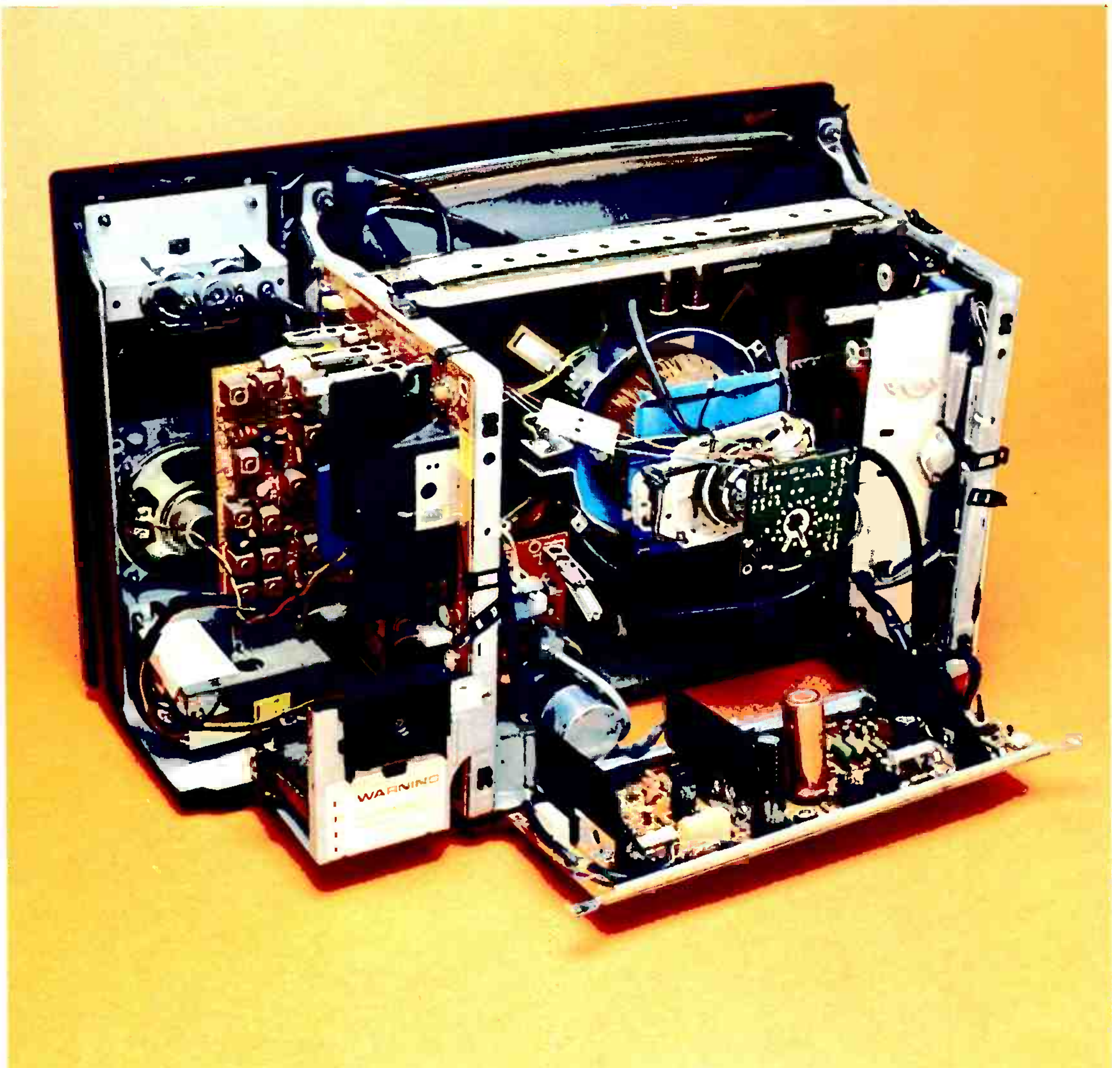
AUGUST 1982

Australia $1.74; New Zealand $2.00; Malaysia $5.50; I.R. £1.21 (inc. VAT)

80p

TELEVISION

SERVICING·VIDEO·CONSTRUCTION·DEVELOPMENTS



SERVICING THE RANK Z718 CHASSIS

A SATELLITE TV INSTALLATION

VCR CLINIC: VR2020 MOTOR CONTROL

WIDEBAND UHF AERIALS

TELEVISION

August 1982

Vol. 32, No. 10
Issue 382

CORRESPONDENCE
All correspondence regarding advertisements should be addressed to the Advertisement Manager, "Television", King's Reach Tower, Stamford Street, London SE1 9LS. Editorial correspondence should be addressed to "Television", IPC Magazines Ltd., Lavington House, 25 Lavington Street, London SE1 0PF.

SUBSCRIPTIONS
An annual subscription costs £10 in the UK, £11 overseas ($24.20 Canada or USA). Send orders with payment to IPC Services, Oakfield House, Perrymount Road, Haywards Heath, Sussex.

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QUERIES
We regret that we cannot answer technical queries over the telephone nor supply service sheets. We will endeavour to assist readers who have queries relating to articles published in *Television,* but we cannot offer advice on modifications to our published designs nor comment on alternative ways of using them. All correspondents expecting a reply should enclose a stamped addressed envelope. Requests for advice in 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").

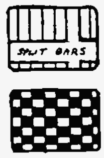
this month

OUR NEXT ISSUE DATED SEPTEMBER WILL BE PUBLISHED ON AUGUST 18

MANOR SUPPLIES

NEW MKV CHEQUERBOARD & PAL COLOUR TEST GENERATOR FOR TV & VCR.

TEST DEMONSTRATIONS AT 172 WEST END LANE

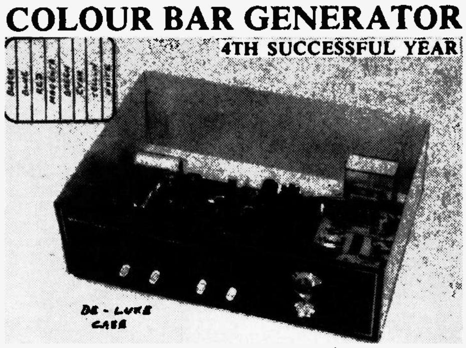


★ 40 different patterns and variations.
★ Broadcast transmission accuracy (fully interlaced sync pulses with correct picture blanking).
★ EBU colour bars, BBC colour bars, whole rasters & split bars (specially useful for VCR service), white, yellow, cyan, green, magenta, red, blue and black.
★ Chequerboard.
★ Mono outputs with border castellations, cross hatch, grey scale, vertical lines, horizontal lines and dots.
UHF modulator output plugs straight into receiver aerial socket.
★ Additional video output for CCTV & VCR.
★ Facilities for sound output.
★ Easy to build kit. Only 2 adjustments. No special test equipment required.
★ Mains operated with stabilised power supply.
★ All kits fully guaranteed with back-up service.
★ Also available with VHF Modulator.

Price of Kit	**£80.50**
Standard Case (10½"×6½"×2½")	**£5.50**
De Luxe Case (10"×6"×2½")	**£8.50**
Optional Sound Module (6MHz or 5.5MHz)	**£4.50**
Built & Tested in De Luxe Case including Sound Module	**£115.00**

Post/Packing £2.00.
All above prices include VAT 15%

PAL COLOUR BAR GENERATOR (Mk 4)



★ Output at UHF, applied to receiver aerial socket.
★ In addition to colour bars R–Y, B–Y etc.
★ Cross-hatch, grey scale, peak white and black level.
★ Push button controls, battery or mains operated.
★ Simple design, only five i.c.s. on colour bar P.C.B.

PRICE OF MK4 COLOUR BAR & CROSS HATCH KIT £40.25 P&P £1.20. DE-LUXE CASE £5.95. ALUMINIUM CASE £3.30, P&P £1.20, BATT HOLDERS £1.70 P&P 85p, ALTERNATIVE STAB. MAINS SUPPLY KIT £5.55 (Combined P&P £1.80).

MK 4 DE LUXE (BATTERY) BUILT & TESTED £66.70 + £1.80 P & P.
MK 4 DE LUXE (MAINS) BUILT & TESTED £80.50 + £1.80 P & P.
VHF MODULATOR (CH1 to 4) FOR OVERSEAS £4.60.
EASILY ADAPTED FOR VIDEO OUTPUT & C.C.T.V.

(ALL PRICES INCLUDE 15% VAT)

MANOR SUPPLIES TELETEXT ADAPTOR KITS

MK 1 (Texas XMII) Cable remote control **£170.20** p.p. £2.80
MK 2 (Philips/Mullard) Infra-red remote control **£227.70** p.p. £2.80.
Further details on request.

Goods available if in stock immediately over shop counter (Mail order between 3 days and 2 weeks

TV SERVICE SPARES

BACKED BY TWENTY YEARS EXPERIENCE & STAFF OF TECHNICAL EXPERTS
Large selection tested colour panels for popular models.

SPECIAL OFFER Leading makers Tuner-Timer in De Luxe Case. 12 station touch tune UHF-VHF + IF amp. Video Audio Outputs, Digital Clock etc. Less than half original trade price **£74.75** p-p £3.50.

TELEVISION MAGAZINE PROJECT PARTS

NEW COLOUR PORTABLE TV
TV PATTERN GENERATOR — SMALL SCREEN MONITOR
MONO PORTABLE TV — LARGE SCREEN COLOUR TV
PHONE, CALL, OR SEND FOR LISTS
WORKING MODELS & PANEL TEST SERVICE AT
172 WEST END LANE.

