will be affected by other

components in the circuit, i.e. those shunting the component being checked. In practice you'll soon get used to this. If you service particular TV sets or VCRs regularly, it's helpful to note various key waveforms you should obtain. If there's room, these can be drawn on or around the circuit diagram.

If it's necessary to isolate a transistor, unsolder only two of its leads and keep them clear of the print. Check the transistor, then resolder the two leads if it tests good. This saves time and also avoids the problems of finding the board unmarked after removing a transistor completely – and perhaps putting it back the wrong way round . . .

The same principle applies with diodes, capacitors etc. – with only one lead being unsoldered of course.

Continuity Testing

Continuity checks on print and transformer windings etc. can also be made. Doubtless you'll find many additional uses for your component tester.

VCR Clinic

Reports from Steve Beeching, T.Eng. (C.E.I.)., Derek Snelling, Hugh Allison, Les Harris and M.S. Barakat

Toshiba V8700

The fault on this machine was no colour in the still picture or picture search modes, though there was some evidence of flashes of colour. As the colour was perfectly stable in normal playback, attention was paid to the still chroma stabilisation circuit - Q228, IC204 and delay line X204. Direct and delayed (64µsec) signals are fed to pins 8 and 9 respectively of the i.c., the idea being that when a disturbance is detected the delayed signal is used. The output at pin 6 should be a 4 43MHz chroma signal with a burst level of around 600mV. If the burst is varying in amplitude, it can be balanced by the "still twiddler" R255. In this particular case however the burst level couldn't be stabilised. We've had this happen before, due either to the i.c. or the coupling capacitor C246. On this occasion the culprit turned out to be the delay line - proved by substitution. (The input at pin 9 of the i.c. was much lower than that at pin 8.)

Ferguson 3V23/JVC HR7700

Interesting to note (April issue) that others have experienced problems with the tuner/timer board due to failure of one of the TA57 transistor logic gate arrays. In the last instance we had the machine would switch to "prog set" just after being powered and refused to have anything further to do with the T/T functions, though the mechanical functions were o.k. One of the gate transistors had a collector-base leak that dragged a data line high enough to cause trouble.

S.B.

Toshiba V9600

A couple of V9600s. The reported fault on the first one was noisy playback. So I inserted a tape which disappeared at a great rate of knots, followed by an all time record lace up. In playback there were horrible great straining noises, so the cassette was ejected – at about 90 miles an hour! It was obvious that all the motors involved were running somewhat fast, mainly due to the 14V power

rail being 22V. This was traced to failure of transistor Q902 in the d.c./d.c. converter (regulated power supply to the likes of you and I) – panel U901. A BC328 was used as a replacement – it's getting a bit like the old days when a BC109 was used as a replacement in almost every conceivable circuit.

The next machine had almost the opposite fault – it could barely turn the cassette motor, which drives the lift in the cassette compartment. This time the 14V rail was missing due to fuse F802 being high impedance. After replacing this there was very little drive, the culprit being transistor QL85 on the UT01 motor drive panel. We replaced it with a TIP31 – who was that shouted "bodge artist"?

Sony SLF1

Finally... After going on a Sony training course run by a nice guy called Rob I felt better able to tackle SLF1 faults. When ET rang up about that fault mentioned under the heading "defeat" in the March issue – the cassette wouldn't thread up – I was confidently able to tell him to change IC2 (which is the one I didn't change) instead of IC3 which issues the threading instruction. Needless to say it turned out to be IC3. You just can't win.

Problem with a Drum

How to make a simple head change difficult – the machine in question was a Ferguson 3V22. The head needed replacement, so I fitted a new one, then did a recording and playback. The head switching was slightly out – showing up as excessive foldover at the bottom of the picture. Out came the scope and we set the record and playback switching points. Lovely picture. Put the top on the machine and do a test card recording as a final check. Oh dear, the switching points are way off. This time they didn't want to set correctly, and even appeared to drift.

The problem had not been present prior to head change, so I thought the new head might be faulty. As

changing it was easier than thinking of another cause for the fault I went to remove the newly installed head. It was at this point that the deliberate mistake was discovered – I'd forgotten to screw the head on. No wonder the switching points were varying – the head was slowly moving around on the spindle, thus constantly altering the position of the heads relative to the switching magnets beneath.

D.S.

Hitachi VT8500

Now to an Hitachi machine with a genuine fault – a VT8500 with no visual search. All other modes worked correctly, but when visual search in either direction was selected the machine went into the stop mode. It did this with both the front panel controls and the wired remote unit, so problems with the switches or the ladder network could be eliminated.

In cases like this I usually start at the microcomputer i.c. and work outwards. Not because this i.c. tends to be faulty – quite the opposite in fact. I just find it the easiest way to go about fault-finding. In this case pins 3 and 4 of the i.c., the search and reverse pins, were found to be high instead of low when visual search was selected. For once the HD44801A05 was responsible.

D.S.

Ferguson 3V22

Our tea lady's grandson had posted a marble through the tape loading flap, then inserted a cassette and switched to play. The picture (after removal of the marble) and all the waveforms showed the classic symptoms of a broken head. A new drum was fitted, but the symptoms remained the same. An eagle-eyed colleague spotted that the slanted pole on the supply loading arm was not fully locating in the supply arm stopper (V-block). Although the gap was only about 1/16th of an inch, there was insufficient adjustment to take up this slack using the method described in the manual. No levers or anything seemed to be bent, and the problem was eventually solved by slackening the set screw on the take-up loading arm lever (underneath), pushing the supply loading arm slightly forward, then retightening. The tape has to run round the head properly of course!

Hitachi VT14

This machine would intermittently fail, with the "operate" light not lit. Voltage checks during the fault condition revealed that the regulators Q101, Q102 and Q103 were all off. These regulators are controlled by IC902 on the system control panel, via an inverter. IC902's power

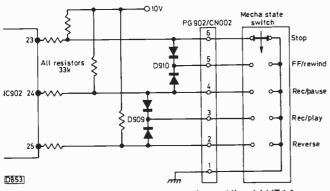


Fig. 1: Mecha state switch connections, Hitachi VT14.

control pin 3 was low instead of high as it should have been, but changing IC902 made no difference. Further checks with the machine in the stop mode under the fault condition revealed that pin 24 of IC902 was low instead of high (pin 23 should be low, pins 24 and 25 high, see Fig. 1). The mecha state switch was checked and found to be in the correct positon, the fault being due to D910 being leaky. Incidentally PG902/CN002 are numbered incorrectly in the official circuit – Fig. 1 is correct. L.H.

Sony C5 and C7

The mother-in-law rang up to say that there was no sound coming out of the video (oh that it could be the other way about!). In fact the accompanying TV set produced sound when a prerecorded tape was played, but there was no sound in the E-to-E mode or with a recording made on the machine. Obviously the sound i.f. chip, a TBA120UB. A quick check with the AVO revealed that there was no voltage at pin 14, one of the input pins. This should be biased up by an internal resistor. With the machine still on, hands were placed on the board to position it ready for removal of the chip when, guess what? – sound! Bung in a $10M\Omega$ resistor from pin 14 to the supply pin (11) and there we were. The next video in for repair was a C7. Same symptoms – and the same bodge worked again!

Remote Control Problem

I'd been handed this Ferguson infra-red remote control handset for repair during the weekend. When I opened it up on Monday I found a spare inch of wire shorting the infra-red LEDs to the supply. Remove wire and check waveform to LEDs with scope. This looked good but were the LEDs o.k.? Being infra-red, I couldn't see, and I'd nothing to try the unit out on. Suddenly a stroke of genius. Get out old monochrome TV camera and monitor and point the control unit at the camera. When it was activated, the monitor displayed white light, the TV camera's spectral response being wider than that of the human eye. Who's a clever boy then?

H.A.

ITT VR3905

This machine (basically the same as the Ferguson 3V35) would load, but the capstan motor wouldn't run – except for unloading (the capstan motor also drives the reels, as with the Hitachi VT11). Checks revealed that there was no voltage at pin 3 (motor drive) of IC206, due to the motor having gone short-circuit to its metal casing. L.H.

Hitachi VT14

This machine stopped displaying timer functions only a week after delivery. The supplies to the timer board were correct, and during our investigation plug/socket 703, which links the timer and programme panels, was disconnected. The timer display then came on and continued, even after reconnecting PG/CN703. All functions were fine except that there was no channel movement up or down. Voltage checks around the programme control chip IC721 revealed that pin 13 was at approximately $1\cdot 2V$ instead of 10V, but the cause didn't seem to be due to anything connected with this pin. Eventually we found that C712, connected to pin 17, measured 40pF instead of $0\cdot 01\mu F$. Replacing this capacitor restored normal operation. M.S.B.

TV Fault Finding

Reports from Jim Rainey, John Coombes, Malcolm Burrell, George R. Wilding and M.S. Barakat

Decca 100 Series Chassis

Intermittent mains fuse blowing on these sets can be due to the earth tag of the h.t. reservoir/smoothing block C801/2. We've had at least six cases recently. It can also cause the fusible resistor R282 on the decoder panel to go open-circuit, giving the white raster with flyback lines symptom.

Field collapse can be the result of resistors R361/8/9 in the field scan circuit going open-circuit. They are all 1Ω , $\frac{1}{2}W$ and are connected in parallel to provide the earth return path and develop a field feedback waveform.

J.R.

Grundig CUC220 Chassis

We've had several cases of field collapse due to D2764 (SKE2F1/01) going open-circuit. The clue is a voltage reading of about 7V at pin 8 of the TDA2655B field timebase i.c. instead of 23.5V.

Philips G11 Chassis

The fault with this set was reduced field scan. It was found to be due to R2104 (1 Ω) going open-circuit. This is one of two parallel-connected resistors that provide the earth return path for the field scan current, their main purpose being to provide feedback waveforms. Since one resistor only was open-circuit, the amplitude of the feedback waveform increased – and since this is negative feedback, the field output was reduced. We discovered the cause of the trouble by scoping waveforms and finding the one concerned to be almost twice what it should have been in amplitude.

Thorn 1690 Chassis

This set had an awkward fault: it would operate quite happily, then the sound and vision would suddenly vanish. It had been in a couple of times already. We'd changed the a.g.c. transistor and the video driver transistor and everything had seemed to be o.k., but back it would come. The problem was to pounce on the set before the fault cleared.

A.G.C. problems can be difficult. Is the fault in the a.g.c. circuit or the controlled stage(s)? A sort of chicken and egg situation. The a.g.c. gating was checked with a scope and was in order. Voltage checks weren't much help, so the scope was used to monitor the a.g.c. voltage at each of the two controlled transistors VT1 and VT2 (see Fig. 1). When the fault occurred, the voltage varied widely. The reservoir/smoothing capacitors in the a.g.c. circuit were suspect, but proved to be o.k.

I decided to try operating both controlled transistor's with bias from a battery/potentiometer combination instead of the a.g.c. line, whilst monitoring the a.g.c. voltage. The biasing of the controlled stages remained erratic but the a.g.c. voltage was stable. At least we'd cleared the a.g.c. circuit of suspicion. The a.g.c. was then reconnected to VT1 while VT2 was biased from the battery. The fault persisted. The biasing arrangements were then swapped over, with VT1 externally biased. The fault was less apparent, but the bias at VT1 still varied. I concluded that the fault was in the first i.f. stage. Having checked the

transistor, C10 was checked. It seemed o.k. when checked with a meter, but the fault went when it was disconnected. After fitting a replacement the set ran on soak test for several days and was then returned to the customer. M.B.

Thorn 1590 Chassis

As far as we could see, the picture on this monochrome portable was of about normal height and linearity. It was displaced however so that it filled mainly the top of the screen – as if there was a shift control that was turned to one extreme. The only possible reason for this unusual condition was an abnormal d.c. supply through the field scan coils. The cause was evident on removing the back. R95 (6.8k Ω), which feeds a small current from the 95V rail to the field scan coils, was badly discoloured. On test it was found to have fallen to a very low value. Replacement restored normal conditions. G.R.W.

Fidelity CTV14R

The contrast level was low, the control itself having negligible effect. This potentiometer varies the voltage, normally about 6V, at pin 7 of the TDA1365 colour decoder i.c. We found that there was little voltage at pin 7 whatever the setting of the control, due to a leak in the electrolytic C116 which decouples its slider. The basic cause of the trouble was that the capacitor had been connected the wrong way round. It had managed to stand up to the effects of incorrect polarity for some time, but had eventually succumbed. We've since heard that this was not an isolated case of C116 being inserted the wrong way round.

G.R.W.

Philips G11 Chassis

There was reduced height and width, but the most disturbing feature was the way in which the raster periodically varied in size and jumped about. Our first impression was that the h.t. supply was incorrect and unstable, but a check at TP1 produced a normal reading of 156V. We've had cases of dry-joints on the line scan panel in this chassis, particularly on the oblong, green-cased capacitors. Applying pressure to one of them produced a distinct

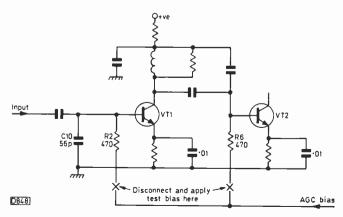


Fig. 1: A.G.C. checks using a battery.

rocking movement, indicating an unsoldered connection. When this connection and one on the other similarly encased capacitor had been resoldered we had a stable, full-sized picture. Since the leadout wires of these capacitors fit straight into the PCB holes without bending, it seems that they may drop away from the board, thus leaving insufficient lead protruding for correct soldering during production.

G.R.W.

Toshiba C1480B

If there's no channel memory, check whether the indicator LED DA20 lights – note that it's shown as DA01 on the circuit diagram and DA20 on the panel. If it does light, check whether it goes out when the memory switch SA21 is operated. Replace DA20 or SA21 as necessary. If these items are all right, check the voltages around the TC9002P control i.c. (ICA01). Replace the i.c. if any discrepancies are found. If necessary check the TMM841P memory chip (ICA02) in the same way.

J.C.

Grundig 8610

The problem with this set was no colour. A replacement colour module was fitted, but still no colour. Next an RGB module was tried, this time restoring the colour. So where was the fault in the original module? This module contains

part of the colour decoder, including a rather unusual i.c. (IC941, type TCA660) which seems to be to do with Secam operation. Scope checks showed that the demodulated chroma signals were reaching pins 8 and 9 of this i.c., but there were no colour-difference outputs at pins, 7, 10 and 12. Voltage checks around this i.c. were then made. All voltages were present and correct except for pin 6, which was at approximately 0.8V instead of 5.5V. This pin is associated with Secam operation, and the only thing connected to it in UK models is C904 $(0.01\mu\text{F})$. It turned out that this capacitor was leaky, replacement restoring normal operation.