TV SOUND IF TRANSISTOR, FULLY TESTED **£7.82** p.p. £1.00.
SAW FILTER IF AMPLIFIER PLUS TUNER COMPLETE AND tested for T.V. SOUND & VISION **£32.80** p.p. £1.20 (SUITABLE FOR USE WITH TELEVISION SIGNAL BOARDS).
SPECIAL OFFER TEXAS XMII TELETEXT MODULE NEW & TESTED, AT REDUCED PRICE **£57.50** p.p. £1.60.
TELETEXT 23 BUTTON DE-LUXE HANDSET WITH 5 YDS. CABLE **£7.80** p.p. £1.20. XMII INTERFACE PANEL (THORN) **£2.10** p.p. 75p.
CROSS HATCH UNIT KIT, AERIAL INPUT TYPE, INCL. T.V. SYNC AND UHF MODULATOR. BATTERY OPERATED. ALSO GIVES PEAK WHITE & BLACK LEVELS. CAN BE USED FOR ANY SET **£12.65** p.p. 60p. (ALUM CASE **£2.60** DE LUXE CASE **£5.50** p.p. £1.20.) ADDITIONAL GREY SCALE KIT **£3.35** p.p. 45p.
UHF SIGNAL STRENGTH METER KIT £21.60 (VHF version also available). ALUM CASE **£2.00** DE LUXE CASE **£8.50** p.p. £1.80.
CRT TESTER & REACTIVATOR PROJECT KIT FOR COLOUR & MONO **£29.40** p.p. £2.00.
BUSH Z718 BC6100 SERIES IF PANEL **£5.75** p.p. 90p.
BUSH A816 IF PANEL (SURPLUS) **£1.90** p.p. 90p.
DECCA "Bradford" IF T.B. POWER ex rental **£5.75 each** p.p. £1.40.
DECCA 80, SERIES, IF FRAME TB **£5.75 each** p.p. £1.40.
GEC SERIES I MONO PANELS **£2.10** p.p. £1.30.
GEC 2110 Decoder, RGB panels (ex rental) **£5.75 each** p.p. £1.00.
GEC 2040 DECODER PANEL **£2.88** p.p. £1.60.
GEC 2040 IF PANEL **£3.22** p.p. £1.40.
GEC 2040 (SERIES) CDA PANEL **£2.88** p.p. £1.40.
PYE 713/715 Convergence **£5.75 each** p.p. £1.40.
THORN 3000 LINE T.B. PCB **£5.75** p.p. £1.00.
THORN 3000 BEAM LIMITER PANEL **£1.72** p.p. 80p.
THORN 3000 VID, IF, DEC, Ex Rental **£5.75 each** p.p. £1.30.
THORN 8800 Varicap channel selector & front control unit **£4.37** p.p. £1.80
THORN 8000/8500 IF/DECODER PANELS salvaged **£5.52** p.p. £1.80.
THORN 8000/8500 FRAME T.B. PANELS salvaged **£5.52** p.p. £1.40.
THORN 9000 LINE T.B. (incl. Lopt etc.), Salv., spares **£8.62** p.p. £2.00.
THORN 9000 SERIES TOUCH TUNE REMOTE CONTROL UNIT PLUS ULTRASONIC TRANSMITTER HANDSET **£19.32** p.p. £1.84.
THORN 9000 IF/DECODER PANELS Salvaged **£8.90** p.p. £1.60.
PHILIPS 210, 300 Series Frame T.B. Panels **£1.15** p.p. 80p.
PHILIPS G8/G9 IF/DECODER Panels for small spares **£4.80** p.p. £1.40.
G8 IF Panels for small spares **£1.75** p.p. 95p.
G8 Decoder panels salvaged **£4.25.** Decoder panels for spares **£2.00** p.p. £1.40.
VARICAP, U321, U322, ELC 1043/06 ELC 1043/05 **£7.82** p.p. 80p; G.I. type (equiv. 1043/05) **£4.00** p.p. 60p. Control units, 3PSN **£1.40,** 4PSN **£1.75,** 5PSN **£2.00,** 6PSN **£4.00** p.p. 60p. Makers special types available.
SPECIAL OFFER ELEVEN POSITION VARICAP CONTROL UNIT UHF/VHF **£2.10** p.p. £1.00.
BUSH "Touch Tune" Varicap Control Unit **£4.40** p.p. 95p.
VARICAP UHF-VHF ELC 2000S **£9.80.** BUSH TYPE **£7.82** p.p. 85p.
VARICAP VHF MULLARD ELC 1042 **£7.95** p.p. 80p.
UHF/625 Tuners, many different types in stock. **UHF** tuners transisted. incl. s/m drive, Mullard 4 position push button **£4.80** p.p. £1.50.
MULLARD EP9000 Audio Unit incl. LP1162 Module **£4.38** p.p. 85p.
LINE OUTPUT TRANSFORMERS. New guar. p.p. £1.35.

BUSH 145 to 186SS series	£9.20	R.B.M. A823	£5.60
BUSH, MURPHY A816 series	£9.80	R.B.M. Z179	£6.70
DECCA 20/24, 1700, 2000, 2401	£8.80	R.B.M. Z718	£16.60
FERG., HMV, MARCONI, ULTRA 850 to 1580	£6.80	R.B.M. T20, T22	£11.30
THORN 1690, 1691	£10.50	R.B.M. T20, T22 Bobbin	£6.44
GEC 2000 to 2038 series	£7.80	**DECCA** Bradford (state Mod No.)	£10.15
GEC series 1 & 2	£9.20	**DECCA** 80, 100	£10.15
INDESIT 20/24EGB	£8.80	**GEC** 2028	£5.60
ITT/KB VC1 200, 300	£8.80	**GEC** 2040	£6.70
MURPHY 1910 to 2417 series	£8.80	**GEC** 2110 Series	£12.20
PHILIPS 19TG 170, 210, 300	£8.80	**ITT** CVC 5 to 9	£11.30
PYE, INVICTA, EKCO, FERR. 368, 169, 569, 769 series	£8.80	**ITT** CVC 30 Series	£10.15
SPECIAL OFFER		**PYE** 691-697	£14.80
GEC 2114J/FINELINE	£5.50	**PYE** 713-715	£7.85
PYE 40, 67	£2.00	**PYE** 731 to 741	£7.85
THORN 1590/1591	£5.50	**PHILIPS** G8, G9	£10.15
KB VC ELEVEN (003)	£2.00	**PHILIPS** 570	£7.85
		THORN 3000/3500 SCAN, EHT	£7.85
		THORN 8000/8500/8800	£14.80
		THORN 9000 to 9600	£10.15

COLOUR LOPTS p.p. £1.40 Bobbins 80p
OTHERS AVAILABLE, PRICES ON REQUEST. ALSO F.OPTS.
TRIPLERS Full range available.
Special Offer: Thorn 1400 5 stick EHT Tray **£1.72** p.p. 65p.
THORN 3000/3500, 8000, 8500, MAINS TRANSF. **£10.15** p.p. £1.80
6·3V CRT Boost Transformers **£5.80,** Auto Type **£3.20,** p.p. £1.20.

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INTEGRATED CIRCUITS

AN240	3.84
AN214Q	3.91
AN7150	3.97
CA555	46
CA741	25
CA748	45
CA3065	1.80
LA4031P	3.21
LC7130	5.93
LC7120	5.87
LC7137	5.50
LM1303N	2.63
HA1151	3.89
MC1307	1.00
MC1310P	1.60
MC1327	1.70
MC1351P	1.50
MC1330P	90
MC1349	1.20
MC1350	96
MC1352	1.00
MC1358P	1.50
MC1495L	3.00
MC14011BCP	42
MC14049UB	43
ML231/ETTR6016	2.20
ML232	2.20
ML236	5.35
ML237	1.95
ML238	4.20
ML239	2.50
ML920	4.12
ML922	3.29
ML926	2.18
ML928	2.18
MRF475	2.50
MRF477	10.00
MSN5807	7.87
PLL02AG	9.89
MS1513L	2.80
MS1515L	3.28
SAS560S	1.80
SAS570S	1.80
SAS580	2.90
SAS590	2.90
SL901B	4.45
SL917B	6.25
SL1310	1.80
SL1327Q	1.20
SL76544	2.05
SN76003N	1.75
=SN76013N	
SN76013ND	1.65
SN76023N	1.65
SN76110N	89
SN76115N	2.27
SN76131N	1.30
SN76226(DN)	1.55
SN76227N	1.18
SN76532N	1.50
SN76533N	1.38
SN76033N	1.65
SN76544N	1.35
SN76650N	1.05
SN76660N	80
SN76666N	80
SW153	2.74
TA7050P	95
TA7051P	95
TA7074P	1.00
TA7108P	3.43
TA7120P	2.43
TA7130P	1.93
TA7141P	95
TA7193P	5.67
TA7171P	1.85
TA7172P	1.85
TA7173P	1.85
TA7176P	2.50
TA7193P	5.67
TA7204P	3.77
TA7205AP	3.72
TA7222	4.07
TA7310P	2.78
TA7609P	4.39
TAA300	58
TAA310	2.83
TAA320	2.00
TAA350A	60
TAA550	28
TAA570	1.80
TAA630	3.15
TAA621-AX1	3.00
TAA840/S1	1.96
TAA700B	1.70
TAA700	1.70
TAA661B	1.20
TBA120A	70
TBA120S	70
TBA120SA	70
TBA120AS	70
TBA120B	1.30
TBA120SB	1.30
TBA120U	1.00
TBA395	2.20
TBA396	80
TBA440N (TBA1441)	2.75
TBA440P	2.50
TBA480(Q)	1.20
TBA500P	1.58
TBA510	3.00
TBA520Q	1.20
TBA530(Q)	1.28
TBA540	1.49
TBA550(Q)	1.58
TBA560Q	1.59
TBA570	1.00
TBA690	1.50
TBA673	2.45
TBA700	2.12
TBA720A	2.45
TBA720Q	2.12
TBA750	2.05
TBA800	99
TBA810AS	1.35
TBA820	1.70
TBA890	3.94
TBA920(Q)	1.80
TBA950(2X)	2.40
TBA970	4.09
TBA990	1.49
TBA1441	2.75
TCA160	1.20
TCA760	2.30
TCA270SQ	1.25
TCA800	2.15
TCA940	1.65
TDA440	2.20
TDA1002	1.95
TDA1003A	5.50
TDA1004A	2.95
TDA1006A	2.50
TDA1035	4.70
TDA1044	4.37
TDA1170	1.99
TDA1190	2.60
TDA1200	2.95
TDA1270	3.95
TDA1327	1.70
TDA1352B	1.60
TDA1412	1.20
TDA2002	2.50
TDA2140	5.95
TDA2190	4.70
TDA2020	4.66
TDA2030	2.80
TDA2521	4.17
TDA2522	2.40
TDA2523	2.20
TDA2532	2.45
TDA2524	2.25
TDA2540	3.84
TDA2541	2.65
TDA2560	2.15
TDA2581	2.25
TDA2590	3.25
TDA2591	2.95
TDA2593	2.95
TDA2600	3.25
TDA2611A	1.95
TDA2640	2.60
TDA2680	3.15
TDA2690	1.35
TDA3560	2.95
TDA3950	2.50
TDA3960	2.95
UPC566H	2.95
UPC575C2	3.40
UPC1025H	2.95
UPC1182H	2.95
UPC1156H	4.26
UPC1350C	4.15
UPC1185H	3.86

VOLTAGE REG. I.C.