Decca 110 Series Chassis

For a bright picture with flyback lines, check whether $R913~(220k\Omega)$ on the tube base panel is open-circuit. It's in the earthy side of the tube's first anode supply network. J.C.

Toshiba C2090B

The field output transistors TR306 (2SC2073) and TR307 (2SA940) can be responsible for field jitter on this model. Check them by substitution. If still in trouble suspect the TA7609P timebase i.c. (IC301). Again check by replacement.

J.C.

Improved Replacement Modules

Tony Thompson

It's odd that some of us tend to have an irrational fondness for certain older TV chassis even though we know all too well that they suffer from various weaknesses due to poor design. Occasionally the illnesses to which they are prone become so acute that repair is impossible. An alternative in this case is replacement of the offending module. But this isn't always possible. Manufacture of the module concerned may have ceased, or a serviceable unit may be demanded before a working one is provided – an illogical requirement, since non-repairability is the usual reason for the need to fit a replacement!

We are fortunate nowadays in often having an alternative to the units supplied by the original manufacturers. Such panels and modules are generally of improved design, produced by enterprising smaller firms that are quick to spot a servicing need and can make the quantities required economically. The claim is that such units are not only as good as the originals but often capable of providing measurably better results.

The following notes cover various currently available tuners, tuner selector switches, convergence and colour-difference amplifier panels, i.f. gain modules, transistorised replacement units for valves and certain e.h.t. trays and line output transformers. I'm not claiming that the list is exhaustive: it should however give an idea of what's available, and the items mentioned have all been tried and found to be satisfactory. The chassis involved are getting on a bit, but the endemic faults that call for a replacement module will show up as a set ages.

GEC CTVs

I've been well served by the solid-state GEC C2110

series over the years. It's a chassis with no really bad features apart from the annoying double-sided print. The main problem arises in those models fitted with touch tuners. These are prone to sticking on one channel, or tend to return to the same channel despite the customer's efforts to watch his favourite programme. They can also vacillate between channels at a fair old speed, seemingly unable to decide which one to pick. It's mainly due to the neons, or to dirt or moisture on the touch pads. You sometimes come across a really troublesome one.

The problem can be eliminated by fitting a conversion tuner. These come complete with a new escutcheon with the station titles screened on – the touch pads are replaced by light-action switches. Fitting this conversion unit is in my experience well worthwhile, especially if you are renting the sets out or selling them under guarantee.

There are still some of the older hybrids with us. In this case I don't know of any alternatives, so it's out with the file, soldering iron and the thick copper wire and the hope that the burn-up on the timebase panel is not too severe!

The Philips G8

The later 550 version of the popular Philips G8 chassis suffers from three basic weaknesses: the tuner head switches, the line output transformer and the convergence panel.

The tuner control unit has six flap switches in two rows of three, the whole thing pivoting forwards for adjustment. It's often unreliable and is rather fiddly to tune – there's an uncertain quality that gives the conscientious engineer a guilt complex even when he's taken care, switch parts have been refitted and a new a.f.c. switch has been

installed. S.E.M.E. Ltd. (address later) can supply a new head that's a direct replacement for the original but has a radically different and more robust switch action and an easier to adjust potentiometer bank. The unit can be fitted without having to remove the back cover – a real bonus, as anyone who's struggled with the G8's awkward back will testify! I've not tried it on the earlier 520 version of the chassis, but it seems probable that with a little enlargement of the space the switch could also be used with this.

The 550 series convergence panel is troublesome, with a tendency to burn-ups and drift. The print will often be found in a badly charred state, making a satisfactory repair difficult. The alternative replacement panels available from the same source offer no great technological improvements but are better designed and give greater reliability with cooler running and generally better performance. They are direct plug-in units, requiring no soldering and needing only the minimum of adjustment.

I'm sorry to say that to date I know of no replacement for that infernal transformer! All I can suggest is careful balancing of the two-transistor output stage whenever the transformer or the transistors are replaced. This does seem to help, but I'm never without a couple of spare transformers in stock...

Pve CTVs

The Pye hybrid CTV series that's so popular with many engineers has long suffered from a colour-difference amplifier panel with a self-destruct tendency. This badly designed unit is crowded with heat generating valves and resistors and sits horizontally at the base of the cabinet, secured around its extremities by springy wire retainers in other words its support is inadequate! In addition there are numerous whisker thin print tracks. As a result of this, after the flexing and straining caused by many thousands of on-off cycles there's a tendency for lots of elusive intermittent faults to begin to show. Identical replacements were once available, but only on receipt of a repairable panel – a burnt one was not acceptable. Happily there's a solid-state replacement with transistorised output stages. Better definition is claimed. but you must decide for yourself. Some care is necessary in fitting the unit, with thoughtful dressing of the leads, if patterning and other instability problems are to be avoided.

Before splashing out on a replacement panel however the condition of the rest of the set should be assessed – pay attention to the power supply, especially with the later line timebase/power supply panel which suffers from the same malady of thin print tracks and flexing due to the heat and the weight of components (it's also somewhat inaccessible).

The module that gives most trouble in the subsequent solid-state Pye chassis (the 713/725/731 series) is the i.f. filter/gain unit. I've found the replacement developed by LEDCo a useful alternative.

Tuner Control Conversions

The ITT CVC8/9 chassis have proved their reliability. Due to the fact that the tubes seem to last forever, they are deservedly popular. The problem here is the five-way, square button tuner bank. There's a conversion replacement (Alderson-James Ltd.) with six round buttons: well worthwhile.

Piano key versions of the Decca hybrid chassis can be

fitted with more reliable six- or eight-key units – some Telefunken sets were fitted with this chassis. The solid-state 70/90 series, which feature touch tuning, can be easily converted to light-action push buttons.

General Replacements for CTVs

There are two main items when it comes to general replacements rather than modules for particular chassis. First the universal e.h.t. tray. These are available from a number of sources to fit, with slight modifications, a whole range of UK and Continental chassis including those from Luxor, Decca, ITT, Telpro, Autovox and dozens more. The main exception is the Thorn range, from the 2000 onwards. Thorn went their own way in the matter of triplers, and you've just got to fit the proper replacement.

The second item relates to the luminance output stage. Most hybrid sets use the PL802 valve, which has been scarce and expensive for a long time. When a solid-state version came on the market many of us breathed a sigh of relief. The device works tolerably well, but I find that care is sometimes needed in adjusting the a.g.c. etc. I have to admit that I prefer the valve.

Monochrome Sets

"Solid-state" line output transformers are available for use in a number of monochrome chassis including the Pye 169/173 series, the Philips 210/300 series and the Rank A774 – they are solid-state in the sense that a stick e.h.t. rectifier is used in place of the troublesome thermionic diode type. They cost no more than the conventional type of transformer: I'd recommend the change if replacement is necessary.

The problem with some Rank portables is hard to obtain tuner units. Modified tuners based on standard electronic types are now available at prices that make the repair of these previously too costly to fix sets once more worthwhile.

Assess the Set First

Finally, a word of caution. These improved units can be tempting, but the general condition of the set should be carefully considered. A new tuner head or panel won't give the whole set a new lease of life and may cost a fair proportion of the set's market value. If the set is in generally good condition however it will often benefit from this updating.

Sources

The items that have been mentioned are available from various advertisers in this magazine. Other sources include:

S.E.M.E. Ltd., Unit 2E and F, Saxby Road Industrial Estate, Melton Mowbray, Leics. Tuner head conversions and convergence panels for the G8, solid-state CDA panels for Pye hybrid colour sets, universal triplers and the solid-state PL802 are available from this source.

Willow Vale Electronics, Old Hall Works, Arborfield Road, Shinfield, Reading can supply solid-state monochrome receiver line output tranformers, universal e.h.t. triplers, LEDCo i.f. filter/gain modules for the Pye 713-741 series, solid-state CDA panels for the Pye Hybrid chassis, and GEC C2110 series tuner head conversion kits from touch-tune to light-action switching.

HV2000 Sync Adaptor Unit

John Hammond

The Sony HV2000 provides a 12V d.c. supply for a colour and a monochrome camera and enables the user to switch synchronously between the two cameras. In addition the monochrome signal can be faded or superimposed on the colour display, and can be synthetically coloured. A description appeared in the February 1981 issue of *Television*. It's a good quality unit, considering the low price, but its flexibility is limited by the unusual sync drive it provides for use with Sony's own monochrome camera. The simple circuit described in this article allows you to use any camera that requires HD and VD drive pulses, e.g. the National WV241 or various "industrial" cameras that can be bought cheaply secondhand.

Circuit Operation

The circuit is shown in Fig. 1. It produces HD and VD pulses directly from the HV2000's inverted mixed sync output. This means that there's a slight delay, and there are no syncs of any sort if there's no signal applied to the HV2000's colour camera input. The delay is no real problem, because the monochrome input is "cut" into the colour signal. The lack of syncs means that the camera's scan circuits must free run in the absence of any drive. The drive pulses provided are not to CCIR specifications or anything like it, but all the cameras tried have been quite happy.

Since we have to change only the form of the sync signal, the circuit is very simple. Regardless of what feeds the HV2000 unit, the mixed sync signal it provides is the same – all the separation and filtering have been done for

Vertical Drive Pulse Circuit

R2 and C2 form a low-pass filter that gives us a VD signal to feed to Tr1 for amplification and inversion. Tr1

just about saturates, which helps to reduce any HD ripple on the VD signal. Diode D2 ensures that Tr2 turns off completely between sync pulses, giving a clean back edge. The VD pulse thus obtained is buffered by the emitter-follower Tr3 – a pnp device is used because current for a negative-going pulse is required.

If you compare the two pulses on a scope, you'll see that the VD pulse is slightly behind the incoming vertical component of the mixed syncs. Altering the value of C2 will reduce this delay if necessary, but the value of R7 will probably need to be changed as well to ensure that D2 operates correctly.

Horizontal Drive Pulse Circuit

The HD pulse is fed to the base of Tr4 by the coupling network C1, D1, R13. Tr4 is another saturating amplifier which inverts the pulse to obtain the correct polarity. The output is buffered by Tr5. The sync signal from the HV2000 unit swings nicely about earth potential once the operating conditions have settled after switching on – hence R1. This means that on the negative swings (the VD pulse part) D1 conducts. C1 then sees a path to earth, whereas on the positive swings it sees R13. Thus adequate RC filtering of the HD pulses and d.c. clamping are both obtained, providing a good operating point for Tr4.

Construction

Several types of transistors were used in the prototype and seemed to behave well. Avoid using very high or low gain types. Boxed versions of the BC107 and BC117 were finally used. The power supply required comes from the HV2000 which can also supply the camera if this is suitable for 12V operation.

The original prototype was housed in a diecast box with a 10-pin socket at the side for the camera cable. A BNC

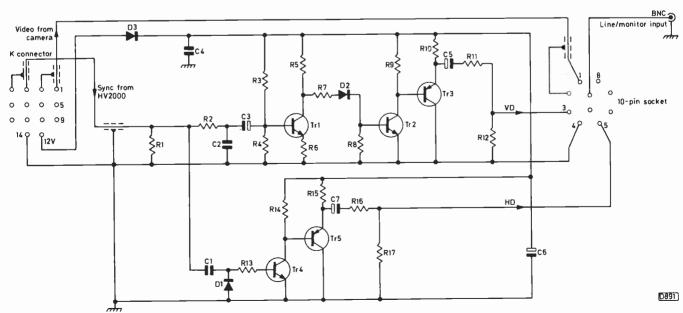
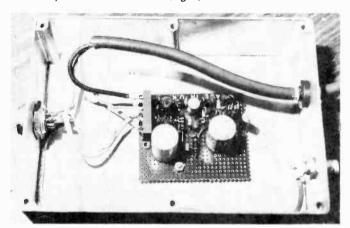


Fig. 1: Circuit diagram of the sync adaptor unit.



The sync adaptor unit (left) in its diecast box connected to the Sony HV2000 video unit (right).



Internal view of the sync adaptor unit. The circuit is built on Veroboard and is not critical.

socket was also fitted as a video return feed to the camera. Cameras such as the WV241 have a camera/line switch in the viewfinder. By connecting the HV2000's monitor output to this socket, a caption can be lined up in the viewfinder to see how it looks.

A short multicored lead was fitted, with a K connector, to suit the HV2000. Separate leads could have been used of course. Suitable coaxial cable must be used for the video lead. The sync lead should be the same or at least an audio type screened lead.

The camera was tried with 10-pin leads up to 50ft long and no problems arose. Remember the sync delay however – this will mean that the caption or whatever will shift, so go by the centring as seen by the "lineview" position or any other monitor connected to the HV2000's monitor output.

Components list					
Resi: R1 R2 R3 R4 R5 R6 R7 R8 R9 R10 R11 R12 R13 R14 R15 R16	22k 10k 10k 470 10k 6k8 4k7 1k 47 4k7 2k2 4k7 1k 56	Capacitors: C1 0.0033 C2 0.022 C3 $10\mu\text{F}$, 25V C4 0.047 C5 1,000 μF , 25V C6 1,000 μF , 25V C7 $47\mu\text{F}$, 25V Semiconductor devices: D1-2 1N4148 D3 1N4001 Tr1-2 BC107 Tr3 BC177 Tr4 BC107 Tr5 BC177			

next month in

TELEVISION

VIDEO RECORDING ON TAPE

As the current generation of VCRs roll off Japanese production lines at the rate of millions a year, it's difficult to appreciate the problems the pioneers had, only some twenty or so years ago, in getting any sort of picture at all in their attempts to record video signals on tape. The evolution of video recording to its present highly successful state has been a magnificent engineering achievement. Perhaps we tend to take it too much for granted. Next month Eugene Trundle takes a look at the way in which a video signal is tailored and modulated so that the tape medium can handle it.

SPECTRUM-MONITOR INTERFACE

The Sinclair Spectrum is one of the most popular low-cost home computers. John de Rivaz wanted to use it with a monitor that required RGB plus sync inputs. Unfortunately the nearest signals that could be found in the Spectrum were luminance plus PAL chominance. So an interface to produce the required signals had to be devised. It was found that the SL901B i.c. and a small number of extra components enabled a compact interface unit to be built.

• ELECTRONIC CIRCUIT BREAKER

One of the most difficult faults to deal with is the set that blows fuses intermittently. Finding the cause of the fault can be time consuming, and expensive in terms of blown fuses and other possible damage. This electronic circuit breaker was developed to assist with the problem. It uses a current sensing transformer and a relay to switch off the mains supply to the set.

SERVICING FEATURES

Mike Phelan on the Grundig 2×4 Super. TV Fault Finding. VCR Clinic. Plus Service Talk by Malcolm Burrell – on various aspects of the servicing scene.

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TV Test Pattern Generator

Part 2

Tony Jenkins, G8TBF

This month we'll look at the colour encoder section and the power supply. A separate printed circuit board has been prepared for both of these and details, along with constructional and setting up details, will be given next month.

Coder and Modulator

The colour encoder takes in separate sync, red, green and blue signals (also the grey-scale signal) and produces a composite video output. This is available at v.f. or, via the modulator, at u.h.f.

The encoder/modulator circuit is shown in Fig. 6. The heart of the encoder is a Mullard i.c. (IC3), type TEA1002. A block diagram for this device is shown in Fig. 7. It has an internal 8-86MHz oscillator from which the R-Y and B-Y carriers are generated. Composite sync, burst gate enable, PAL switch and composite blanking timing signals are required in addition to the RGB and grey-scale inputs. The output is a 16-colour (including black and white) composite video signal, based on 75 per cent colour bars.

The RGB, composite sync and composite blanking signals are fed directly to the i.c. from the logic board where they are generated and inverted as required. The burst gate enable and PAL switch signals are generated on

the colour encoder board from the composite sync signal. The grey-scale drive is also generated on the encoder board. The burst gate enable signal is derived from one half of IC4, type 4528, a dual retriggerable-resettable monostable. A CMOS device is used deliberately to introduce a small delay at the start of the signal. The RC network R4/C2 sets the pulse width at around $2 \cdot 2\mu$ sec. The output goes to pin 15 of the TEA1002.

The other half of IC4 is used to provide a line frequency trigger pulse for one half of the 4013 dual D-type flip-flop IC5. This produces the 7 8kHz PAL switch signal which is fed to pin 12 of the TEA1002.

The three-bit binary-coded grey-scale information is fed to IC1 (a quad two-input OR gate) along with the grey-scale enable signal. The outputs from these OR gates (when enabled) are fed to sections of IC2 (hex driver with open-collector outputs) and arrive, via the three presets VR1, VR2 and VR3, at a common summing point that drives the TEA1002's luminance input (pin 7). FC2 is the most significant bit, causing a single transition from black to white. FC1 is the next most significant bit, producing the "almost black" and "almost white" bars. FC0 is the least significant bit, filling in the greys. The background enable signal simply inserts a level of grey, set by VR4, to lift the crosshatch background out of black.

Since the current capability of the video output from the

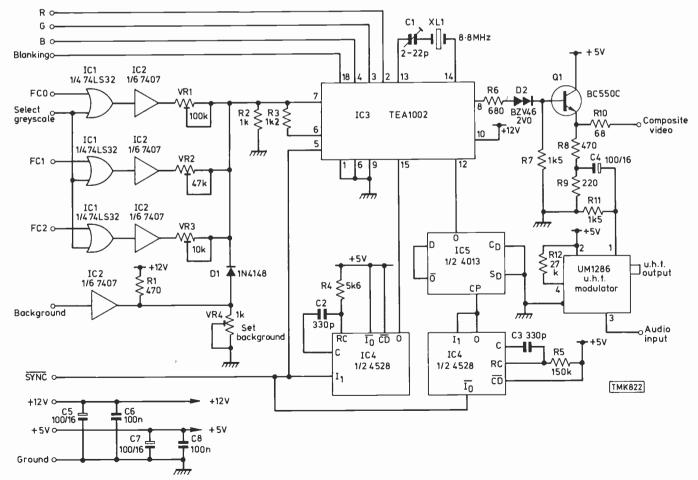


Fig. 6: Circuit diagram of the encoder and modulator sections of the pattern generator.

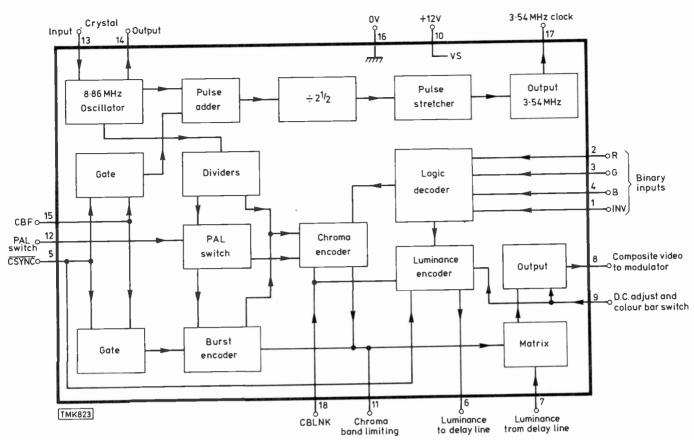


Fig. 7: Block diagram of the TEA1002 encoder i.c. The 3.54MHz clock output is not used.

Components list: encoder						
Resistors: R1 470 R2 1k R3 1k2 R4 5k6 R5 150k R6 680 R7 1k5 R8 470 R9 220 R10 68 R11 1k5 R12 27k All \(\frac{1}{2} \text{W}, 5\text{%} \) carbon film VR1 100k VR2 47k VR3 10k VR4 1k miniature skeleton presets, horizontal mounting	C1 C2 C3 C4 C5 C6 C7 C8 Sen D1 D2 Q1 IC1 IC2 IC3 IC4	330pF ceramic 330pF ceramic 100μF, 16V radial el. 100μF, 16V radial el. 0·1μF ceramic 100μF, 16V radial el. 0·1μF ceramic niconductor devices: 1N4148				
Miscellaneous: XL1 8-8MHz crystal v Astec UM1286 u.h.f.	with He modu	C18/U case lator. PCB.				

TEA1002 is rather limited, a buffer transistor (Q1) is used. Resistors R6 and R7 reduce the input level at the base of this transistor to 2V peak-to-peak. The output is a 75Ω signal which is reduced to the normal 1V peak-to-peak when terminated at 75Ω . D2 is the equivalent of two diodes in series but giving a close-tolerance forward voltage drop

Components list: power supply

C1 C2 C3 C4	1,000 μ F, 25V axial el. 1,000 μ F, 25V axial el. 4,700 μ F, 16V axial el. 100 μ F, 16V axial el. 0.1 μ F ceramic	D1 D2 BR1 IC1 IC2	1N4001 1N4001 KLB02 7812 7802
C5 C6	100μ F, 16V axial el.	102	7002

0.1μF ceramic

C7

Mains transformer RS 208-333, 18VA. Heatsink 50mm length of RS 401-497 (for IC1/2).

of 2V. Its purpose is to remove 2V from the 2.6V d.c. pedestal on which the video signal sits. Q1's base-emitter voltage drop removes the residual 0.6V. In practice there's a very small residual d.c. voltage, though it's insignificant. D2 can be omitted if a 2V pedestal can be tolerated.

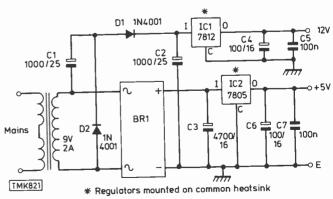


Fig. 8: Power supply circuit.

Another potential divider, in Q2's emitter circuit, reduces the signal to the level required to drive the UM1286 u.h.f. modulator. R11 sets the modulator's d.c. working point. This should be 2.2V: any significant departure from this voltage will cause sync crushing or even loss of sync. The value of R11 may need to be adjusted.

The modulator selected is a good-quality wideband type which also contains an intercarrier oscillator. If required, the frequency of this can be changed to 5.5MHz. An addon audio oscillator will be described later. Constructors can if they wish use a CMOS divider circuit fed from the 7.8kHz output of IC5 to produce several frequencies, one

of which can be fed directly to the modulator's audio input pin.

Power Supply

The power supply is straightforward, using a 7805 regulator to produce the 5V rail and a voltage doubler followed by a 7812 for the 12V rail. This arrangement is an economical design requiring only one mains transformer providing one secondary voltage, without excessive dissipation in the 5V regulator. Connect the transformer's primaries in series and the secondaries in parallel.

Teletopics

THE FS TUBE

There have been several major developments in colour tube technology over the years. First, in the early seventies, came the self-converging, in-line gun tube. More recently there's been the development of tubes that require neither EW nor NS raster correction. The latest development is the FS (flat, square) tube, which has squared off edges and an almost flat faceplate. As with previous advances, the main improvements have been made possible by developments in yoke design - and in electron gun focusing arrangements. The advantages claimed for the new tubes include absence of display geometry distortion, reduced ambient light reflection as a result of the flat screen, and improved legibility at the corners of the screen. The new tubes have been under development for some time by Toshiba, Philips and Mitsubishi amongst others. They are expected to be used initially in up-market receivers and monitors.

The first domestic receiver in the UK to be fitted with such a tube has already been announced – the Fisher Model CFB2110STX. This is a full-specification 21in. model featuring a SCART socket, stereo sound, remote control and a built-in teletext decoder. It's expected to retail at around £530.

1983 TRADE FIGURES

The official BREMA figures for TV and VCR deliveries during 1983 have now been released. Total CTV deliveries during the year were a record at 3,496,000, an increase of 19·2 per cent on the 1982 figure. VCR deliveries showed a slight (0·05 per cent) decline at 2,234,000. This decline was much sharper during the final quarter however, the fourth quarter figure of 546,000 being 40 per cent down on the total recorded during the final quarter of 1982. Various reasons for this decline have been suggested, including price rises. Whatever the cause, it appears that the boom is over for the present at any rate.

TV deliveries for 1983 break down as follows: Large-screen colour sets 2,240,000 (10·7 per cent increase); small-screen colour sets 1,256,000 (37·9 per cent increase); teletext equipped sets 641,000 (12·3 per cent increase); monochrome portables 1,131,000 (11·8 per cent increase). Imports of large-screen colour sets increased by 44·2 per cent to 519,000 while imports of small-screen colour sets increased by 39·3 per cent to 787,000. Deliveries of UK manufactured small-screen

colour sets increased by 35.5 per cent to 469,000: it's clear that UK capacity at this end of the range is still nowhere near adequate.

RCA ENDS DISC PLAYER PRODUCTION

RCA has decided to cut its losses and cease production of CED video disc players, leaving production entirely to Hitachi. Production of the discs will continue at RCA's Indianapolis plant. This seems to be a rationalisation measure since the system has not done as well as hoped and there is little point in having two player manufacturers at current rates of production. RCA, Hitachi and GEC have announced that the decision on player production will make no difference to current plans to promote the system in the UK. Greater emphasis is to be placed on selling the discs in competition with audio records rather than video cassettes.

THORN'S MOULDING INVESTMENT

Thorn EMI Ferguson is investing £8 million in a new plant to make high-quality plastic mouldings for consumer electronics and computer products - the largest single investment ever made by the company. The plant will occupy a seven acre site at High Wycombe and is expected to be in production by the end of the year. The aim is to meet Thorn's own needs for TV and VCR cabinets etc. and increase the sales of mouldings to other information technology companies. About 60 per cent of production will be used initially for Ferguson brand products. Thorn plan to increase production by 50 per cent within two years, when external sales should rise to 60 per cent of production. The present Elco Plastics plant at High Wycombe and a smaller plant at Gosport are to be closed. A statement from the company comments that "the decision to invest in high technology capital equipment, which includes robotics, follows a period of investigation into developments in consumer electronics and information technology and is in direct response to the recent National Economic Development Office report and recommendations." Thorn's investment should certainly help overcome the excessive dependence on imported smallscreen colour sets noted above - you can't produce sets without cabinets to put them in, and this seems to have been something of a production bottleneck in the UK in recent times.

TELEVISOR RENOVATED

Engineers and apprentices at Plessey Radar, Cowes, Isle of Wight have combined their talents – and patience – in restoring an antique Baird televisor dating from the early thirties. It had been found under a pile of rotting firewood in an Essex outhouse and has now been lent to the

National Wireless Museum at Arreton Manor, IOW. Only six televisors have survived: they are believed to be priceless. To operate the 30-line televisor a household also had to own two radio sets. This lot gave them pictures that were described as "barely discernible". They were broadcast for two hours each evening, on the medium wave band. One radio provided the vision signal, the other the sound. It's hoped that with the aid of a scan converter the televisor may eventually be adapted to show current 625-line pictures. The greatest problem was presented by the aluminium Nipkow disc, which had been buckled and torn. It couldn't be restored, so a copy had to be made. Fortunately the televisor was complete, with no bits missing, but it was extremely tarnished and needed much cleaning up.

VCR LATEST

Philips have now released details of their plans to market VHS VCRs in the UK. The initial VCR, Model VR6520, will be imported from Matsushita. A subsequent model, the VR6460, will have Japanese mechanics and Philips' electronics. Later machines will be wholly produced in Philips' plants, starting this autumn. A new generation of lightweight V2000 machines is due to go into production at the same time.

Grundig (now controlled by Philips) appears to be ahead of its new parent company with its plans to launch European produced VHS machines. The initial Grundig VHS machines (the VS range), due for release this summer, are expected to be of almost entirely European design and manufacture.

An agreement has been reached between Sony and the Spanish Industry Ministry to establish a plant for the manufacture of Betamax VCRs in Spain. The plan is for production to start by 1987 at an initial annual rate of 125–150,000 machines.

Two VHS VCRs have been added to the Decca/Tatung ranges - Models VRH8400TK/VRH8400DK and VRH8500TK/VRH8500DK respectively.

A Betamovie camcorder, Model VCR100P, has been added to the Sanyo range. It's fitted with a ½in. SMF Trinicon tube and is expected to retail at around £1,000.

There are reports that a half-speed 8mm video system is under development, giving a record/playback time of three hours.

The latest EIAJ figures, for February, show that Japanese VCR exports during the month rose to 1.49 million units, an increase of 55.5 per cent on February 1983. The main increase was in shipments to the USA: these rose by 167.4 per cent, accounting for 43.4 per cent of the total. Exports to the EEC fell by 14.7 per cent – by 47.1 per cent in the case of the UK.

12GHz CONVERTER

A low-noise 12GHz downconverter has been announced by Wave Devices Ltd. (9 Betterton St., London WC2H 9BF). Key to the light weight and compact size, which enable the converter to be mounted on a dish as small as 2ft in diameter without excessive mechanical stress or shadowing of the reflector surface, is the use of microwave i.c.s. The 1·5 × 1·5 × 5·4in. unit contains an ultra low-noise gallium arsenide f.e.t. preamplifier, a block downconverter, local oscillator and i.f. amplifier, and weighs only 16oz. There are two models, the ACA1170X which converts signals in the 10·95–11·75GHz band to an i.f. of 900–1,700MHz, and the ACA1270X which accepts

signals at 11·7–12·7GHz and provides an output at 950–1,950MHz. Both have a 50dB conversion gain with a maximum noise figure of 3dB at 25°C and a typical output power of +7dBm at the 1dB gain compression point. The i.f. amplifier consists of three microwave i.c. modules occupying just 0·3 square inches of the board and providing a gain of 30dB, the output power level being sufficient to minimize the possibility of noise pick up in the downlead.