7805	78	7905	98
7806	78	7906	98
7808	78	7908	98
7812	78	7912	98
7815	78	7915	98
7818	78	7918	98
7824	78	7924	98
78L05	68	79L05	72
78L08	68	79L12	72
78L12	68	79L15	72
78L24	68	79L24	72

T.T.L. 74LS SERIES

74LS00	19	74LS37	19	74LS92	35	74LS160	60	74LS251	54
74LS02	19	74LS38	20	74LS93	35	74LS161	60	74LS253	1.00
74LS03	19	74LS40	20	74LS107	46	74LS162	85	74LS257	53
74LS04	20	74LS42	36	74LS109	27	74LS163	60	74LS258	67
74LS05	19	74LS47	80	74LS112	27	74LS164	65	74LS259	74
74LS08	19	74LS48	80	74LS113	27	74LS165	65	74LS273	80
74LS09	19	74LS49	80	74LS114	27	74LS174	57	74LS283	50
74LS10	19	74LS51	19	74LS123	52	74LS175	47	74LS293	70
74LS11	19	74LS54	19	74LS125	46	74LS191	66	74LS352	1.54
74LS13	37	74LS55	19	74LS126	46	74LS192	65	74LS353	1.10
74LS14	46	74LS73	28	74LS132	46	74LS193	66	74LS365	36
74LS15	19	74LS74	26	74LS138	48	74LS194A	69	74LS366	36
74LS20	19	74LS75	46	74LS139	48	74LS197	80	74LS367	36
74LS21	19	74LS76	22	74LS151	44	74LS240	80	74LS368	36
74LS22	19	74LS78	22	74LS153	44	74LS241	80	74LS373	99
74LS26	19	74LS83A	60	74LS155	44	74LS242	76	74LS374	99
74LS27	19	74LS86	26	74LS156	44	74LS243	76	74LS393	80
74LS30	19	74LS85	62	74LS157	44	74LS244	80	74LS670	1.20
74LS32	20	74LS90	35	74LS158	44	74LS245	1.18		

'4000 B' SERIES CMOS

		4027B	39	4069B	22	4511B	76	4539B	77
		4028B	64	4070B	22	4512B	72	4541B	96
		4029B	90	4071B	22	4513B	1.68	4543B	1.12
4001B	21	4032B	1.04	4072B	22	4514B	1.88	4551B	96
4002B	21	4035B	80	4073B	22	4515B	1.88	4553B	2.40
4008B	72	4038B	99	4075B	22	4516B	76	4554B	1.20
4011B	21	4040B	72	4076B	80	4518B	76	4556B	48
4012B	21	4042B	58	4077B	22	4519B	64	4560B	1.76
4013B	30	4043B	71	4078B	22	4520B	76	4561B	74
4014B	74	4044B	71	4081B	22	4521B	1.68	4566B	1.20
4015B	76	4046B	96	4093B	43	4522B	88	4580B	3.60
4016B	31	4047B	70	4094B	1.56	4526B	88	4581B	1.84
4017B	66	4049UB	32	4099B	1.20	4527B	1.20	4582B	80
4018B	72	4050B	32	4160B	72	4528B	88	4583B	1.00
4020B	76	4051B	72	4161B	72	4529B	1.04	4584B	40
4021B	70	4052B	72	4162B	72	4530B	62	4585B	88
4022B	70	4053B	72	4163B	72	4531B	72	4597B	1.84
4023B	21	4060B	96	4502B	72	4532B	1.00	4598B	2.40
4024B	50	4066B	43	4505B	1.88	4536B	2.64	4599B	2.00
4025B	21	4068B	22	4510B	76	4538B	1.04		

SEMICONDUCTORS

AC107	35
AC126	22
AC127	22
AC128	20
AC128K	32
AC141K	34
AC142K	30
AC176	25
AC176K	32
AC186	41
AC187	26
AC187K	28
AC188	25
AC188K	37
AD143	82
AD149	79
AD161	42
AD161/2	1.15
AD162	42
AF106	49
AF114	89
AF118	62
AF121	56
AF124	34
AF125	35
AF126	34
AF127	32
AF139	42
AF178	1.54
AF239	45
AF279	97
AL102	2.00
AU106	2.50
AU107	2.00
AU110	2.00
AU113	1.40
BC107	20
BC107A	20
BC107B	20
BC108	20
BC108A	20
BC108B	20
BC108C	20
BC109	20
BC109B	20
BC109C	20
BC114	12
BC115	17
BC116A	12
BC117	20
BC118	24
BC139	26
BC140	32
BC141	26
BC142	21
BC143	24
BC147	9
BC148	9
BC149	10
BC157	11
BC158	10
BC159	10
BC160	25
BC161	28
BC170B	15
BC171	9
BC171A	10
BC171B	10
BC172	9
BC172B	10
BC172C	10
BC173C	12
BC174A/B	10
BC177	27
BC178	26
BC182	9
BC182LB	10
BC183LB	10
BC184L/B/C	10
BC204	10
BC208	13
BC209	10
BC212	9
BC212L	9
BC213	9
BC213B	10
BC213L	9
BC214	9
BC214L	10
BC237B	12
BC238A/B/C	8
BC251A	12
BC252A	12
BC252B	12
BC261A	18
BC261B	15
BC262A	15
BC262B	15
BC300	33
BC301	28
BC303	28
BC307	10
BC308A/B	17
BC327	11
BC328	9
BC337	11
BC338	9
BC461	30
BC547	10
BC548	10
BC549	8
BC550	7
BC557	8
BC558	9
BCX34	27
BCY72	13
BD115	32
BD116A	65
BD124P	60
BD131	33
BD132	35
BD133	40
BD135	26
BD136	27
BD137	26
BD138	23
BD139	28
BD140	31
BD144	1.20
BD159	65
BD160	1.30
BD166	52
BD179	52
BD182	72
BD183	75
BD201	85
BD202	80
BD203	80
BD204	84
BD222	46
BD223	56
BD225	47
BD232	45
BD233	35
BD234	37
BD235	33
BD236	40
BD237	33
BD238	35
BD410	55
BD434	55
BD437	86
BD438	94
BD507	52
BD508	55
BD509	56
BD510	60
BD517	60
BD520	75
BD526	62
BD696A	1.49
BDX32	1.50
BF115	35
BF117	36
BF125	26
BF127	26
BF154	12
BF158	18
BF160	27
BF167	24
BF173	22
BF177	35
BF178	26
BF179	28
BF180	36
BF181	36
BF182	30
BF183	29
BF184	30
BF185	30
BF194/394	11
BF195	11
BF196	10
BF197	11
BF198	18
BF199	15
BF200	30
BF224	18
BF225	20
BF241	15
BF256LC	28
BF256	28
BF257	28
BF258	25
BF259	24
BF262	84
BF263	50
BF271	24
BF273	12
BF274	24
BF310	30
BF311	30
BF336	36
BF337	30
BF338	34
BF355	37
BF362	37
BF363	33
BF371	30
BF457	35
BF458	28
BF459	35
BFR39	27
BFR90	1.74
BFT42	28
BFT43	28
BFW10	60
BFX29	30
BFX84	27
BFX85	28
BFX86	30
BFX88	25
BFY50	20
BFY51	22
BFY52	20
BFY90	75
BR100	17
BR101	30
BR103	59
BRC4443	80
BRX46	40
BRY39	30
BRY56	57
BT100/02	92
BT101	1.20
BT102/500R	1.20
BT106	1.00
BT107	1.69
BT108	1.69
BT109/500R	1.20
BT116	1.21
BT119	3.66
BT120	1.95
BT151/800R	1.20
BU104	2.00
BU105	1.25
BU108	1.90
BU124	1.30
BU126	1.49
BU204	1.50
BU205	1.34
BU206	1.80
BU208	1.60
BU208A	1.65
BU208/02	2.10
BU326A	1.42
BU407	1.25
BU500	1.95
BU526	2.46
BU807	2.94
BUW81A	3.84
E1222	28
MJE340	40
DT112	1.91
OT121	1.91
SW150	3.90
SW153A	2.74
BU105/02	1.58
DC71	27
DC79	20
R2008B	1.80
R2010B	1.80
R2265	1.40
R2322	58
R2323	67
R2461	1.50
R2540	2.80
RCA16334	90
RCA16335	80
TIP29C	43
TIP30A	47
TIP30C	43
TIP31C	55
TIP32C	42
TIP33B	75
TIP41C	46
TIP42C	47
TIP47	70
TIP120	65
TIP2955	90
TIP3055	63
TIS91	21
TV106/02	1.55
2N696	21
2N918	82
2N2904	51
2N2905	28
2N3054	60
2N3055	60
2N3702	11
2N3703	10
2N3705	10
2N3706	10
2N3708	17
2N2904	30
2N5294	48
2N5296	48
2N5298	69
2SB337	1.86
2N5496	53
2N6107	75
2N6109	81
2SA715	1.98
2SC495	1.10
2SC496	1.31
2SC643A	1.50
2SC1096	1.72
2SC1172Y	2.20
2SC1173Y	1.69
2SC1306	2.73
2SC1307	3.00
2SC1449	1.67
2SC1520	68
2SC1678	2.67
2SC1909	2.90
2SC1953	1.44
2SC2028	1.82
2SC2029	2.60
2SC2078	2.90
2SC2091	1.34
2SC2166	2.73

I.C. SOCKETS

DIL to DIL

8 way	22
14 way	29
16 way	32
18 way	32
20 way	32
22 way	34
24 way	36

DIL to QUIL

14 way	32
16 way	34
18 way	37

QUIL to QUIL

14 way	32
16 way	36

CERAMIC FILTERS

6Mhz	74
5.5Mhz	74

THERMISTORS

VA1104	75
VA1040	
VA8650	55
VA1039	35
GEC Dual Posistor	1.50
GEC Dual 2040 (CK1)	1.50