The downconverters can be used to drive any number of receiver/demodulators by signal power division – additional signal amplification will in most cases not be required. A high or low local oscillator is available for either a normal or an inverted signal. Installation is easy, the units coming equipped with a standard WR75 waveguide flange and being self-supporting when bolted to the aerial's waveguide flange mount. A 15–28V d.c. supply is required, fed in via the N output female connector. The converters can be factory preset to a number of international downlink bands.

DIGITAL TV TRANSMISSION

A two-way digital microwave link has been installed between the IBA's Engineering Centre near Winchester and the Isle of Wight for the investigation of digital transmission systems using frequencies above 10GHz and a data rate of 140 Mbit/second. The link will provide the IBA with a test bed for the evaluation of digital transmission techniques and the assessment of the effects of microwave terrestrial propagation on transmission performance. The video coders/decoders sample the composite TV signal at three times the colour subcarrier frequency, using eight bits per sample. Differential pulse-code modulation is then used to reduce the bit rate to give a difference signal with a five-bit resolution. The audio codecs use the NICAM system to code up to six highquality programme channels at 2Mbit/sec. This is added to the coded video signal to produce a 68Mbit/sec channel carrying one vision and up to six audio channels. Two such 68Mbit/sec data streams are multiplexed for transmission over the link at 140Mbit/sec.

The digital transmission system uses quadrature phase-shift keying (QPSK) at the carrier frequency. Two types of circuit are being used in the receivers and transmitters to permit direct comparisons to be made between coherent and differential demodulators and between solid-state and travelling-wave tube 250mW transmitter amplifiers.

BBC experiments using a TV signal consisting of separate luminance and colour components were briefly mentioned in this column last March.

REDIFFUSION'S FOUR NEW CHANNELS

Rediffusion is now offering cable TV subscribers four additional channels, each catering for a particular interest – sport, music, films and general entertainment. Screen Sport is providing the sports programmes, Music Box the music-video channel, Sky Channel the general entertainment service and TEN (The Entertainment Network) the film service – at least 50 films per month, of which 15 will be new to television. The channels will be offered in two packages: Super at £4.95 a month provides Sky Channel, Screen Sport and Music Box; Super Plus at £12.95 a month includes the movie channel as well. Programmes are repeated to enable viewers to pick and choose their times of viewing, the scheduling being such that programmes can be seen at different times on different days.

Satellite links are being used to distribute the services from a central location to local stations. A Cabletext service provided by Oracle will be available on each channel between programme transmission times.

RANK HI-BEAM 250 PROJECTOR

Rank's new Hi-Beam 250 video/data colour projection system has been designed for educational, commercial or entertainment purposes where a display between five and ten feet horizontal is required. Many of the features of the Hi-Beam 800, which provides displays up to 24ft wide, are incorporated, including keystone correction (±20°), flat, curved or "white wall" projection, and video or RGB inputs as standard. In addition the Hi-Beam 250 has dual-focus high-resolution lenses giving improved edge definition.

Eighty per cent of the components are mounted on pluggable Eurocards, making replacement quick and easy and simplifying modification when tailoring the specification to interface with various computers. Rank Video Systems' sales manager Alex Taylor comments that "the projection of computer graphics and text is likely to be the biggest growth area for this type of product". The suggested price for the Hi-Beam 250, with remote control and ceiling or floor mount, is £4,400 plus VAT. The larger-screen Hi-Beam 800 system comes at £7,200 plus VAT. Stereo amplifiers and speakers and an input select/

enhance unit are available as extra accessories. The latter allows up to six video inputs to be connected.

IN BRIEF

Matsushita has announced the development of an 8-bit analogue-digital video signal converter i.c. whose high speed makes it suitable for use with high-definition TV systems. It appears to be intended for use with the 1,125 line system proposed by NHK for use in Japan.

GEC TV sets are to be distributed by the revived GEC Radio and Television instead of GEC McMichael, which will in future concentrate on professional broadcasting equipment. This change, following GEC's withdrawal from joint production with Hitachi (see last month), restores the marketing arrangements to the set up in operation until eighteen months ago.

The US International Trade Commission has at last ruled on the charges of dumping of colour sets from South Korea and Taiwan on the US market. The decision that US companies are being materially harmed means that the import duties already being imposed by the Commerce Department will become permanent (up to 16 per cent in the case of Korean CTVs and 23 per cent with Taiwanese sets). Duties were first imposed last October following a preliminary Commerce Department ruling. US companies and unions had charged that the imported sets were being sold at less than the fair market value.

VCR Servicing

Mike Phelan

Before we get down to fault finding in the 3V24/5/6, I omitted last month to mention the operation of the sawtooth generator used with the chopper that controls the supply to the reel motor drive amplifier in this machine. It employs a BA222 i.c., which we've already met used as a monostable multivibrator. For it to operate as a free-running oscillator, the input pin 5 is connected to the timing capacitor pin 1, the output being taken from this point. The squarewave that appears at pin 6 is not used.

We'll dismiss the 3V25 and 3V26 tuner/timer and charger briefly. They are very reliable but, like all portable equipment, they tend to get knocked about a bit. Nevertheless a 24/25 or 24/26 combination represents a good buy on the secondhand market if the price is right – cabinet parts are easy to obtain and are not too expensive.

Cabinet Assembly

The 3V24 is, as we've seen, a very compact machine. Before doing any work it's best to remove the cabinet entirely. This is good practice when working on any equipment, to ensure that screws go back in the correct places. It's doubly important with the 3V24, as the chassis can be cracked by fitting wrong screws. Unfortunately if someone else has got there first the screws may not be correct to start with.

First remove the cabinet bottom. There are six self-tapping screws (two also secure the front feet). The front screw is longer and the rear screw shorter than the other four. Don't loose the two rubber feet. Next remove the

handle, its attachment screws, the two plated screws and the side plates. The cabinet top slides off after removing the two screws at the rear and opening the cassette lift. The front unclips. Don't loose the eject knob or the flap that covers the rear sockets. The machine cannot be battery operated with the cabinet removed.

Alarm Mode

The most common fault symptom seems to be that the 3V24 goes into the alarm mode, i.e. all LEDs flashing in sequence. If this happens within six seconds or so of switching on, before any functions have been selected, check the cassette lamp. Most of the other causes of this condition relate to the solenoid control arrangements - as you'll recall, the brake and pinch solenoids are both held in by a permanent magnet and are driven electrically by a bridge circuit. Each also operates a switch to tell the microcomputer i.c. which position it's in. At switch on both solenoids are pulsed in the off direction irrespective of their initial states. If either the drive circuit is faulty or the switch doesn't operate, the alarm mode will be entered. Both the switches are rather flimsy, with open contacts moulded in a block of plastic. The metal loses its spring and the switch remains either open or closed. Usually the brake solenoid switch sticks in the closed position. Alarm is then entered when a function is selected. When the pinch solenoid switch sticks in the closed position the alarm mode is entered without a function being selected.

To gain access to the switches, take off the tracking knobs and remove the servo panel (front bottom). The brake solenoid switch is the one operated by the long bar at the front; the pinch solenoid switch is next to it, with an orange lead. Bending the contacts may work, but the switch will fail again. Replacement is best. Look out also for loose bits of mechanism due to broken plastic posts on the deck – caused by an attack of switch cleaner?

Both solenoid drive bridges give trouble. If any transistor is faulty, replace all four – X25-X28 in the case of the pinch solenoid, X21-X24 in the case of the brake solenoid. If these are defective the solenoid will be either permanently energised or repelled. The transistors are on the audio/microcomputer board and are rather inaccessible – the two bottom boards and the front one must be removed first. These devices must all be replaced with the *exact* type.

If all these things are found to be in order, check the keyscan output waveforms at pins 2, 4 and 6 of IC6 on the audio/microcomputer board – just to the left of the microcomputer i.c. (IC4). Each waveform should be 10V peak-to-peak. If one is stuck at 10V or chassis or is much reduced in amplitude, suspect IC6 – it's a buffer between the microcomputer i.c. and the keyboard.

The microcomputer i.c. itself can cause this fault, but this is unusual. Two types have been used, the $\mu PD553C-066$ and the later $\mu PD553C-159$. They are completely interchangeable. The $\mu PD553C-159$ has a revised program that gives certain benefits.

Common Faults

A blank screen with no sound in the E-E mode, plus a constantly running drum motor, means that the clock oscillator has stopped. This is common with the -066 microcomputer i.c., but check the ceramic resonator first.

IC4 can also be responsible for a permanently on audiodub LED.

If the alarm mode is entered on playback but the machine appears to be running normally, check at TP2 (drum flip-flop signal) on the servo panel. If this waveform is missing, try adjusting the pulse level control R82. Other causes are leaks in X1 and an open-circuit pickup head. A similar effect occurs when the take-up reel sensor goes open-circuit – it's located below the reel disc. Occasionally it doesn't fail completely but the machine packs up towards the end of an E120 or E180 tape, when the reel speed is slow.

Failure of the tape to take up at all points to the chopper transistor X49, the operational amplifier IC8 or the reel motor itself $-2V \pm 0.3V$ across the motor during playback is normal. Check that the reel idler is free to move.

A very strange set of symptoms arises when the 9V fuse FS1 on the chroma panel goes open-circuit, as the 12V rail is still present. Select play and the reel and capstan motors take off, alarm is entered and the flashing LEDs are accompanied by the sound of tape being mangled.

The Servos

Most drum servo and motor drive amplifier faults result in the drum rotating at a terrific speed (in either direction!). The most common cause is that C24 or C25 (both $4.7\mu F$) in the loop filter circuit is leaky – remove them and the drum should run at the correct forward speed, though erratically. C1 and C2 ($0.022\mu F$) on the MDA board can also cause this. IC3 (VC1029, back to the servo board again) can also be responsible for excessive forward speed, as can a couple of its associated components, namely C34 ($10\mu F$) and C35 ($0.01\mu F$). There should be 6V ± 0.2 V at pin 9 of a VC1029, as it contains its own 6V regulator.

The same remarks apply to IC5 (SFF and SREW speed control) and IC13 (capstan speed control). With these two VC1029s there will be excessive tape speed when the voltage at pin 9 is low – so much so that line lock is lost,

leading one to suspect the drum servo. The head speed is correct however, line lock being restored in the still frame and slow motion modes.

The HA11711 drum/capstan phase control i.c. can give problems but is generally reliable.

One other component in the capstan servo circuit causes trouble, C17 ($0.047\mu F$). It can leak or go short-circuit. It's the trapezoid (TP5) integrating capacitor – the trapezoid will either disappear altogether or be severely distorted, with rounded slopes. The result is excessive tape speed or severe wow and a noisy picture.

Signal Circuits

The signal circuits are reasonably reliable. Picture quality with early models can be improved by changing C47 to $22\mu F$, R52 to 180Ω and replacing R62 with a shorting link. These components are on the luminance panel.

Any spillage of liquid into the machine ends up on the luminance and servo boards. Sometimes the only answer is to replace them both, as the component and i.c. leads corrode away. The *LC* filters on the luminance board, LPF1 and EQ1 in particular, seem to be prone to corrosion after an accident, causing either complete loss of E-E video or a negative picture (because we've altered the d.c. conditions at X6 and thus the a.g.c. amplifier in IC2).

If there's no picture, or severe limiting in both E-E and playback, the fault must lie towards the "back" end – X14, X15 or the r.f. converter. We've also had C69 ($10\mu F$) go open-circuit, causing cogging and field jitter, i.e. poor video l.f. response. There are lots of electrolytics in video recorders and some of them are starting to age. Don't forget to check the E-E and PB 9V rails with no picture faults – they are switched by X20/21 and, for E-E 9V, X22/23. We've actually had X22 going leaky to give E-E and playback at the same time – stereo pictures!

Most chroma faults are down to i.c.s or crystals. As always, scope the main converter first (IC2, pins 6, 8 and 9). Don't forget that if the signal is being lost at a later point on playback there'll be no gated out burst and no a.c.c. The input at pin 6 of the converter will thus be of excessive amplitude and the output at pin 9 will be severely distorted. BPF2 (4.43MHz) going open-circuit is the favourite.

Scopes and Probes

We'll finish off by stating the importance of having a reliable, accurate scope with good probes that are correctly adjusted. X1 probes are not much use — even a 25Hz trapezoid will end up with curved sides! X10 probes must be correctly adjusted each time they're used on a different instrument, or even changed to the other Y input of the same scope. It's no use trying to look at an f.m. signal at 3 or 4MHz or so if the probe's frequency response takes a dive at 2MHz — even with a super-duper 50MHz scope. We use the Trio CS1830 scope which has a 30MHz bandwidth — adequate for our needs (up to now!). We also have some nice probes by a firm called Coline. The plugs, tips, leads and earth leads are all removable and obtainable as spares.

Trailer

Next month a little chat on the Grundig 2×4 Super (V2000 system) by way of a change.

DX Amplifier Unit

Roger Bunney

Over the years I've built up quite a range of amplifiers, filters, switches, etc. for DX use, all housed in diecast cases. The February-April 1982 issues of *Television* featured a DX receiver system with i.f. bandwidth switching and an upconverter to enable the system to be used with an unmodified u.h.f. TV receiver. Later that year a converter for reception of French system L signals was featured. This pile up of diecast boxes led me to consider some rationalisation at the front end. Hence the present article.

Basic Requirements

There are certain conflicting factors when it comes to amplifiers for DX use. Ideally one wants high gain with linearity, low noise, freedom from interference and stability. Unfortunately high gain will with most receivers cause adjacent channel interference problems – when for example you're trying to receive a weak ch. 25 signal and there's a 500kW BBC ch. 24 transmitter a few miles down the road! The problem of interference in fact seems to be the main constraint with weak signal reception, at least in

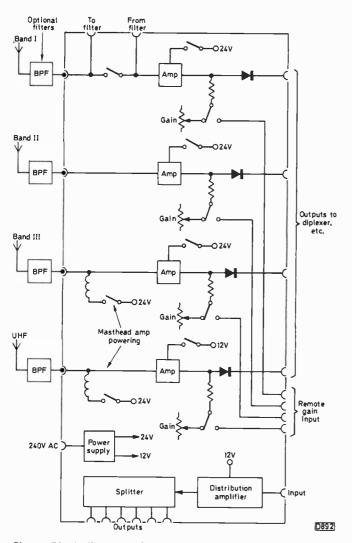


Fig. 1: Block diagram of the unit.

the populated areas where most of us live. Thus along with amplification there'll be a need for filtering.

The average DX enthusiast will have perhaps two or more v.h.f. aerials and at least one u.h.f. aerial. So one requirement is to minimise the amount of aerial lead plugging and unplugging needed. With a receiving system that's external to the main set, there'll be several stages without a.g.c. To prevent overloading, some form of gain control should be provided. This may be preset, but is better made available to the operator to adjust. The present unit meets these requirements and also incorporates a simple distribution amplifier with six outputs to enable several receivers to be used on various channels. The building block approach adopted will enable others to vary the design to suit their needs.

Block Diagram

A block diagram of the system is shown in Fig. 1. There are four preamplifiers, three for v.h.f. and one for u.h.f. The prototype was fitted with Wolsey Supa Nova v.h.f. amplifiers with the BFY90 transistor's biasing modified to give a slight increase in gain and a reduced noise figure of around 3-3.5dB. For Band I use a noise figure of 4dB will suffice – this equates with the general cosmic/terrestrial noise present. As the frequency increases, the amplifier's noise figure should fall: 2dB is ideal in Band III. For u.h.f. the demand is yet more stringent – 1.5dB should be sought in Band IV. My own DX installation uses masthead amplifiers for Band III and at u.h.f., and these largely set the overall noise figure. For u.h.f. reception the unit incorporates the single-stage BFR91 preamplifier featured in the April issue (page 303).

The three v.h.f. preamplifiers receive inputs from the Band I, II and III aerials. In view of the future plans for Band I, it was decided that the provision of filtering in this channel should be made as simple as possible. To this end a single switch enables the incoming Band I signal to be routed via appropriately biased pin diodes to a varicap tuned notch filter (for example). In the straight through position there will be a loss of some 2dB. The Band II input goes directly to the preamplifier while the Band III input is modified slightly to allow for masthead amplifier powering (24V). This provision is also made in the u.h.f. input. The masthead powering is switchable with LED indication (see Fig. 2).

All four preamplifiers have on/off supply switching with LED indication via a DPDT switch – the second pole is used to apply 12V to the relevant gain control which operates by biasing a pin diode in the signal path. Placing the pin diode at the output of the amplifier minimises mismatching effects – having the pin diode at the low-level end would degrade the input matching.

A four-pole, two-way switch enables either the built-in or external gain controls to be selected. The remote unit I use is again diecast housed and simply duplicates the onboard controls. Each preamplifier's output is taken to a coaxial socket to enable it to be connected directly to other equipment, fed to a diplexer or linked to the integral distribution amplifier. The Labgear CM6032/BF is an

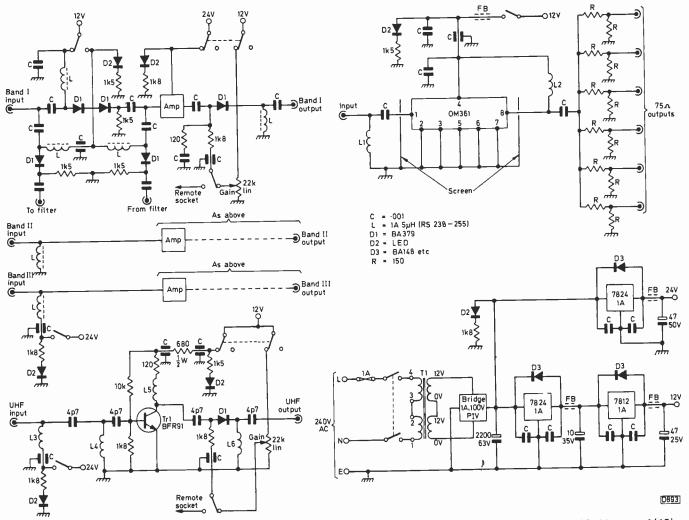


Fig. 2: Circuit diagram. Mains transformer RS type 207-649. Coil details: L1 11 turns 2/10in. diameter; L2 11 turns 1/10in. diameter; L3 8 turns 1/8in. diameter; L4/5/6 2 turns 1/10in. diameter.

ideal diplexer for DX-TV use (see later).

To minimise out-of-band interference, commercial inline bandpass filters are available for use at the inputs.

The power supply arrangements are conventional and the whole thing fits into an RS 509-254 diecast box.

Distribution Amplifier

The hybrid RS OM361 i.c. is used as the distribution amplifier, giving a single output with a gain of typically 28dB and a noise figure of 6dB. It requires 12V at 50mA. The advantage compared to the better known OM335 is the greatly improved signal handling characteristics. The output is split six ways, at 75Ω . This part of the circuit could be used as the basis of a domestic distribution system in view of its wide bandwidth (40-860MHz).

Gain Figures

The Supa Nova amplifiers were used because I had them in stock – they are no longer in production but might be available from some suppliers. As an alternative the simple BFY90 wideband amplifier circuit shown in Fig. 3 can be used.

Gain figures with Supa Nova amplifiers are as follows. Band I 11dB at 50MHz, 12dB at 65MHz (pin diode attenuation 45dB maximum at 60MHz). Band II 13dB at 76MHz, 13 5dB at 90MHz, 12 5dB at 108MHz (pin diode attenuation 42dB maximum at 99MHz). Band III

12.5dB at 170MHz and 195MHz, 12dB at 220MHz, 11dB at 230MHz (pin diode attenuation 35dB maximum at 200MHz). The u.h.f. preamplfier gain figures are 6dB at 470MHz and 500MHz, 7.5dB at 600MHz and 700MHz, 11dB at 800MHz, 7dB at 860MHz (pin diode attenuation 26dB maximum at 650MHz).

The u.h.f. gain figures for the BFR91 amplifier may look rather low, but in most installations a head amplifier will be in use – in my own case the masthead amplifier provides a gain of 30dB with a noise figure of 1.8dB and further gain simply isn't needed. If a head amplifier is not used, the gain could be increased by adding a second BFR91 stage in cascade.

If the simple BFY90 wideband amplifier circuit is used, gain figures of 14dB at 60MHz, 13dB at 100MHz and 11dB at 200MHz are to be expected, with a typical noise figure of 3.5dB.

The OM361 distribution amplifier is stable in use, the

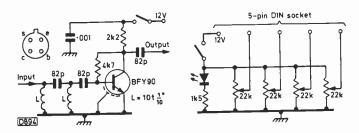


Fig. 3 (left): Suitable v.h.f. amplifier circuit. Fig. 4 (right): Remote gain control arrangement.

gain at any output being 8dB at 50MHz, 9.5dB at 100MHz, 7.5dB at 250MHz, 8dB at 700MHz. These figures are for a single output terminated at 75Ω . If all outputs are terminated at 75Ω , each will be loaded down by 2.5dB.

Use

The end result is a compact amplifier system with head amplifier powering, a distribution amplifier and gain control on all channels. Should additional gain be needed, which is unlikely, further gain blocks could be added as an outboard facility prior to the input sockets. I have available v.h.f. and u.h.f. low-noise Mutek amplifiers should more gain be required. Note that in my own system ATV

signals in the 434-440MHz band are not passed through the amplifier, being routed via separate selective filtering circuits instead.

The Labgear CM6032/BF diplexer is ideal for combining several feeds in a DX installation. Of particular interest are the Band I/II input bandpass curves – the crossover is such that the Band II section picks up at $-2\mathrm{dB}$ (76MHz), just below the ch. R3 vision frequency. Typical insertion loss is only 1dB (confirmed by measurement). The $-1\mathrm{dB}$ bandpass curve is 40-74MHz for Band I, 76·5-110MHz for Band II and 164-240MHz for Band III. Adjacent band attenuation is claimed as $-20\mathrm{dB}$, though measurement showed isolation as $-30\mathrm{dB}$. The inputs and outputs are via standard Belling Lee 75Ω sockets.

Letters

FERGUSON FEEDBACK

In the April issue Service Bureau column there's mention of converting the Ferguson Videostar 3V31 so that the clock operates on a twelve-hour cycle. I agree that by linking pins 40 and 41 of IC401 a twelve-hour indication is obtained. This does not produce a corresponding a.m./p.m. indication however. As a result, any attempt to use the timer function could be abortive, since there will be no way of determining whether one is setting up for the morning or the afternoon.

Frank Pack,

Editor, Ferguson Feedback.

SPECTRUM PROBLEM

With reference to the Sinclair Spectrum/Grundig GSC200 chassis no-colour problem mentioned in Service Bureau (April), the cause is not to do with signal levels but the Spectrum's burst timing. Neither product is in any way faulty, but it's easier to modify the TV set. With decoder type 29301-024-61, a longer burst gating pulse is required. This can be obtained by changing the value of C843 from 1nF to either 2·2nF or 4·7nF – choose the lowest value that gives stable colour.

The same problem occurs with the Network Model NWC1401 – the decoder design is very similar. In this case increasing the value of C29 to 4.7nF will cure the problem.

Denis G. Mott,

Service Manager, Network Industries Ltd.

SONY KV1340UB

After servicing a couple of Sony KV1340UBs – the switching transistor Q601, the series regulator transistor Q604, and the converter and line output transistors Q801/2 had all gone short-circuit – I noticed that there was an unacceptable amount of teletext interference at the top of the screen. This couldn't be removed by adjustment. The cure, suggested by Sony, is to remove R568 (56k Ω) on the VH panel and replace it with a $100k\Omega$ preset. This should be adjusted for minimum disturbance – I've found that it's best to do this with a low brightness picture and that the resistance remaining in circuit will be around $27k\Omega$. The preset fits nicely on the print side of the panel. It adjusts

the field flyback blanking pulse fed to the video/decoder panel.

G. Haigh, Morley, Leeds.

BUZZING 3V22s

In connection with the 3V22 buzzing problem mentioned in the April issue Service Bureau column, I've found that a lot of buzzing with these VCRs can be cured by careful adjustment of the sound potentiometers in the r.f. converter – I think Steve Beeching first commented on the need to do this a year or so ago.

Derek Snelling,

Brownhills, W. Midlands.

THOSE BLUE TUBES

Your Teletopics column (April) slipped up in suggesting that sets fitted with tubes that have light blue screens would not be sold in the UK. In fact these tubes are used in the Mitsubishi Blue Diamond range which has been widely advertised in the UK.

P. M. Litler,

Stockport, Cheshire.

THE VL100 AND OTHER EXPERIENCES

I was interested to read Malcolm Burrell's article on the Rigonda VL100 (April issue) as I've serviced many of these receivers in the past and still see the odd one occasionally. In addition to the faults mentioned, a frequent cause of the no results symptom, with reduced voltage from a heavily loaded regulator circuit, is the line output transformer - it tends to develop short-circuit turns. When diagnosing this fault, experience has helped me to develop a feeling (usually of the sinking kind) for what's wrong. The relative ease with which a replacement transformer can be fitted makes hunch-proving a speedy process however. Incidentally the Vega 402D, a younger brother (comrade?) of the VL100, also suffers from this weakness: unfortunately the line output transformers are not interchangeable. Beware also of the high capacitance/ low voltage Russian electrolytics used in these sets, particularly the 500 µF, 6V types in the audio and field output stages. I use a 10V or 16V 470µF electrolytic as a more reliable replacement.

I'm fortunate in owning a successful radio and TV servicing business with no new set sales, offering repairs to equipment of all makes and ages and working by myself (with my own H.B. of course). In my more modest

moments I often think that this success is due less to my undoubted technical brilliance than to the appalling incompetence and indifference of the competition. Here's an example.

A new customer brought in a Teleton T12BS monochrome portable, saying that he'd been to two dealers who'd both examined the set before declaring it to be "not worth repair". The symptoms were an enlarged picture severely distorted by 100Hz hum bars, the cause being a hard-on series regulator transistor that produced an output at 15V instead of the correct 12V. Adjusting the relevant preset made no difference, so the series regulator transistor TR601 was checked. The circuit shows this to be a 2SA473Y silicon pnp device, so what was a TIP136 Darlington pair doing in there?! In went a TIP32, on went the power, and up went the l.t. rail to 15V...I was preparing to make quick in situ tests on the other two transistors in the regulator circuit when I noticed that the reference zener diode had also been replaced - the wrong way round. Refitting this and adjusting the preset gave us 12V and a surprisingly good picture considering the age of the set and the recent tube heater cooking. The tube's an NEC type - Not Easily Clobbered?

As one regular and much enjoyed contributor to the magazine frequently admits, TV servicing makes fools of us all from time to time – usually when a simple fault gets us chasing red herrings, condemning innocent chips and ending up with egg on our faces (if you'll forgive the mixed metaphor!). But even TV receiver designers can make mistakes, a comforting thought for us lesser mortals though it's the cause of many a discomforting headache. Those of us with higher grey hair counts can nostalgically recall the open-circuit $10k\Omega$ carbon composition oscillator

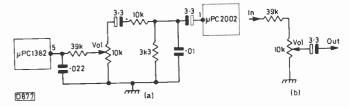


Fig. 1: Suggested modification to the Amstrad CTV1000.

load resistor in a certain turret tuner, the charred remains of an $18k\Omega$ EH90 sound detector feed resistor (and its $5.6k\Omega$ partner) in a certain TV chassis, the field oscillator feedback capacitor (PCL85 pentode anode to triode grid) rated at 400V, and other such things!

More recently a customer brought in an Amstrad CTV1000 10in. colour portable with the complaint that the sound was severely distorted at low volume settings. Apparently the fault had been present from new, but the owner had got round the problem by using a high volume control setting and covering the speaker with a cushion! The obvious things were suspected - the speaker, the μ PC2002 audio chip and the μ PC1382 intercarrier sound i.c. - but these were all o.k. The circuit was then consulted and revealed a rather unusual volume control arrangement - see Fig. 1(a). It seemed reasonable to suppose that the changed d.c. conditions in the μ PC1382 at low volume control settings were the cause of the distortion, and changing the circuit to that shown in Fig. 1(b) provided a complete cure. I wrote to Amstrad about this but didn't get a reply - maybe they were all at the Guardian offices receiving their awards . . .

Chris Avis,

RadioVision, Exeter.

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PANASONIC NV7000

There's a slight but annoying colour playback problem, most noticeable on saturated reds. The effect is something like Hanover bars, i.e. cancellation of the colour in approximately one line in every three or four. The machine records all right – proved by trying its recordings on another VCR.

The problem is likely to be around the chrominance crosstalk-cancelling delay line DL8001. While the delay line or the AN6360 chroma amplifier/switching chip IC8001 could be responsible, dry-joints in the area are a more likely cause. Check also the condition and setting of the comb balance control R8021.