CRYSTALS

4.3Mhz	1.30
8.8Mhz	1.30
10.692Mhz	6.00

NEW VALVES

30FL2	1.60	EZ80/1	56	PD500	2.93
DY802	72	GY501	1.45	PFL200	1.35
DY86/7	66	GZ34	1.56	PL36	1.15
ECC81	60	KT66	7.00	PL81	94
ECC82	68	KT88	8.00	PL82	46
ECC83	60	PC86	81	PL83	1.43
ECC84	80	PC88	81	PL84	84
ECC85	98	PC92	90	PL95	1.00
ECC88	1.35	PC97	1.14	PL504	1.50
ECF80	80	PC900	80	PL508	2.90
ECF82	88	PCC84	70	PL509/19	4.50
ECF86	1.50	PCC85	85	PL802	3.25
ECH81	1.04	PCC88	82	PY33	61
ECH84	1.13	PCC89	79	PY88	81
ECL80	84	PCC189	1.02	PY500A	1.90
ECL82	77	PCC805	1.40	PY800/1	69
ECL86	84	PCF80	75	UCF80	67
EF80	68	PCF86	1.13	UCH81	1.43
EF85	68	PCF200	1.35	UCL82	84
EF86	1.19	PCF800	1.38	UCL83	94
EF89	1.43	PCF801	1.13	UL84	1.02
EF183	68	PCF802	86	U26	1.30
EF184	68	PCF805	1.80	U191	95
EH90	1.02	PCF806	1.30	6F23	85
EL34	3.50	PCF808	1.63	UY85	80
EL81	2.05	PCH200	1.55	PL802T	3.00
EL84	68	PCL82	78	40KD6	4.50
EL90	82	~~PCL84~~	~~81~~	21LU8	3.00
EL509	4.50	PCL85/805	90	17DW4A	1.60
EY86/7	68	~~PCL86~~	~~81~~	3AT2B	2.25
EY500A	1.50			12BY7A	3.75

LINE OUTPUT TRANS.

R.B.M. T20A	13.95
R.B.M. A774 Mono	11.74
R.B.M. Z179	15.00
R.B.M. Z718 22"	23.00
PHILIPS 320	8.70
PHILIPS 210/300 Mono	10.00
PHILIPS G8	8.75
PHILIPS G9	7.75
PHILIPS G11	13.50
PYE 691/3	17.75
PYE 697 (Printed)	14.50
PYE 713	10.00
PYE 731	10.00
PYE 725 90°	10.50
PYE 169	10.00
DECCA 80	8.58
DECCA 100	8.58
DECCA 1700	9.00
DECCA 1730	8.58
DECCA 2230	8.58
GEC 2110	9.45
GEC 2040	9.50
GEC 2200	6.65
ITT CVC 1-9	9.60
ITT CVC 25/30/32	8.00
ITT CVC 20	7.75
THORN 3000 EHT	6.90
THORN 3000 SCAN	6.90
THORN 8000	11.33
THORN 8500	11.33
THORN9000	10.65
THORN 3000/3500 Mains	10.00
THORN 1591	8.68
THORN 1691	9.68
THORN 9800	18.00
THORN TX10	12.50

L.E.D.'s

5mm

T1 3/4 PACKAGE

Red	12
Green	14
Yellow	14
Amber	22

T1 PACKAGE 3mm

Red	12
Green	14
Yellow	14

FLASHING L.E.D.

CQX21	62
CQX22	66

RED ONLY

THREE COLOUR L.E.D.

3 Colour options Red/Green/Yellow

V518P	76

PANEL CLIPS

For stnd. range L.E.D. as above

3mm	4
5mm	4

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ALL AVAILABLE EX-STOCK ON GLASS FOR GLASS EXCHANGE BASIS FROM TRADE COUNTER

17" A44/271X	30.00
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18" A47/342X (Low Focus)	30.00
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20" A51/110X	30.00
22" A56/120X	30.00
22" A55/14X	30.00
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26" A66/120X	34.00
26" A67/120X	34.00
22" A56/140X (400) 110°	50.00
26" A66/140X (410) 110°	50.00
26" A51/161X	50.00
22" A56/510X	50.00

P.I.L. TUBES – we can rebuild your own glass – please ring for quotes.

NB Mail Order supplies of tubes. We will send 12" + 14" portable for £5 **carriage.** For 20" + 24" Mono and **all** Colour tubes please ring for quotes on next day delivery service and quotes for the return of old glass. Certain tube types can be supplied without a glass exchange with a basic glass charge incurred. Please ask – we will try to help

CARBON RESISTORS

¼W 3R3-8M2	20	pkt.
½W 3R3-8M2	20	10
1W 10R-10M	36	per
2W 10R-10M	62	type

WIREWOUND RESISTORS*

(Preferred Values)*

4W 1R-10K	20p each
7W 1R-22K	21p each
11W 1R-22K	24p each
17W 1R-22K	28p each

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18" A47/343X	59.00
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22" A56/120X	43.00
25" A63/200X	55.00
26" A66/120X	53.00
26" A67/120X	53.00

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G8 Knobs S	50
E.W. Correction Coil G11	1.95
Transductor 90°	2.60

THORN

1591 Speakers Sm	3.45
Lg	3.95
1500 Frame Hold 390K	32
1500 Line Hold 470K	32
1500 Contrast 1K5	32
Focus Control Thorn/GEC	1.83

DECCA 100

Bridge Transformer	97
30 Series Width Control	50
3R9 Modulohm	60
Height Control 2M2	25
RR1 T.20 Focus Control	2.20

SOLDERING EQUIPMENT

Solder Iron Stands	2.50
WELLER Iron 15W	4.31
WELLER Iron 25W	4.31
WELLER 3/16" Single Flat Tip	51
MIN Soldering Iron	5.00
WELLER Heat Gun	11.75
(Pair) Tips for Gun	42
WELLER Cordless Iron	24.78
ANTEX Soldering Iron 25W	5.20
Solder Remover Sucker	6.50
Solda Mop	72
500G Reel Solder	7.00
DIY Type Solder	43
250G Solder	3.50

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MULLARD A31/510 110° 12"	18.50	A61/120WR 24"	16.90
MULLARD A34/510 110° 14"	20.00	VEGA 12" 90° (Japanese Types)	15.00
A50/120WR 20"	14.50	CME1520 (15" Mono)	15.00

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+ .65
6.48
+ .65
+ .33
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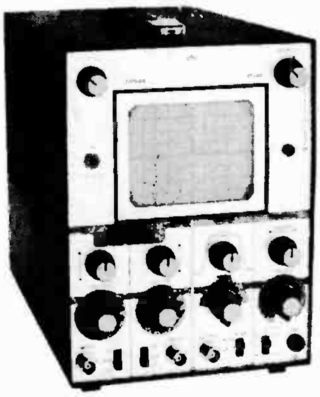

SAFGAN DT-420 DUAL TRACE SCOPE 20MHz
BANDWIDTH

SPECIFICATION
- ★ CH1, CH2: 5mv/div-20v/div
- ★ Time Base: 1 sec/div-100ns/div
- ★ XY Facility: Matched XY inputs
- ★ Trigger: Level control, ± slope selection
- ★ Auto, normal, TV triggering
- ★ Z-Modulation
- ★ CAL output 1V 1KHz
- ★ Graticule blue ruled 8×10 div (4" CRT)
- ★ Size: H215mm, W165mm, D280mm
- ★ Weight: 4kgs
- ★ Supply: 200-240V, 40-60Hz

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Probes as Thandar below.

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LEADER LCT-910A C.R.T. TESTER-REJUVENATOR

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- ★ Tests cathode emission characteristics.
- ★ Separately checks condition of guns.
- ★ Removal of short circuits and leakage between electrodes.
- ★ Checks heater warm-up characteristics.
- ★ Rejuvenation of low emission cathodes with automatic timing.
- ★ Super rejuvenation with manual control.
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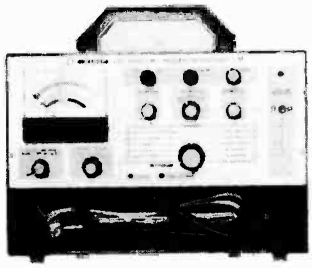
Size: H 230mm W 330mm D 120mm.



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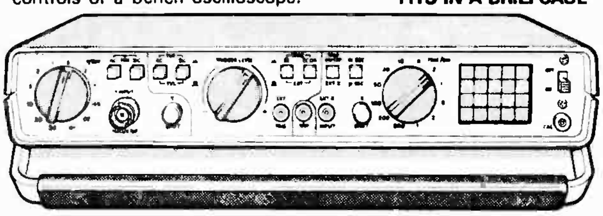
The new Thandar SC110 represents a break-through in oscilloscope development. The SC110 is LESS THAN TWO INCHES thick and weighs under two pounds, yet retains the standard features and controls of a bench oscilloscope. **FITS IN A BRIEFCASE**



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- 10 mV per division sensitivity.
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× 1/× 10 Switched Probe **£9.50** + £1.42 V.A.T.
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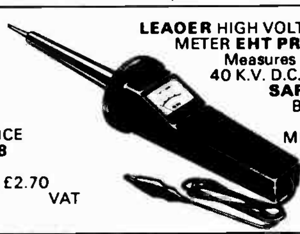
(Overseas purchasers please state voltage.)



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AC117	0.38
AC126	0.36
AC127	0.54
AC128	0.48
AC128K	0.55
AC141	0.65
AC141K	0.70
AC142	0.60
AC142K	0.65
AC151	0.31
AC152	0.36
AC153	0.42
AC153K	0.52
AC154	0.41
AC176	0.45
AC178	0.51
AC179	0.55
AC187	0.56
AC187K	0.65
AC188	0.52
AC188K	0.61
AC193K	0.70
AC194K	0.74
ACY17	1.20
ACY19	0.95
ACY28	0.98
ACY39	2.02
AD140	1.79
AD142	1.90
AD143	1.78
AD149	1.42
AD161	0.66
AD161/162	1.22
AD162	0.71
AF114	1.32
AF115	1.26
AF116	1.28
AF117	1.32
AF118	0.98
AF121	0.68
AF124	0.38
AF125	0.38
AF126	0.36
AF127	0.86
AF139	0.58
AF147	0.52
AF149	0.45
AF178	1.35
AF179	1.36
AF180	1.35
AF181	1.33
AF186	1.48
AF202	0.27
AF239	0.73
AF240	1.40
AF279S	0.91
AL100	1.30
AL103	1.58

Type	Price (£)
AU103	2.40
AU107	2.75
AU110	2.40
AU113	2.80
BC107*	0.16
BC108*	0.15
BC109*	0.16
BC113	0.22
BC114	0.22
BC115	0.24
BC116*	0.25
BC117	0.30
BC118	0.24
BC119	0.34
BC125*	0.30
BC126	0.30
BC132	0.20
BC134	0.22
BC135	0.21
BC136	0.22
BC137	0.30
BC138	0.352
BC140	0.36
BC141	0.44
BC142	0.35
BC143	0.38
BC147*	0.12
BC148*	0.12
BC149*	0.13
BC152	0.42
BC153	0.38
BC154	0.41
BC157*	0.13
BC158*	0.12
BC159*	0.14
BC160	0.52
BC161	0.58
BC167B	0.15
BC168B	0.14
BC169C	0.15
BC170*	0.15
BC171*	0.15
BC172*	0.14
BC173*	0.22
BC174A & B	0.26
BC176	0.22
BC177*	0.20
BC178*	0.22
BC179*	0.28
BC182*	0.15
BC182L*	0.15
BC183*	0.14
BC183L*	0.14
BC184*	0.15
BC184L*	0.15
BC185	0.36
BC186	0.25
BC187	0.27

Type	Price (£)
BC192	0.56
BC204*	0.39
BC205*	0.39
BC206*	0.37
BC207*	0.39
BC208*	0.37
BC209*	0.39
BC211*	0.36
BC212*	0.17
BC212L*	0.17
BC213*	0.16
BC213L*	0.16
BC214*	0.18
BC214L*	0.18
BC225	0.42
BC237*	0.16
BC238*	0.15
BC239*	0.22
BC251*	0.25
BC252*	0.26
BC253*	0.38
BC261A*	0.28
BC262A*	0.28
BC263*	0.26
BC267*	0.20
BC268*	0.28
BC286	0.40
BC287	0.49
BC291	0.27
BC294	0.37
BC297	0.36
BC300	0.62
BC301	0.38
BC302	0.86
BC303	0.64
BC304	0.44
BC307*	0.17
BC308*	0.14
BC309*	0.18
BC317*	0.15
BC318*	0.15
BC319*	0.19
BC320	0.17
BC321A&B	0.18
BC322	0.28
BC323	1.15
BC327	0.16
BC328	0.18
BC337	0.17
BC338	0.17
BC340	0.19
BC347*	0.17
BC348A & B	0.17
BC349B	0.17
BC350*	0.24
BC351*	0.22
BC352A*	0.24
BC360	0.59

Type	Price (£)
BC377	0.29
BC394	0.39
BC440	0.52
BC441	0.59
BC461	0.78
BC477	0.30
BC478	0.25
BC479	0.33
BC547*	0.13
BC548*	0.13
BC549*	0.15
BC550	0.24
BC556	0.23
BC557*	0.16
BC558*	0.16
BC559*	0.17
BCY10	0.30
BCY30A	1.06
BCY32A	1.19
BCY34A	1.02
BCY72	0.27
BD115	1.35
BD123	1.50
BD124	1.85
BD130Y	1.56
BD131	0.58
BD132	0.68
BD133	0.70
BD135	0.37
BD136	0.38
BD137	0.40
BD138	0.42
BD139	0.46
BD140	0.50
BD144	2.24
BD145	0.75
BD150A*	0.51
BD155	0.90
BD157	0.51
BD158	0.75
BD159	0.68
BD160	2.69
BD163	0.67
BD165	0.66
BD166	0.88
BD175	0.90
BD177	0.58
BD178	0.92
BD181	1.94
BD182	2.10
BD183	1.34
BD184	2.30
BD187	1.20
BD188	1.25
BD189	0.71
BD222	0.91
BD225	0.91
BD232	0.91
BD233	0.62

Type	Price (£)
BD234	0.68
BD235	0.63
BD236	0.63
BD237	0.68
BD238	0.68
BD253	1.58
BD410	1.65
BD433	0.65
BD435	0.70
BD436	0.71
BD437	0.74
BD438	0.75
BD519	0.88
BD520	0.88
BD599	0.87
BD600	1.23
BD663BR	0.86
BDX18	1.55
BDX32	2.95
BDY16A	0.63
BDY18	1.55
BDY20	2.29
BDY38	1.38
BF115	0.48
BF117	0.45
BF120	0.55
BF121	0.85
BF123	0.48
BF125	0.55
BF127	0.51
BF137F	0.78
BF152	0.19
BF158	0.25
BF159	0.27
BF160	0.20
BF161	0.84
BF163	0.65
BF164	0.95
BF166	0.50
BF167	0.38
BF173	0.35
BF177	0.36
BF178	0.46
BF179	0.58
BF180	0.53
BF181	0.53
BF182	0.44
BF183	0.52
BF184	0.44
BF185	0.42
BF186	0.42
BF194*	0.14
BF195*	0.13
BF196	0.14
BF197	0.15
BF198	0.29
BF199	0.29
BF200	0.25
BF218	0.42

Type	Price (£)
BF222	0.51
BF224 & J	0.22
BF240	0.32
BF241	0.31
BF244*	0.51
BF245*	0.43
BF254	0.48
BF255	0.58
BF256L*	0.49
BF257	0.47
BF258	0.52
BF259	0.54
BF262	0.73
BF263	0.88
BF270	0.47
BF271	0.42
BF272A	0.80
BF273	0.33
BF274	0.34
BF336	0.63
BF337	0.65
BF338	0.68
BF355	0.72
BF362	0.49
BF363	0.49
BF367	0.29
BF451	0.43
BF457	0.46
BF458	0.49
BF459	0.52
BF594	0.16
BF596	0.17
BF597	0.27
BFR39	0.30
BFR40	0.29
BFR41	0.30
BFR50	0.29
BFR52	0.33
BFR61	0.29
BFR62	0.28
BFR79	0.30
BFR80	0.29
BFR81	0.30
BFR88	0.42
BFT41	0.48
BFT43	0.55
BFW11	1.02
BFW30	2.58
BFW59	0.19
BFW60	0.20
BFW90	1.65
BFX29	0.38
BFX84	0.42
BFY50	0.38
BFY51	0.37
BFY52	0.36
BFY53	0.36
BFY90	1.98
BPX25	1.62

Type	Price (£)
BPX29	1.62
BR101	0.53
BR103	0.64
BR303	1.06
BRC4443	1.76
BRY39	0.60
BRY56	0.44
BSS27	0.92
BT106	1.50
BT109	1.99
BT116	1.45
BT119	5.18
BU102	2.85
BU105	1.80
BU105/02	1.95
BU108	2.98
BU126	2.91
BU204	2.50
BU205	2.58
BU206	2.59
BU208	2.75
BU407	1.38
BUY77	2.50
C106D	0.80
C106F	0.43
C111E	0.46
D40N1	0.64
E300	0.42
E1222	0.47
E5024	0.19
GET872	0.46
ME0402	0.18
MF0404/02	0.18
ME6001	0.18
ME6002	0.18
MJ2955	1.30
MJ3000	1.58
MJE340	0.68
MJE341	0.72
MJE370	0.74
MJE371	0.79
MJE520	0.85
MJE521	0.95
MJE2955	1.20
MJE3000	1.95
MJE3055	1.22
MPF102	0.40
MPS3702	0.33
MPS3705	0.30
MPS6521	0.36
MPS6523	0.36
MPS6566	0.44
MPSA05	0.30
MPSA06	0.32
MPSA55	0.43
MPSA56	0.45
MPSA93	0.56
MPSL01	0.33
MPSU01	0.61

Type	Price (£)
MPSU05	0.66
MPSU06	0.76
MPSU55	1.26
MPSU56	1.32
MPSU60	0.82
MPU131	0.59
OC26	1.90
OC28	1.49
OC29	1.60
OC35	1.25
OC36	1.25
OC42	0.90
OC44	0.68
OC45	0.63
OC70	0.65
OC71	0.73
OC72	0.73
OC81	0.83
OC81D	0.95
OC139	1.30
OC140	1.35
OC170	0.80
OC171	0.82
OC200	3.90
OC201	3.95
OC202	2.40
OC205	3.95
OCP71	1.98
ON236A	0.94
R2008B	2.72
R2010B	2.79
R2322	0.75
R2323	0.85
ST2110	0.49
ST6120	0.48
TIC44	0.25
TIC46	0.35
TIC47	0.45
TIP29A	0.47
TIP30A	0.50
TIP31A	0.51
TIP31C	0.67
TIP32A	0.56
TIP32C	0.72
TIP33A	0.77
TIP34A	0.84
TIP41A	0.72
TIP42A	0.80
TIP2955	0.77
TIP3055	0.58
TIS43	0.44
TIS73	1.36
TIS90	0.23
TIS91	0.28
ZTX108	0.14
ZTX109	0.16
ZTX213	0.2
ZTX300	0.16
ZTX304	0.26

Type	Price (£)
ZTX500	0.18
ZTX502	0.22
ZTX504	0.28
2N404	1.30
2N696	0.46
2N697	0.46
2N706A	0.33
2N708	0.29
2N914	0.32
2N916	0.46
2N918	0.54
2N930	0.29
2N1164	10.29
2N1304	1.40
2N1305	1.29
2N1306	1.49
2N1307	1.32
2N1308	1.53
2N1711	0.47
2N1893	0.52
2N2102	0.71
2N2217	0.55
2N2218	0.38
2N2219	0.42
2N2221A	0.26
2N2222A	0.41
2N2369A	0.40
2N2401	0.80
2N2484	0.35
2N2570	0.74
2N2646	0.82
2N2784	1.15
2N2869	2.08
2N2894	0.45
2N2904*	0.40
2N2905*	0.39
2N2906*	0.36
2N2926G	0.15
2N29260	0.14
2N2926Y	0.14
2N2955	1.12
2N3053	0.48
2N3054	0.66
2N3055	0.72
2N3250	0.52
2N3254	0.58
2N3391A	0.38
2N3633	0.60
2N3703	0.17
2N3704	0.19
2N3705	0.17
2N3706	0.16
2N3707	0.18
2N3708	0.17
2N3715	1.70
2N3771	2.09
2N3772	2.08
2N3773	2.90
2N3794	0.40