RANK T20 CHASSIS

The horizontals on a crosshatch pattern are o.k. but the verticals have loops where they meet the horizontals. In addition, the vertical edges of the picture are slightly irregular. Otherwise the picture is very good.

A degree of this sort of thing is present in many TV receiver designs and is quite normal. If the effect is worse at high brightness levels, check the earth strapping between the c.r.t.'s Aquadag coating and the base connector, and from there to chassis. If necessary, check the sync separator bias resistor $4R50~(1\cdot 2M\Omega)$ on the timebase panel.

PHILIPS KT3 CHASSIS (Mk. I)

The set works perfectly off air and with a VCR, but colour drop-outs occur when it's used with a camera. These happen on a change of scene, colour returning after a brief period when the syncs and burst have settled down. The problem seems to be to do with the colour-killer/ident system, since reducing the value of the colour-killer reservoir capacitor C3231 gives some improvement though not a cure.

On later boards the value of C3231 was reduced from $4.7\mu F$ to $1\mu F$. A much greater improvement can be obtained by altering the values of the components in the relevant detector filter circuit as follows: increase the value of R3128 from $1.5 k\Omega$ to $5.6 k\Omega$ and reduce the value of C3219 from $4.7 \mu F$ to $1 \mu F$.

GRUNDIG 6022

When the set is switched on, standby only is indicated – it's necessary to bring the remote control unit into action to get results or alternatively to operate the on switch on the manual panel.

There's an auxiliary contact on the mains switch to connect, momentarily at switch on, pin B8 of the Telepilot receiver with D4' of the "electronic" module. Try linking these two points during standby. If the set switches on, a new mains switch is required.

REDIFFUSION Mk. I CHASSIS

I look after a number of these sets which have proved to be very reliable. There is however a tendency for teletext lines to be visible. Any suggestions? A recent case of ragged verticals was traced to the VA1038 thermistor TH430 which is used to stabilise the supply to the line oscillator – a new one to me!

We don't know of any official modification for the teletext problem, but would suggest that experimentation with the values of the components in the field flyback blanking pulse network – C242, C428 and R448 – should be fruitful. Thanks for the tip about the thermistor.

BOOST DIODE

The problem we had with a Toshiba monochrome portable was an open-circuit boost diode. Several replacements of different types have been tried but they all tend to overheat, though the picture and sound are o.k. Any suggestions?

Diodes such as the MR854, BYX71 and the "blob" type that Sony supply as a replacement for their SID30 type work well in this position. They tend to be a bit expensive for this application, but reliability is good.

SONY KV1300UB

The picture is perfect at switch on but after about five-ten seconds there's vision interference. This takes the form of striations across the screen, similar to the effect when the aerial is loose, though disconnecting the tuner fails to remove the fault. I've checked for dry-joints etc. The effect varies in intensity. The sound is perfect at all times.

We've known this effect to be caused by the i.f. transistors. The most common offenders are the two (Q751/2) in the i.f. preamplifier can. A dose of freeze and heat should sort out the culprit.

THORN 9800 CHASSIS

At switch on the picture is broken up. Adjusting the tuning and a.f.c. corrects this but drift can happen several times until the set has fully warmed up. Even then the picture is lost when changing channels and adjustment is necessary. A new tuner has been tried.

We suspect the ML237 channel selector i.c. on the touch-tune panel – this device has a certain notoriety. Before condemning it however try heat and freeze treatment on the BC212 35V stabiliser transistor on this panel and the two associated diodes.

ITT CVC30 CHASSIS

The problem is intermittent field collapse, preceded sometimes by a two inch foldover at the top of the screen. I've resoldered most earth points but the fault remains.

The problem you describe could well be due to transistor T8 (FT3055) or bias diode D10 (BY133) in the field output stage being faulty. Check also for flux on the pins of the CMF30 field timebase module. The symptom is occasionally caused by dry-joints around the raster correction transductor or its peripheral components.

CORRECTION

The burst transformer in the Hitachi CNP190 (page 390 last month) is T502, not T503. The no-colour symptom appears to be quite common on these otherwise reliable sets (CNP190/CNP192). Other things worth checking are the ident amplifier emitter decoupling electrolytics C535 and C538 (both $22\mu F$, 16V).

TEST CASE

258

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.

We're sometimes bewildered by the sheer number of Grundig TV models! They all seem to be called Super Colour, but the colour is not necessarily super after a few years' use, and trying to relate model numbers to chassis types can be difficult.

The Super Colour Grundig entrusted to us for repair recently was a Model 2222GB. The chassis used in this receiver was designed in the mid-seventies when delta-gun tubes were giving way to in-line types, and variants on the basic chassis design were able to drive either type of tube with 110° deflection. All versions share decoder module 07247-072-00, and it's here that we focus attention this month.

Ironically enough, the problem was no colour. It was plain that the tuning was correct since with the set tuned "on the nose" to the Channel 4 test pattern a prominent dot pattern was visible on the colour bars. We gleaned another important clue from the pattern displayed - it told us that the colour killer was operative, but we'll leave you to puzzle that one out as a mini bonus! The options were to replace or repair the colour module, and as the modules in this chassis can be plugged into the print side of the mother board we decided to have a go at repair. There are two chips in the decoder module, a TBA510 for the chroma processing and burst gating stages and a TAA630 for demodulation, PAL switching and colour-difference signal matrixing and amplification. The burst detector, reference oscillator and ident stages use discrete component circuitry.

The first step in a case like this is to override the colour killer – this is conveniently done by linking pins 13 and 14 on the colour module. On doing this we were greeted with very bright unlocked colours that floated up and down, an indication that the reference oscillator was unlocked. For starters we hooked an oscilloscope to pin 13 of the TBA510 to check that the burst gating pulse was present. This was correct, and further confirmation that all was well within the chip was given by the emergence of correct-amplitude gated bursts at pin 12. A further check at the collector of the burst amplifier transistor Tr845 showed that this transistor was working, so attention was turned to the reference oscillator circuit.

Adjustment of the RN (set frequency) control R871 had some effect on the bars of colour, but at no setting could we get a "zero beat" effect. Plainly the oscillator was

off frequency, and as a first move the 4.43MHz crystal was replaced. Our suspicions of this item were strong, following several recent struggles with VCR under-colour circuits, where the crystals seem to be rather restless devices, but on this occasion we were wrong. Back went the old crystal, and we then spotted some high-value resistors (220k Ω) in the phase discriminator circuit. These are R863 and R864: we measured them carefully out of circuit. Both proved to be o.k., and since the d.c. voltages around the oscillator transistor Tr881 were correct at a certain setting of R871 we next tried the feedback capacitors C882 and C885. Once again we drew a blank, and we couldn't proceeed with our next intended check because we didn't have a BB109 varicap diode in our stores.

We didn't need one however! With so much of the relevant circuitry eliminated from the search, you shouldn't have too much difficulty in arriving at the answer! Full details next month.

ANSWER TO TEST CASE 257 - Page 392 last month -

Our ailing Thorn 3000/3500 chassis last month had several short-circuit semiconductor devices on the power supply and line timebase panels (and elsewhere too, as we subsequently discovered!). In the second or two between switching it on and subsequent failure it had given a fair imitation of the Battle of Waterloo... We'd traced the source of the problem to the line output/e.h.t. department, and by taming the h.t. voltage and disconnecting the e.h.t. tray had got the set working in a way that enabled us to scope the line flyback voltage pulse.

This one reading was enough. It showed that the pulse was of far too short duration – it was very much less than the normal 12μ sec. The output voltage from a flyback transformer is proportional to the rate of change of current flowing in it: the rapid rate of change resulted in an enormous voltage pulse input at the e.h.t. tripler, and indeed to all other circuits fed from the line output and e.h.t. transformers T504 and T503. The flyback time is set by the tuned circuit consisiting of the output transformers and the tuning capacitor C518. As we suspected, C518 $(0.028\mu\text{F})$ was virtually open-circuit, a replacement restoring normal operation. The fact that several other areas of the set had suffered when the sparks flew is a depressing corollary to our tale, but is one we needn't go into here.