Type	Price (£)
2N3819	0.47
2N3820	0.72
2N3866	1.08
2N3904	0.20
2N3905	0.20
2N3906	0.20
2N4036	0.94
2N4123	0.17
2N4124	0.17
2N4126	0.17
2N4236	2.20
2N4289	0.32
2N4292	0.32
2N4416	0.85
2N4444	1.90
2N4921	0.80
2N5042	1.65
2N5060	0.28
2N5061	0.30
2N5064	0.63
2N5086	0.49
2N5087	0.50
2N5208	0.59
2N5294	0.66
2N5296	0.68
2N5298	0.71
2N5322	1.16
2N5449	0.18
2N5457	0.46
2N5458	0.40
2N5459	0.58
2N5494	0.85
2N5496	1.05
2N6027	0.55
2N6107	0.71
2N6122	0.60
2N6178	1.07
2N6180	1.39
2N6211	2.74
2SB337BP	4.28
2SC458C	0.78
2SC643A	2.25
2SC930D	1.50
2SC1061	1.45
2SC1172Y	3.55
2SD234	1.48
3N128	1.60
40250	0.98
40251	1.14
40327	0.67
40361	0.48
40362	0.50
40410	0.94
40429	0.88
40530	0.79
40595	1.39
40603	1.13
40636	1.25
40654	0.89

Alternative gain versions available on items marked*. For matched pairs add 20p per pair.

LINEAR IC's

Type	Price (£)
CA810QM	2.44
CA3005	1.85
CA3012	1.45
CA3014	2.23
CA3018	0.71
CA3020	1.89
CA3028A	0.80
CA3028B	1.09
CA3045	3.75
CA3046	0.70
CA3065	1.74
CA3068	1.90
CA3130S	1.57
FCH161	2.40
FCJ101	3.32
LM309K	1.98
LM380N-14	1.65
LM1303N	1.03
MC1307P	1.82
MC1310P*	1.84
MC1312P	2.34
MC1327P*	1.86
MC1330P	0.83
MC1350P	1.22
MC1351P	1.42
MC1352P	1.42
MC1357P	2.92
MC1358P*	2.30
MC1458G	1.43
MC1496L	1.15
MC3051P	0.58
MFC4000B	0.85
MFC4060A	0.98
MFC6040	1.11
MIC1P	1.10
ML231	3.57
ML232	3.57
NE555	0.72
NE556	1.34
NE566	1.95
SAA1024	5.70
SAA1025	10.35
SAS560A	2.01
SAS570	2.01
SC9503P	1.40
SC9504P	1.38
SL432A	2.52
SL450	5.10
SL901B	4.70
SL917B	5.60
SL918A	5.95
SN72440N	2.21
SN76001N	1.67
SN76003N	2.20

Type	Price (£)
SN76003N	3.32
SN76013N	2.52
SN76023N	3.02
SN76023ND	2.52
SN76033N	3.32
SN76033ND	1.40
SN76033N	2.20
SN76110N	1.20
SN76115N	1.62
SN76116N	1.78
SN76131N	2.10
SN76226N	2.60
SN70227N	1.61
SN76228N	1.80
SN76502N	1.92
SN76530P	0.97
SN76533N	1.38
SN76544N	1.85
SN76546N	1.85
SN76570N	1.81
SN76620AN	0.99
SN76650N	1.48
SN76660N	0.64
SN76666N	0.96
TA7073P	3.51
TAA263	2.20
TAA300	3.8F
TAA320	1.10
TAA350A	2.48
TAA370A	3.18
TAA435	1.70
TAA450	3.39
TAA521	1.10
TAA522	2.09
TAA550	0.35
TAA560	1.93
TAA570	2.20
TAA611A	1.67
TAA611B	1.89
TAA621AXI	4.75
TAA630Q	3.91
TAA630S	4.18
TAA661A	2.39
TAA661B	1.75
TAA700*	2.80
TAA840	3.38
TAA861A	0.95
TAA930A	1.43
TAA930B	1.43
TAA960	3.20
TAA970	2.81
TAD100	2.66
TBA120A	0.90
TBA120S*	0.99
TBA120SA	1.02
TBA231	1.12

Type	Price (£)
TBA240A	3.98
TBA281	2.07
TBA395*	2.58
TBA396	2.40
TBA400	2.20
TBA480Q	1.84
TBA500*	2.21
TBA510*	2.21
TBA520*	2.98
TBA530P	2.24
TBA540*	2.88
TBA550*	3.13
TBA560C*	3.18
TBA570*	1.29
TBA611B	2.68
TBA641	4.55
TBA641A12	4.55
TBA641BX1	4.60
TBA651	2.42
TBA673	2.31
TBA700*	2.50
TBA720AQ	2.38
TBA720Q	2.38
TBA750*	2.18
TBA800	2.05
TBA810AS	2.00
TBA920*	2.80
TBA940	3.52
TBA950	2.08
TBA990*	2.90
TCA270A*	3.56
TCA280A	1.43
TCA290A	3.46
TCA420A	2.10
TCA440	1.67
TCA640	4.26
TCA650	4.26
TCA660	4.26
TCA730	4.10
TCA740	4.04
TCA750	2.53
TCA760	1.52
TCA820	3.29
TDA440	4.16
TDA1003	1.68
TDA1004	3.86
TDA1005	3.04
TDA1022	6.89
TDA1024	0.97
TDA1034	2.98
TDA2610	2.86
TDA2640	2.86
ZN414	1.45

* Indicates Q version is also available.

DIODES

Type	Price (£)
AA113	0.17
AA119	0.21
AA129	0.28
AA143	0.18
AAY30	0.28
AAZ13	0.42
AAZ15	0.35
AAZ17	0.28
AY102	3.85
BA100	0.24
BA102	0.36
BA104	0.19
BA110	0.80
BA111	0.70
BA115	0.17
BA116	0.56
BA121	0.85
BA129	0.45
BA145	0.19
BA148	0.19
BA154	0.06
BA155	0.17
BA156	0.17
BA157	0.25
BA158	0.28
BA159	0.40
BA164	0.14
BA182	0.27
BA201	0.13
BA202	0.14
BA203	0.14
BA216	0.08
BA219	0.11
BA243	0.45
BA317	0.06
BA318	0.07
BAV10	0.10
BAV21	0.18
BAW62	0.06
BAX13	0.07
BAX16	0.10
BAX17	0.19
BAY72	0.16
BB104B	0.52
BB105B	0.33
BB105G	0.30
BR100	0.40
BY100	0.35
BY103	0.35

Type	Price (£)
BY114	0.60
BY118	1.10
BY126	0.20
BY127	0.21
BY133	0.35
BY140	1.40
BY164	0.75
BY176	2.80
BY179	0.83
BY182	1.14
BY184	0.44
BY189	5.30
BY190	4.90
BY206	0.26
BY238	0.25
BYX10	0.30
BYX38/600	0.70
BYX70/500	0.53
ITT44	0.08
ITT210	0.63
ITT827	0.80
MCR101	0.48
MR854	1.10
OA5	0.88
OA10	0.58
OA47	0.20
OA81	0.19
OA90	0.13
OA91	0.15
OA95	0.20
OA200	0.13
OA202	0.13
OA210	0.89
TIL209	0.14
TIL211	0.18
TV20	2.25
IN914	0.06
IN916	0.06
IN4001	0.06
IN4002	0.07
IN4003	0.08
IN4004	0.08
IN4005	0.09
IN4006	0.10
IN4007	0.12
IN5400	0.15
IN5401	0.17
IN5402	0.20
IS920	0.09
IS921	0.11

ZENER DIODES

400mW plastic	3.0-75V	14p each
1/1.3W plastic	3.3-200V	18p each
1.5W flange	4.7-75V	£1.26 each
2.5W plastic	7.5-75V	67p each
20W stud	7.5-75V	£1.31 each

VDR's, etc.

Type	Price (£)
E295ZZ	
/01	0.28
/02	0.28
E298CD	
/A258	0.25
E298ED	
/A258	0.22
/A260	0.22
/A262	0.22
/A265	0.22
/P268	0.22
E298ZZ	
/05	0.25
/06	0.22
E299DD/P116-P354	all 0.23
E299DH /P230	0.72
VA1015	0.92
VA1026	0.79
VA1033/34/38/39/40/53	all 0.20
VA1055s/56s/66s/67s	all 0.23
VA1074	0.20
VA1077	0.31
VA1091	0.29
VA1096/97/98	all 0.20
VA1103	0.32
VA1104	0.66
VA1108/09/10/11/12	all 0.24
VA8650	1.20
2322 554 02221	0.59
2322 662 98003	0.88

VALVES

Type	Price (£)
DY86/87	0.75
DY802	0.75
ECC81	0.78
ECC82	0.95
ECC83	0.78
ECH81	0.83
ECL80	0.82
EF80	0.60
EF183	0.75
EF184	0.75
EH90	0.94
EL34	3.08
EY51	1.20
EY86/87	0.67
PCC84	0.61
PCC85	0.79
PCC89	0.74
PCC189	0.94
PCF80	1.20
PCF86	0.87
PCF200	2.32
PCF801	0.74
PCF802	1.20
PCF805	3.37
PCF808	3.80
PCL82	0.93
PCL83	5.25
PCL84	0.65
PCL86	1.27
PCL805/85	1.00
PD500	3.75
PFL200	1.40
PL36	1.20
PL81	0.94
PL84	0.79
PL504	1.50
PL508	1.86
PL509	4.75
PL519	4.75
PL802	5.60
PY81/PB10	0.60

BRIDGES

Rating	Price (£)	Rating	Price (£)
1½A 50V	0.27	2A 100V	0.36
100V	0.28	200V	0.40
200V	0.32	400V	0.47
400V	0.40	600V	0.53
600V	0.50	800V	0.60
800V	0.58	1000V	0.87
3A 100V	0.52	6A 100V	0.66
200V	0.55	200V	0.68
400V	0.61	400V	0.74
600V	0.67	600V	0.80
800V	0.80	800V	0.86
1000V	1.20	1000V	0.95

10A and 25A ranges also stocked.