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TELEVISION JUNE 1984

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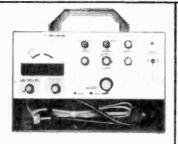
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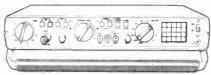
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			_					BC172 0.13	BU407 1.40	SMOOTHING	EHT TRAYS	
								BC173 0.12	BU426V 1.70 BU526 1.62	CAPACITORS		
NI	FI	LEC'	TR	ON		2		BC174 0.12 BC182L 0.12	E1222 0.35	Decca 200/200/400 350V2.70	Decca 1830 Decca 2230	5.90 6.95
								BC183L 0.12	FT3055 0.65	Decca 400/400 350V 2.90	Decca 2230 Decca 80	6.95
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		n						BC213L 0.11	R2009 1.90	Philips 2200 63V 1.55 Philips 470 250V 2.00	GEC 2040	6.25
CHESTE		ע.		_				BC237 0.10	R2010B 1.90 R2540 2.10	Philips (G9) 600 300V 2.80	GEC 2110	6.25
S41 0SN					IEL.	(0246) 209	0/9	BC238 0.12	SP8385 2.10	PYE 200/200/100/32 2.85	GEC 2200 Grundig 5011	6.25 7.00
						Г		BC250 0.11 BC251 0.11	TIP29 0.38 TIP30A 0.34	PYE 600 300V 2.80	ITT CVC 5/8	7.00
INTEGRA	TED (CIRCUITS		UPC 1024H	0.63	DIODES		BC252 0.12	TIP31A 0.34	RRI 2500/2500 30V 1.20 RRI 220 400V 2.90	ITT CVC 20	6.95
HAILOHA	TLD (UPC 1025H	3.70			BC253 0.11	TIP31C 0.48	Thorn 150/160/100 300V 1.90	ITT CVC 45	7.20
BTT 822	1.90	TBA 120B	0.78	UPC 1026C UPC 1028H	1.60 2.40	BA148	0.18	BC301 0.31	TIP32A 0.34 TIP32C 0.48	Thorn 4700 25V 0.85	Korting 90°	6.95
CA 3089	1.20	TBA 120C	0.75	UPC 1031H2		BA159 BB103	0.10 0.20	BC302 0.31 BC303 0.33	TIP33B 0.75	Thorn 1000 70V 0.70	Philips 520 Philips 550	7.05 7.05
ETT 6016 ETTR 6016	1.95 1.95	TBA 120SA TBA 120U	0.75 0.75	UPC 1032H	1.50	BB105B	0.20	BC307 0.13	TIP41A 0.46	Thorn 200/100/100 350V 2.85 Thorn 175/100/100 400V 2.40	Philips G9	6.25
MC 1307P	1.70	TBA 231	1.65	UPC 1035C	2.50	BY127	0.11	BC308 0.13	TIP41C 0.58 TIP42A 0.45	Thorn 400 400V 2.50	Philips 570	6.50
MC 1310P	1.20	TBA 396	1,70	UPC 1037H UPC 1042C	1.62 2.60	BY133	0.11	BC327 0.11	TIP42C 0.68		Philips KT3	8.95
MC 1327P	1.10	TBA 395	1.70	UPC 1042C	2.60	BY176 BY184	1.35 0.40	BC328 0.13 BC337 0.11	TIP2955 0.74	PUSH BUTTON	PYE 691/697	6.30
MC 1330P	1.50	TBA 480	0.99	UPC 1156H	2.40	BY187	0.69	BC338 0.13	TIP3055 0.55 2N3055 0.73	UNITS	PYE 713 5 lead PYE 713 4 lead	6.50 7.60
MC 1349P	1.10	TBA 510 TBA 520	1.20 1.50	UPC 1158H	0.78	BY190	0.60	BC350 0.12	2110000	Decca 30 4 way 6.80	PYE 725/731	7.00
MC 1351P MC 1352P	1.20 1.50	TBA 520	1,45	UPC 1161C3 UPC 1163H	1.58 0.98	BY210-800	0.29	BC365 0.30 BC413 0.11	ZENERS	Decca 30 6 way 7.80	RRI 823	7.75
MC 1352P	1.20	TBA 540	1.70	UPC 1167C2		BY223 BY226	0.95 0.27	BC413 0.11 BC460 0.48	400MW 0.10	GEC 2110 11.00	RRI T20	6.50 6.50
ML 236E	3.00	TBA 550	1.80	UPC 1168C	2.75	BY227	0.31	BC461 0.52	1.3W 0.18	GEC 2112 12.95 GEC 2136/7 8.90	Tandberg TV2-2 Thorn 1500 3 stick	4.95
ML 237B	1.80	TBA 560C TBA 570	1.90	UPC 1170C	1.75	BY295	0.25	BC462 0.53		GEC 2112 Conversion 13.00	Thorn 1500 5 stick	5.50
SAA 1021	3.80	TBA 570	1.10 1.50	UPC 1171C UPC 1176C	1.62 2.43	BY296 BY298	0.25 0.25	BC463 0.53 BC527 0.13	THYRISTORS	Hitachi 190 4 way 8.95	Thorn 3000/3500	7.70
SAA 1024 SAA 1025	2.40 4.40	TBA 800	1.10	UPC 1177H	2.60	BY298 BY299	0.25	BC527 0.13 BC528 0.13	15/80 2.50	ITT CVC5 7 way 10.00	Thorn 8000 Thorn 8500	4.95 6.80
SAA 1025 SAA 1124	2.40	TBA 810S	0.90	UPC 1178C	2.14	BYX10	0.21	BC546 0.12	15/85 2.50	ITT CVC8/9 12.85 ITT CVC20/30 6 way 8.00	Thorn 8500	7.80
SAA 1130	4.30	TBA 820 TBA 890	1.20 3.50	UPC 1180C	3.00	BYX36-600	0.50	BC547 0.12	BR101 0.40 BR103 0.62	ITT CVC 25 6 way 8.50	Telpro 561	7.00
SAA 5040	7.50	TBA 920	2.00	UPC 1181H3 UPC 1182H	1.62 2.70	BYX71-350 BYX71-600	0.50 0.99	BC548 0.12 BC557 0.12	BR103 0.62 BRY39 0.56	Philips 520 11.00	Universal	5.50
SAS 560	1.80	TBA 950	2.65	UPC 1183H	2.30	BYX55-600	0.33	BC558 0.12	BRY49 0.65	Philips 550 13.55	TV11 TV13	0.65 0.65
SAS 570	1.80	TBA 990	1.60	UPC 1185H2		BR100	0.35	BD131 0.30	BRY55 0.60 BT100 1.10	Philips G11 22.50 PYE 713 4 way 8.70	TV18	0.70
SAS 660 SAS 670	2.30 2.30	TBA 1440 TBA 1441	2.70 2.70	UPC 1186H	0.98	0A47	0.10	BD132 0.36	BT106 1.55		1,1,10	
SL 901B	5.00	TCA 270S	1.90	UPC 1187V UPC 1188H	1.70 3.60	0A90 0A91	0.08 0.08	BD135 0.30 BD136 0.30	OT112 1.85	PYE 725 (UHF-VHF) 13.50		
SL 917B	6.20	TCA 270SQ	1.90	UPC 1190C	2.00	SKE5F	1.40	BD139 0.33	0T121 1.55 2N4444 1.55	11111	LINE OUTPUT	
SN 29848	2.25	TCA 640	2.60	UPC 1191V	1.70	IN60	0.08	BD140 0.60	2144444 1.55	RRI 823 6 way 9.50 RRI T20 6 way 10.50		c
SN 57108AN		TCA 650 TCA 660	2.40 2.80	UPC 1197C	1.70	IN4001	0.05	BD150A 0.70	REGULATORS	RRI Z718 6 way 9.50	TRANSFORMERS	3
SN 76001AN SN 76003	1.60 2.20	TCA 740	2.90	UPC 1198H UPC 1200V	1.41 1.97	IN4002 IN4003	0.05 0.05	BD207 0.90 BD221 0.40	78 Series 0.60	Thorn 3500 6 way 2.75	Autovox 90°	9.75
SN 76013N	2.50	TCA 800	2.00	UPC 1204C	1.63	IN4004	0.06	BD228 0.35	79 Series 0.80	Thorn 8500 6 way 2.75	Autovox 110°	9.75
SN 76023N	2.20	TCA 830S TCA 940	1.60	UPC 1208C	2.00	IN4005	0.07	BD233 0.53	78L Series 0.42	Thorn 9000 6 way 2.75 Thorn 1615 4 way 8.70	Decca 1700 Mono Decca 1830	9.80
SN 76131N	1.35	TCA 4500A	1.80 2.00	UPC 1211C UPC 1212C	4.00 1.34	IN4006 IN4007	0.07 0.07	BD234 0.38 BD238 0.38	79L Series 0.70	Telpro 4 way 8.50	Decca 2230	8.30
SN 76226DN SN 76227N		TDA 1003	2.00	UPC 1213C	1.53	IN4148	0.03	BD239 0.42	FUSES	DDECETC	GEC 2110	9.50
SN 76532	1.20 2.00	TDA 1004A TDA 1044	2.40	UPC 1215V	2.70	IN5402	0.13	BD253B 0.65	20 A-4: 0	PRESETS	GEC 20AX Grundig 1500 mono	12.00 13.70
SN 76550	0.29	TDA 1044	2.50 2.80	UPC 1216V UPC 1217G	1.99 3.59	IN5404	0.15 0.17	BD416 0.42 BD534 0.33	20mm Anti Surge (10 pack) 1.20	Horizontal and Vertical	Grundig 5010	11.50
SN 76546	1.80	TDA 1180	2.80	UPC 1218H	3.00	IN5406 IN5408	0.17	BD595 0.55	11/2" Anti Surge	Standard and sub mid sizes	ITT CVC5/8	10.25
SN 76660	0.90	TDA 1190	2.00	UPC 1222	2.00	Y969	0.87	BD596 0.55 BD681 0.58	(10 pack) 2.30 20mm Q Blow 0.50		ITT CVC20	10.75 8.75
SN 76666N SN 76707	1.10 1.70	TDA 1327 TDA 1412	1.70 1.00	UPC 1223	3.70			BD807 0.50	1½" Q Blow 0.70		ITT CVC45	9.75
TA 7061AP	3.60	TDA 2010	1.80	UPC 1225 UPC 1226	3.00 2.49	BRIDGE R	ECT.	BDX32 1.70	Most Values	_	Indesit mono	10.75
TA 7063AP	3.50	TDA 2522	2.40	UPC 1227	2.00	B40	0.80	BF127 0.30 BF137 0.30	Stocked	Decca 20 mono 1.35	Korting 90°	10.75
TA 7066P	3.90	TDA 2523	2.20	UPC 1228H	0.90	BY164	0.50	BF180 0.29	CAPACITORS	Decca 30 3R9 0.60 Philips G8 2R2 + 68R 0.84	Korting 110° Philips 210	12.50 9.90
TA 7072P TA 7074P	2.90 3.30	TDA 2530 TDA 2532	2.20 2.70	UPC 1230H UPC 1238V	3.60 1.90	BY179	0.70	BF181 0.27		Philips G8 47R 0.50	Philips G8	8.90
TA 7108P	2.44	TDA 2540	2.20	UPC 1236V	2.20	W005	0.25	BF182 0.28 BF185 0.32	.1 1000V 0.40 .1 1250V 0.48	Philips 210 (no link) 1.10	Philips G9	9.00
TA 7117P	3.20	TDA 1365	5.75	UPC 1250	2.40	TDANSIC		RF194 0.12	.22 1000V 0.50	Philips 210 (with link) 0.95 PYE 725 3R3 1.35		12.95
TA 7120P TA 7129AP	1.61 3.20	TDA 2541 TDA 2560	2.30 2.05	UPC 1350C	4.50	TRANSIST	UKS		.22 1250V 0.60	PYE 725 3R +link +56R 1.40		14.95 8.50
TA 7130P	1.38	TDA 2500 TDA 2571	2.10	UPC 1353C UPC 1356C2	2.80 3.00	AC127	0.30	BF196 0.13 BF197 0.13	.47 1000V 0.70 Also stocked:	PYE 725 + 56R + 3R 1.55	Philips 570	9.50
TA 7137P	2.00	TDA 2581	2.80	UPC 1358H	3.00	AC128	0.30	BF198 0.16	Tants, Discs,	RR1 823 56R + 68R 0.85		13.00
TA 7139P	2.75	TDA 2582	2.60	UPC 1360C	3.50	AC153K	0.36	BF199 0.18 BF200 0.34	Polys, Plates,	Thorn 1500 1.55 Thorn 1600 1.45	PYE 725 PYE 731	8.95 8.95
TA 7146P TA 7157P	2.00 3.20	TDA 2593 TDA 2600	2.70 5.95	UPC 1363C UPC 1366C	3.50 3.00	AC176 AC186	0.30	BF240 0.16	Electrolytics. Please ring for	Thorn 3500 0.97	PYE 169	10.75
TA 7171P	3.20	TDA 2611A	1.15	UPC 1367C	3.00	AC187	0.30	BF245 0.30	details.	Thorn 8000 1.20	RRI 640/793	11.75
TA 7172P	3.30	TDA 2640	1.80	UPC 1368H	4.00	AC188	0.30	BF256L 0.40 BF258 0.27	CMITCHES	Thorn 8500 0.97 Thorn 8800 0.97	RRI 774	12.90
TA 7176AP TA 7193P	3.00 5.20	TDA 2653 TDA 2680	2.10 2.10	UPC 1370C2		AD149 AD161	0.88 0.45	BF259 0.32	SWITCHES	Thorn 8800 0.97 Thorn 9800 0.90	RRI 823 RRI T20	11.90 12.90
TA 7202P	3.30	TDA 2690	2.10	UPC 1373H UPC 1377C	1.11 4.50	AD162	0.45	BF264 0.40	G8 Plastic 0.85		SABA	12.50
TA 7203P	3.30	TDA 3560	5.10	UPC 1378H	4.00	AF139	0.48	BF273 0.13 BF274 0.11	G8 Metal 1.30 G11 0.85	CONVERGENCE	Skantic	12.50
TA 7204P	2.16	TDA 3561	6.50	UPC 1382C	1.97	AF239	0.60	BF337 0.32	G12 0.85	CONTROLS	Thorn 1500 20" Thorn 1500 24"	7.00 7.00
TA 7205P TA 7208P	1.40 2.70	TDA 3950 TDA 4600	2.40 2.65	UPC 1384C UPC 1447W	5.70 0.98	AU113 BC107	3.40 0.15	BF338 0.32 BF355 0.56	3500 0.85		Thorn 1591	10.50
TA 7210P	5.60	UPC 41C	3.50	UPC 1470H	0.90	BC108	0.15	BF458 0.48	1500 Rotary 0.80 Many others,	5R 7R 10R 12R 15R 20R 50R	Thorn 1615	10.00
TA 7222P	1.70	UPC 393C	2.90	UPC 2002V	2.80	BC109	0.15	BF459 0.51	Please Ring.	100R 200R 500R 0.38		8.75
TA 7223P	3.50	UPC 554C	1.34			BC116 BC140	0.13 0.30	BFR79 0.26 BFY50 0.24	<u> </u>	G8 Metric 10R 15R 20R 0.50 Thorn 50R 200R 0.50		10.90 10.00
TA 7227P TA 7310P	5.10 1.70	UPC 555H UPC 556H3	0.80 1.70			BC140	0.30	BFY51 0.23	We also stock		1110111 3000	. 0.00
TA 7313P	2.80	UPC 557H	0.92	ZENERS		BC142	0.22	BFY52 0.23	Resistors,		I	
TA 7609P	4.00	UPC 566H3	3.50			BC143	0.27	BU105 1.40 BU108 1.60	Crystals, Filters, Thermistors,	PLEASE ADD 6	E DENICE DOCT	.,
TA 7611AP TA 75902P	2.90	UPC 574J UPC 575C2	0.55 3.00	2V4 to 75V	0.10	BC147 BC148	0.12 0.12	BU124 0.98	Wound			
TAA 320A	1.30	UPC 57502	3.50	1.3W	0.10	BC149	0.12	BU126 1.60 BU137 1.40	Components, Service Aids,	PACKING TO YO		
TAA 470	2.30	UPC 585C	1.49	2V7 to 91V	0.18	BC154	0.11	BU204 1.40	Solder,	AND THEN 15%	VAT. GOODS A	ARE
	0.39	UPC 741G	0.95	100V to 200\	/ 0.19	BC157 BC158	0.11	BU205 1.40	Heatsinks, Focus	DESPATCHED E	BY RETURN AN	ID
TAA 550	4 05						0.11	BU208 1.55	Units, Video			_
TAA 550 TAA 691 TAA 700	1.95 1.65	UPC 1009H UPC 1017G	2.41 2.50	15 WATT BZV15C12R	1.18	BC159	0.11			SHOULD BE DE	CEIVED WITH	N
TAA 691					1.18 1.18 1.18			BU208A 1.90 BU208D 2.30 BU326 1.80	Heads and Many Other Items. Please Ring.	SHOULD BE RE	CEIVED WITHI	N

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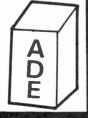
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ZX 68 30 ZY 47 10 ZY 72 10 AA 113 10 AA 119 AA 144 10 BA 102c 10 BA 157 8	p TIP 34B 60p TIP 34C 70p TIP 34C 70p TIP 35B 50p TIP 35D 80p TIP 35D 80p TIP 36C 70p TIP 36C 70p TIP 41B 40p	Mono scan coil 110° small neck	18R/11 Watt 25p 120R/17 Watt Pront End Music Center. VHF/ MW/LW 13"->3f" £3 Output Stage for music center £5 SONY 1400KV Chroma Panel £6 SONY 1400KV Tuner unit £3.50 SONY 1400KV Touch button unit £3.50 Texas Viewdata Decoder VDP 12/80	BF 199 20 for £1 BC 547 100 for £4 10 × 20 Turn 100k pots. Rank £2 Thorn 9 volt power supply regulated £3.00 BF 470 20 for £2 Metal BD 124 20 for £2 20 Sider Knobs 6 Mixed UHF Aerial Isolating Sockets, some with long leads. Fit ITT, GEC, Philips, Pye £1.00
BA 159 8 BA 173 8 BA 173 8 BA 182 8 BA 201 8 BA 202 8 BA 243 8 BA 248 8 BA 316 5 BA 318 5	P TIP 48 40p TIP 49 30p TIP 57 30p TIP 100 30p TIP 102 30p TIP 102 30p TIP 112 30p	1982 Hitachi Ae isolator 50p Mullard FM decoder 1401 £1 Philips service pack, flat films, 57 condensers 56nf-2.2uf £2 VHF 3 Transistor rotary tuner DX-TV £1 15K-20 turn pots 20p Thorn panel 6×100 pot +	Output Column C	Mixed Packs TO66 12 Power Trans RCA 16182 NPN Replacement for & Mounting BD124 Kit etc. 50 Mixed AC series Transistor \$4.50 15 Panel mount rocker switch 250V/10A £1.50
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BRC 83c13 10 BZX 46c22 15 BZX 61 9-1 6 BZX 61c10 6 BZX 61c20 10 BZX 61c30 10 BZX 61c220 10	TIP 2955 35p T 6032 30p T 7 6036 40p T 6040 40p T 6047 40p T 6047 40p T 6051 40p T 6052 40p	unit with circuit \$6 SPECIAL OFFER Decca-TTT etc. FEO4/1/250AC/4 Mains filters (grey type) × 4 £1	2SC2122A 10 for £8.00 BF458 10 for £1.00 BD136 10 for £1.25 BF224 20 for £1.40 OA90 40 for £1.00 BYX10 100 for £4.00 KT3 multicaps 50 High voltage ceramic	100 Transistor £2.50 20 Convergence Pots 80p 100 Sticks £1.00 10 Thermistors 50p 20 Stider Pots £1.00 30 Presets 50p 15 VDR + thermistors, degaussing, HT.
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27. 33 10p eas BZX 84c6v8×10 36 BZX 85c8v2 10 BZX 88c0v7, 3v9, 4v3, 6v2, 8v2.12 10p eas 1 A/1600V 10 CV 8617 10	SPECIAL OFFER CVC 21 Chassis complete £35 Complete Computer Transformer 201/2.25&; 201/1.5&; 201/2.35&; 201/1.5&; 201/2.35&; 201/2	W005 GEC remote panel. Main transformer 3/6: SAA 1025/SN 74141/TBA 231	OF APP COMM CHEMIS	Lucky Dip 600 gram \$1.00 Jungle Bag 5Kg £5.00 20 Knobs £1.00 40 Pots, I'+6mm spindles for audio/TV£3 20mm Fuse Holders Chassis Mount 10 for £1 IN4001/6 100 mixed £2.50