RESISTORS

Carbon Film (5%)

	Ea	10 of one value	50pc	100pc	500pc
			Mixes of a minimum of 10pcs of any value:		
¼W 5.6Ω-330kΩ (E12)	3p	25p	95p	£1.48	£6.40
½W 10Ω-10MΩ (E24)	3p	25p	95p	£1.48	£6.40
1W 10Ω-10MΩ (E12)	5p	45p	£1.95	£3.40	£15.25
2W 10Ω-10MΩ (E6)	9p	80p	£3.60	£6.40	£28.90

Wirewound (5%)

2½W 0.22Ω-270Ω	18p
4W 1.0Ω-10kΩ	22p
7W 0.68Ω-22kΩ	24p
11W 1.0Ω-22kΩ	28p
17W 1.0Ω-22kΩ	33p
Vertical mounting pillars	3p

Presets (†)

0·1W (Vertical and Horizontal)
100, 220, 470Ω, 1, 2 2, 4·7, 10, 22, 47, 100, 220, 470kΩ, 1, 2·5, 5MΩ **all 14p each**

0·2W (Vertical and Horizontal)
Values as 0 1W **all 14p each**

FUSES (all packs of 10)

20mm Time Delay (BEAB)

40mA	£3.68
50, 63mA	£2.55
100mA	£1.86
160, 200, 250mA	£1.44
315, 500, 800mA, 1, 1.25, 1.6, 2, 2.5, 3.15, 5A	all £1.19

20mm quick-blow (BEAB)

100mA	68p
200, 250, 315, 500, 630, 800mA, 1, 1.25, 1.6, 2, 2.5, 3.15, 5A	all 56p

2A circuit breakers metal **£1.52** plastic **£1.48**

LABGEAR (Details of full range on request)

TELETEXT ADAPTOR 7056. An amazing box which can be used with any UHF Receiver. **£223** + £2.25 P&P + VAT. – ask us for a fully descriptive brochure.

AUGUST SPECIAL OFFER

5mm Red LED's	10p each	100 for £5.00
5mm Yellow LED's	14p each	100 for £10.00
5mm Green LED's	14p each	100 for £10.00

Send *NOW* for our SPECIAL OFFER LISTS.

MULTIMETER SPECIAL

Russian type U4324
DC Voltage: 0.6, 1.2, 3, 12, 30, 60, 120, 600, 1200.
AC Voltage: 3, 6, 15, 60, 150, 300, 600, 900.
DC Intensity M/A: 0.06, 0.6, 6, 60, 600, 3000.
AC Intensity M/A: 0.3, 3, 30, 300, 3000.
DC Resistance: 0.2, 5, 50, 500, 5000K.
ge level dB: –10 to +12.

Special Price £12. including p/p and VAT.

P. & P. UK: £0.30 per order. **Overseas:** At cost.
Please add VAT at 15%.
Delivery by return of mail on all stock items.
It is only possible to show part of our range here. Our catalogue (30p refundable) shows Service Aids, 7400 series, CMOS, op amps, SCRs etc., hardware, capacitors, special TV items and many more transistors, diodes, i.c.'s and valves.

A/c facilities available

CAPACITORS

Metallised Paper

2n2F	1500V DC	60p	10nF	500V AC	80p
2n2F	600V AC	24p	15nF	300V AC	30p
3n6F	1700V DC	60p	22nF	300V AC	32p
4n7F	1500V DC	60p	100nF	1000V DC	46p
10nF	1000V DC	22p	470nF	1000V DC	60p

H.V. Disc Ceramic (†)

1kV	1.5nF	18p
3kV	1.5nF	20p
8kV	10, 22, 47, 82, 100, 120, 150, 180, 200, 220pF	30p
	270, 300pF	39p
10kV	1nF	67p

SPECIAL OFFER

2 pin European battery eliminators (fits shaver socket).
240V: 6V. 200mA **£1.00**
240V: 6V. 400mA **£1.50 each**
240V: 9V. 150mA **£1.50 each**
Quantity prices available.

CONVERGENCE POTENTIOMETERS

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TELEVISION

Cable Controversy

Just ten years ago, in September 1972, Harrogate town council decided to go ahead with a scheme to build a conference centre. It was to cost £750,000 and be completed in 1975. A new hotel to cater for those using the centre and an office block were to be included in the scheme. The cost would be financed by selling council land, and no loan charges would be passed on to the town's ratepayers. It all sounded too good to be true. Conferences mean big business for a resort like Harrogate, and clearly the town's future prosperity would be enhanced by attracting as much of this sort of business as possible. The centre was finally completed earlier this year, seven years later than planned and at a cost of over £30 million rather than £750,000. There will be loan charges of over £3 million a year for 40 years, and a council spokesman has commented that the cross-over point to making a profit will probably not be till the end of the century. Oh yes, and only the hotel's foundations have been built.

That sounds awful when put so starkly. There were problems, and some good reasons for the way in which the situation changed. In particular, the centre's specification was altered and up-graded. But there can be little doubt that had the eventual financial outcome been known at the start the scheme for the centre would never have been approved. The moral, if there is one, seems to be that once a major project gets going it's very difficult to stop it. Would it at any particular time as the costs escalated have been reasonable to call a halt?

What's this got to do with television? Well, that report by the Cabinet Office's Information Technology Advisory Panel earlier this year suggested that the capital cost of providing half the UK's population (those living in urban areas) with a modern cable network would be "of the order of £2,500 million" and that "there need be no call on public funds". Hmm. The chapter in the report on the economic and industrial considerations is in fact singularly unconvincing – especially when it comes to finance. It admits that the figures "are inevitably subject to some uncertainty", and adds that the expenditure would be "made over a period of years". Also that "there is little information available in the United Kingdom on the market for additional services supplied via TV screens, whether entertainment, instruction or information." Despite these reservations however the Panel recommends "encouraging the growth of cable systems in the United Kingdom" and that "we cannot stress too highly the need for speed."

Perhaps the most unconvincing argument of all is that it would "be most appropriate for the Government to adopt the creative policy which we recommend during IT Year 1982." The financial section also comments that "the rapid growth in the United Kingdom market for VCRs and cassettes demonstrates the substantial sums that consumers are prepared to pay for additional video material", and that "if experience in the USA is any guide . . ." We'd say that US experience, where the TV situation is quite different for historical and geographical reasons, offers very little by way of guidance, while VCRs don't provide "additional video material" in any very wide sense but rather the ability to see favourite films when you want and off-air material when you want rather than when transmitted.

The real weakness of the report is its failure to outline just what sorts of services should be provided by cable and when. Initially it says that the main impetus would come from "additional popular programming channels." Certainly! There's much talk about DBS, the view that "we consider the long-term potential for providing new sorts of services to be much more important", and that "the main role of cable systems will eventually be the delivery of many information, financial and other services to the home and the joining of businesses and homes by high capacity data links." The question as to exactly what a cable system would be used for is paramount and would seem to require very careful consideration before anything else is done – otherwise we have the perfect recipe for a Harrogate style débâcle. To this however the Panel say that "we would not want possible long-term considerations to delay the investment required now if United Kingdom industry is to benefit from cable systems." This is surely to put the cart before the horse. The creation of jobs and economic activity is certainly desirable – but only to provide goods and services that people want or need. It seems in this respect that we've still to learn the lesson offered by Japanese industry: identify a sure market, then go after it. Or to put it slightly differently, economic activity must be market orientated – it's no use producing the goods then looking for a market. In particular, it's all too easy to get carried away by "creative" arguments in favour of conference centres, supersonic airliners – and cable TV.

HELD OVER

Due to shortage of space several features we had planned to include in this issue have had to be held over – we couldn't even find space for the traditional service problems this month. Part 11 on VCR Servicing and Part 2 on the Luxor 90° hybrid CTVs will appear next month.

Long-distance Television

Roger Bunney

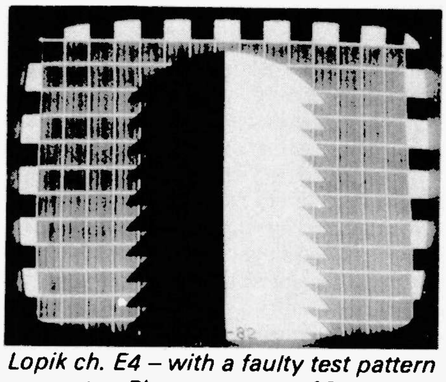
THE 1982 Sporadic E season is at last upon us, with signals at high levels from most of Europe. Propagation during May and early June was mainly from the east and south rather than from Scandinavia. There was F2 reception in both the UK and Holland, with Zimbabwe ch. E2 via daytime F2 and evening TE, while excellent tropospheric openings occurred during the period 8-16th May.

The F2 loggings were on May 5th and 8th via daytime F2 and on the 23rd via TE, the signal each time being ZTV ch. E2. Tropospheric reception was spread over several days and tended to be along a north-south line. Here in Hampshire reception came from north country UK u.h.f. stations and to the south from French u.h.f. stations, the 16th being particularly good. Trevor Rose in Lowestoft reports that conditions there started to improve from the 8th, to the extent that by the 13th several of the more difficult W. German u.h.f. and Danish Band III transmitters were received – also f.m. radio. The 14th was by far the best day for Trevor, with many W. German stations including several low-powered BFBS outlets on chs. E23, E48 and E53. On the 15th John Tellick, who was visiting Lancing, found French u.h.f. signals across the band with his portable TV set used atop a hill. One unusual signal he received was from the 7kW e.r.p. Neufchatel outlet, with TF-1 on 819 lines. Another unusual logging was the Sens ch. E60 FR-3 outlet, with the PM5544 test pattern: this had the identification "TDF" at the top and "SENS E60H" at the bottom. Arthur Milliken received many RTE (Eire) stations at Wigan during the same period.