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l 1500/16 20	.047/600	15p 15p 10p	GMC 120 GMR 64	£2,50 £5,00
3300/16 20 10000/16 25	1 0.01/1090	100	IMN 2	£2.00
15000/16 50 3300/18 20	15/1000 15/1000	10p 20p	VCA 20 VCA 21	£10 £10,00
I 47/25 5	.47/250V A.C.	10p 10p	VCA 21 VMC 26 VMC 34 VMC 44 + 45	£3.00 £5.00
470/25 680/25 5		10p	VMC 44 + 45	£4.00
1000/25 Radial 10 1500/25 10 3300/25 20	.005/1500	10p 10p	VMC 51 Hand Sets	£5.00
3300/25 20	In8/1500	15p	Transducer Hand Set Inser	t, crystal,
4700/25 25 5000/25 25	2 n2/1500	15p	transducer, SAA 1124 & le 8 C.H. Ultrasonic GEC Fu	
l 3500/30 20	G11,11000/1500 .01/1600	15p 15p 15p	C2014H/C2219H	£15.00
470/35 6 2200/35 25	G11.8200/2KV	150	Thorn 4000 insert with 7 b	outtons £5.00 £14.00
100/40 5 220/40 5	0.1/2KV 10n/2KV	20p 15p	Decca RC 11 Decca RC 12	£14,00
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2000/50 20 3000/50 25 3300/50 25	7500pf/2KV 4n7/2KV	15p	Philips, 2 button Rank, Infra-red	£8.00 £10.00
3300/50 25 Infra Red and Ultrasonic G11 Tele	8n2/2KV	£30	Dynatron-Full remote CTV	V 62, 63,
RANK & ITT Mains Remote On-	Off Switch (720R)	£1.50	64 Philips full remote KT3, 16	£19,00
RANK & ITT Mains Remote Swit RANK & ITT Remote Switch 280	en ∠865 ohm 0 ohm	£1.50 £1.50	20C934; 7228/7324; K12 1ST 66K 1826	26C 797/
G11 Mains Switch		50p 25p	1ST 66K 1826 G11, Full remote top butto	£12.00
4 amp Mains Switch GEC Mains Switch 4 amp		30p	assy	£12,00
KT3 Mainswitch THORN Rotary Mains Switch		£1.00 50p	G11, Full remote repair se	
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+250K+100K+500K+50K+500	C Pot on Panel	£2,00	KT3/K30 T/Text	£15.00
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ELC1043/05 Mullard £6.00 ELC1043 (Ex Panel) £3.75	Shoeburyness, ESSEX SS3 8AF SAME DAY SERVICE	SAA5030 £5,00	SN76131 50p SN76141N £1,00	Transistors AC106 15p
ELC1042 ,, £5.00 ELC2000 ,, £7.00	All items subject to availability.	SAA5040 £3.50 SAA5040A £4.40	SN76226 £1.00 SN76227N 60p	AC121 15p AC124 15p
ELC2004 £10,00 ELC2006 £10,00	No Accounts : No Credit Cards Postal Order/Cheque with order	SAA5050 £3.50 SAF1032p £2.50	SN76227N £1.00 SN76270 £1.00	AC128 15p AC137 15p
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Mosfit UHF/VHF (new type) £10.00		£1.00 TA7117 50p £1.00 TA7120P 50p	SN76720 £1.00 UA783P3C 40p	AC188K 15p
SONY 1400KV Tuner unit £3.50 Thorn Tuner PANEL with	DL20A 80p CA270AE CA270CW £1,00 CA270CW	50p TA7315AP 50p 50p TA7607AP 40p	BT100A/02 40p BT138/10A 70p	AD143 50p
6×100K pots + cursors NO TUNER £1,00	G8 (Old Type) £1 CA270CE	50p TA7609P 50p £1.00 TBA120A 40p	BT146 30p TBA540Q £1.50	AD149 50p AD161/162 pair 40p
U321 on panel ITT 40 £6.00 Tuner unit VHS Sylvania GTR	UDE11 30p CA1310	50p TBA120AS 50p 50p TBA120SA 40p	TCA270 £1.00 TCA270Q £1.00	AF139 25p AF181 £1.00
Videon MTS 900 £2.50 Thorn 3500 tuner panel with ELC	Luminance Delay Line (CVC 45) CA3089Q	50p TBA120B 40p	TCA640 £1.00	AF239 25p AF367 25p
1043/05+pots £7.00 Mullard Video Modulator.	10×2A fuse	40p TBA120SQ £1.00	TCA660 £1.00 TCA270S £1.00	AL102 £1.75
Application, video tape recorders, TV cameras, video games, closed	Co-Ax Joint 15p CA3189	40p TBA120Q 30p	TCA270SQ £1.00 TCA740 £1.00	BC161 30p BD507 50p
circuit T/V, C.C.I.R. system. Data	Co-Ax Spliner £1.00 CD4510	30p TBA1441 £1.00	TCA800 £2.00 TCA830 £1.00	BD509 30p BD510 30p
supplied. £10.00 VT 100 Sound Tuner Kit. TV.	Infra Red Emitting Diode 20p HA1196	40p TBA395Q 50p	TCEP100 £2.25 TCE120CQ £1.00	BD517 30p BD519 30p
Viosound. The latest design in low noise fitted with DNR, RF output	NE286H Small Neon Lamps GEC HA1370 HA11223	E2.00 TBA396Q £1.00 40p TBA396 75p	TDA440Q £1.00 TDA1003A £1.00	BD534 30p
and audio £30.00 Sylvania UHF VHF F6013 (Fits	Mullard 5 Watt Amps. LP1162 HEF4001 New 75n HEF4011AF	10p TBA440P £1.00 10p TBA1440C £1.00	TDA1010 £1.00 TDA1060A £1.50	BD535 30p BD544D 30p
Rank) £6.00 Sylvania F6003 £6.00	M913	30p TBA480Q £1,00 £2.00 TBA510 £2.00	TDA1072 £1 TDA1151 30p	BD562 30p BD610 40p
Sylvania UHF F4720B £6.00 Sylvania VHF 900 £6.00	12" A31/300 Hitachi £10 M1025=SAA	£2.00 TBA510Q £2.00 £2.00 TBA520 £2.00	TDA1170 £1.00 TDA1190 £1.00	BD646 50p BD676A 30p
Decca Bradford Tuner 5 Button £4,00	15" A38/170W Hitachi £8 MC476p 18" Hitachi PIL tube with scan MC1307	E1.00 TBA530 E2.00 75p TBA540 E1.00	TDA1327A £1.00 TDA1412 50p	BD678 50p BD681 25p
Small Tuner DX 175-220MHz Auto Changeover £5.00	coils £25 MC1330 MC1349	75p TBA550Q £2.50 50p TBA560CQ £2.00	TDA2003 80p TDA2004 £2	BD807 20p
9000 Thorn Tuner on Panel £7.00 D.P.D.T. switch Black knob;	Integrated Circuits MC1352	E1.00 TBA570 £1.50 E1.00 TBA625 50p	TDA2010 £1.00 TDA2140 £3.50	BD826 50p BD948 30p
Chassis or PCB mount 4p each or 40 for £1.00	AM25LS23PC 10p MC14002 BAV40 40p MC14013	15p TBA641 £2.00 25p TBA651 £2.00	TDA2522 £1.00 TDA2530 £1.50	BDX75 20p BDX32 £1.25
BF694 10p 2SC2073	8p BC350 20p MC14016 MC14066	25p TBA673 £1.00 30p TBA720A £1.50	TDA2530 £1.00 TDA2532 £1.00 TDA2540 80p	BF115 20p BF121 20p
BF758 30p 2SC2122A BF760 30p 2SC2229		15p TBA750Q £1.50 50p TBA780 £1.50	TDA2541 £1.00 TDA2571AQ £2.50	BF127 20p BF137 20p
BFT34 15p 2SC7350 BFT43 10p 2SD180 T	15p BC394 10p MC1748	80p TBA800 50p 75p TBA810AS 60p	TDA2571AQ £2.50 TDA2575A £1.00 TDA2581 £2.50	BF157 20p BF160 20p
BFT84 8p 6A BFW11 20p 2SD200	15p BC414 10p MEM4956	E1.00 TBA810S 60p E2.50 TBA820 60p	TDA2590 £1,00 TDA2593 £1,00	BF161 20p BF164 60p
BFX29 30p 2SK30A BFX84 25p BC107	10p BC440 30p ML232 10p BC454 10p ML236E	E1.20 TBA890 £1.00 E1.50 TBA900 £1.50	TDA2560 50p TDA2600 £5,00	BF179 30p BF180 20p
BFY50 15p BC108 BFY52 20p BC109	10p BC455 10p ML237B	E1.50 TBA920 £1.50 E4.00 TBA920 £1.50	TDA2600 £5.00 TDA2611 £1.00 TDA2653 £1.00	BF181 20p BF182 20p
BFY90 25p BC113 BPW41 25p BC114	10p BC460 25p ML239	3.00 TBA950 £1.50	TDA2002 £1.00	BF184 20p
BRC116 40p BC115 BRX43 15p BC116	10p BC463 10p MM5611	1.00 TMS1000NL £4.00	TDA2640 £2.00 TDA2680 £1.00	BF195 10p
BRX48X 10p BC117 BRY56 30p BC119	20p BC527 10p N64100	75p TMS1943 1.00 (clockchip) £1.00	TDA2690 £1.00 TDA2593 £1.00	BF196 10p BF197 12p
BSS68 10p BC125 BSY79 10p BC126	10p BC546 10p NE555P	75p TMS9980 £4.00 60p TMS9901 £1.00	TDA3190 £1.00 TDA3500 £2.00	BF198 10p BF199 10p
BSY95a 10p BC139	10p BC548 10p IL-1	60p TMS2716JL £1.00 30p TMS3529 £1.00	TDA3560 £3.50 TDA3571Q £1.50	BF200 20p BF222 10p
BSX19 17p BC141	30p BC556 10p OPT600 25p BC557 10p OPT601	30p TMS4014 70p 30p TX-012 £1.00	TDA9403 £3,00 TDA3651AQ £3	BF224 15p BF238 20p
FT3055 30p BC147	10p BC559 10p SAA661 4	1.75 TMS9902 £1.20 UPD2114C 4K RAM	SN74LS 125AN 30p SN74LS 248 50p	BF240 16p BF244 40p
TCE82 30p BC148 2N930 5p BC149	10p BCX31 25p SAA1021	24.00 400ns 75p 24.00 ULN2216 75p	SIL4516 50p SN16861NG 50p	BF245b 20p BF256 10p
2N2221 8p BC153 2N2222 8p BC154	10n BCX32 25n SAA1025	2,50 SN29848 50p 2,50 SN29770BN £1.00	SN16862AN £1.00 SN16964AN 50p	BF257 20p BF258 25p
2N2906 10p BC157a 2N3055 40p BC158	10p BD124 50p SAA1074	3.00 SN29771BN £1.00 3.00 SN29772BN £1.00	SN29764AN £1.00 UA721 40p	BF262 15p BF263p 25p
2N3566 10p BC159 2N3702 10p BC160/16	25p BD130Y 25p SAA1124 3	3.00 SN7402N £1 2.00 SN7472N £1	UA7300 40p RGP30G 10p	BF264 15p BF271 10p
2N3711 10p BC171 2N3583 50p BC172 2N3904 15p BC173	10p BD131 30p SAA1130 4 10p BD132/238 30p SAA1174	22.50 SN74107 £1.00 3.00 SN74167 70p	MPSA14 10p MPSA43 10p	BF273 10p BF274 10p
2N3904 15p BC173 2N4355 10p BC174 2N4442 £1.00 BC183 2N4444 £1.00 BC184	10p BD135 25p SAA1176 10p BD136 30p SAA1250	3.00 SN7472N 20p 3.00 SN75108AN £1.00	MJ13005 30p MJE51T 25p	BF324 25p BF337 50p
1.2N5296 40n 1.RC204	10p BD138 30p SAA1272	3.00 SN76001 £1.00 3.00 SN76003 £1.00	MJE340 28p MJE660 25p	BF355 30p BF362 20p
2N5296 40p BC204 2N5983 30p BC207 2N6099 40p BC212	10p BD175 30p SAA1276 10p BD176 25p 10p BD182 £1.00	SN76013ND £1.50 SN76018 £1.00	MJE661 25p MJE3055 £1.00	BF363 15p BF367 15p
2N6109 40p BC213 2N6130 50p BC214	10p BD183 70p 10p BD202 60p Filters	3 Pin Blue Thermistor	TV Crystals	BF391 15p BF394 10p
2N6130 50p BC214 2N6133 20p BC237 2N6348 20p BC238	10p BD204 60p 5-5MHz 8p BD221 20p 6MHz	15p (fits most sets) 201	4MHz	BF419 30p BF423 15p
2N6399 10p BC239 2X 2N6099 on BC250	10p BD222 30p BFU455K 8p BD228 30p	5p I.C. Heat Sink 20 for £1	4.433-619 6MHz	BF448 30p
heat sink 50p BC251 2SA437 20p BC252	10p BD226 20p BT106 Plastic	30p CVC 9 power supply	8.867238	BF458 30p
TO3 10p BC262	10p BD235 20p BD235 30p BT119	£1.20 CVC 20/2 mains	50p each	BF468 30p
1 28B474 30n 1 BC 294	30p BD238 10p BD239 15p BRC4443	£1.00 panel £2.00	TV100 Therein	BF469 30p BF470 20p
2SB566 10p BC298 2SC381 10p BC300 2SC458 50p BC301 2SC515 10p BC303		Pots 10 k with Switch 25	PT34 New £1.00	BF480 50p BF594 10p
1 2SC732 10n LBC307	7p BD252 20p 2N4444	£1,00 Pots 47 k with Switch 25p	I.C. Hold	BF597 10p lers
2SC733 10p BC308 2SC828 10p BC309 2SC1030 £1.00 BC327	7p BD253B 50p Thermistors 10p BD331 20p VA1104 10p BD332 20p LTTP7266312	Filter RW 153P Colour TV Filter 40p	DIL – DIL 40 Pin × 4 £1.00	D1L - Q1L 16 Pin × 10 £1.00
2SC1172A 10p BC328 2SC1173 10p BC328/338	10p BD373b 20p ITTP7266312 PTH451 AOR PTH451 AOR	15p Mullard Surface Wave 15p Filter RW 154 Colour	42 Pin × 5 £1.00 28 Pin × 5 80p	18 Pin × 10 £1.00 28 Pin × 4 £1.00
2SC1419 20p BC337 2SC1546 20p BC338	10p BD433 10p BD437 25p P13/P fits Pye & P1 25p Degausing Thermisto	(fits G11 Line Scan	24 Pin × 5 75p	8 Pin × 10 50p
2SC1725 2SC2068 20p BC347 BC349b	10p BD439 50p most sets) 10p BD501 30p GEC Double Thermi	20p P.C.B. £1.00 stor 75p ELC 1042 P.C.B. 30p	14 Pin × 10 70p	
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