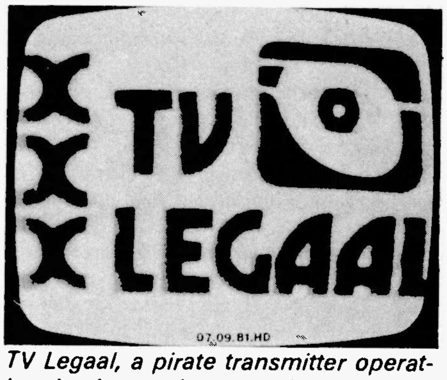
There have already been several strong SpE openings, though with periods of low activity in between. The general log for the UK is as follows:

3/5/82 RAI (Italy) ch. IA; RTVE (Spain) E4; TSS (USSR) R1, 2; CST (Czechoslovakia) R1.
4/5/82 TSS R1, 2.
5/5/82 RTVE E2, 3, 4; Switzerland E2.
6/5/82 RTVE E2, 3, 4; RTP (Portugal) E2, 3; ORF (Austria) E2a; W. Germany E2; SR (Sweden) E2.
8/5/82 RAI IA, B; RTVE E2, 3, 4; JRT (Yugoslavia) E3.
9/5/82 MTV (Hungary) R1, 2; TVP (Poland) R1, 2, 3; TSS R1-5; CST R2; RAI IA, B; ORF E2a, 3, 4; SR E3; NRK (Norway) E3, 4; ARD (W. Germany) E2; NCT (Italian free station) E3.
10/5/82 TSS R1; TVP R1; RAI IA, B; unidentified Arabic E2 signal logged by Hugh Cocks (Sussex).
11-12/5/82 RAI IA.
13/5/82 RTVE E2, 3, 4; RTP E2, 3 (live OB of Pope's visit); NTA (Nigeria) E3 at 1630-1900.
14/5/82 RAI IA; ARD E2; RTVE E2.
15/5/82 TSS R1, 2; TVP R1.
16/5/82 TSS R1, 2, 3; TVP R1, 2, 3; MTV R1, 2; ORF E2a; JRT E3, 4; RAI IA; RTVE E2. Hugh reports suspect Morocco E4 (1930) and NTA E3 during the same opening; RTA (Albania) IC also logged.
17/5/82 Unidentified E2, 3, 4 signals mid-morning; TSS R1, 2; SR E2.
18/5/82 RAI IA; TSS R1.
19/5/82 TSS R1, 2.
20/5/82 CST R1, 2; TVP R1; MTV R1; RTVE E2, 3, 4; RTP E2, 3; RAI IA.
21/5/82 RTVE E2, 3, 4.
23/5/82 JRT E3.
24/5/82 TSS R1, 2; ORF E2a; DFF (E. Germany) E4; NRK E2, 4; RUV (Iceland) E3, 4; RTVE E2, 3, 4; RTP E3; TVP R1. Plus many unidentified signals.
25/5/82 RTVE E2, 3, 4; RAI IA, B; JRT E3; SR E2, 3, 4; NRK E2, 3, 4; TSS R1-5; CST R1; TVP R1, 2, 3. Plus unidentified signals.
26/5/82 RTVE E2, 3, 4; JRT E3, 4; RUV E4; RAI IA.
27/5/82 SR E2.
30/5/82 TSS R1, 2; RAI IA, B; JRT E3, 4; NCT E3; RTVE E2, 3, 4; SR E2, 3. Plus unidentified signals.
31/5/82 CST R1; JRT E3, 4; Switzerland E3, 4; RTVE E2, 3, 4; RTP E2, 3; DFF E4. Plus unidentified signals.
1/6/82 TSS R1-4; TVP R1, 2, 3; RAI IA, B; RTVE E2, 3, 4; ARD E2.

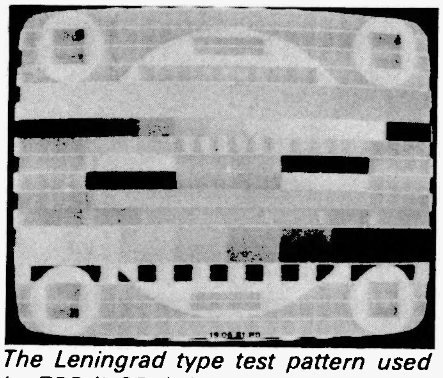
As many enthusiasts will have noticed, RTVE have changed their identification back to TVE as in previous times. A welcome change is the more frequent use of local transmitter identifications for regional programmes. Cyril Willis has been on holiday in Spain and brought back with him a copy of the RTVE TV guide. Regional programmes are generally shown from 1430-1500 local



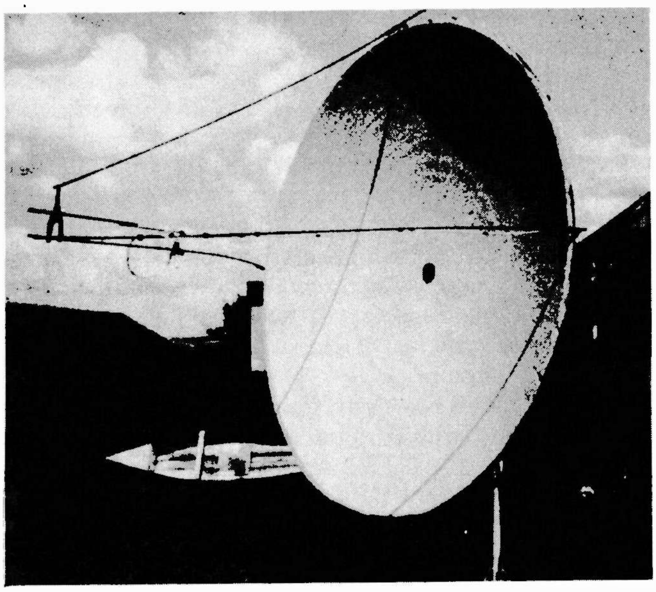
Lopik ch. E4 – with a faulty test pattern generator. Photo courtesy of Ryn Muntjewerff (Holland).



TV Legaal, a pirate transmitter operating in Amsterdam on ch. E4. Photo courtesy of Gosta van der Linden.



The Leningrad type test pattern used by TSS (USSR). Note top central identification. Photo from Henny Demming.



Eight foot fibreglass dish made by Ian Roberts (S. Africa) for 4GHz reception. An aluminium foil covering was added.

time each weekday under the heading "Programacion de Cobertura Regional". Area names are as follows: "Miramar" Barcelona; "Tele-Norte" Bilbao; "Plaza Mayor" Madrid; "Informativo Balear" Palma/Majorca; "Tele-Navarra" Pamplona; "Panorama de Galicia" Santiago de Compostela; "Aitana" Valencia; "Meridiano" Zaragoza. There is an element of regional programming from 1400-1430 on some transmitters, and on others from 1415-1430. TVE-1 carries network programmes during the weekends, but TVE-2 (u.h.f.) carries some regional programmes from 1400-1500.

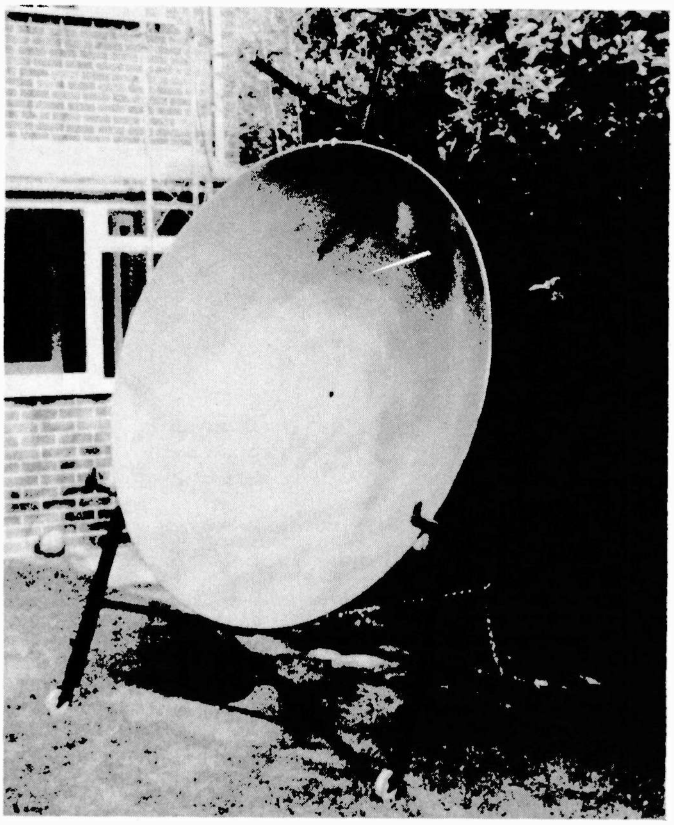
My thanks to the following who contributed to the log this time: Hugh Cocks, Cyril Willis (Ely), John Tellick (Surbiton), Mark Baldwin (Canterbury), Iain Menzies (Aberdeen), Brian Renforth (Chippenham), Robin Crossley (St. Albans), Trevor Rose, Jim Cook (Newcastle), Adrian Hoare (Argyll), and Graeme Wilson (Middlesborough).

News Items

Luxembourg: RTL is planning to start a satellite TV service to the UK with reception by cable distribution and individual terminals in the south and south east.
Seychelles: An initial TV service, in colour (PAL system B/G), is expected to start by next January.
Eire: RTE (Reception Investigation Department, Dublin 4) have issued an updated radio/TV network list. One interesting point is the proposed increase in the Clermont Carn transmitter power to 250kW e.r.p. (group C/D).
Germany: Alexander Wiese reports that a suspected ch. E25/R25 transmitter is in operation in E. Berlin carrying TVP-1 (Polish) programming. It also appears that the TSS-1 (USSR) network is transmitted in E. Germany on ch. R10. W. German DXers have received these signals regularly – it's assumed that they come from military bases.

Band I Intruder?

A 4W transceiver that operates on 40 channels in the spectrum 46-46·39MHz, with 10kHz spacing between channels, is being advertised in certain publications. Fortunately this shouldn't affect TV DXing too much, apart from ch. 0 (Australia) via F2 (at 46·25MHz). Overload problems could possibly arise however, and as with those



The 6ft diameter spun dish from Earth Stations Ltd.

49MHz walkie talkies we'll be watching the situation closely. The RSGB is expected to apply for use of the 50MHz (6 metre) band with the end of 405-line transmissions in 1986.

New EBU Listings

Belgium: Tournai RTBF-2 ch. E63, 20kW vertical.
Spain: Huelva RTVE-2 ch. E45, 250kW horizontal.
Finland: Taivalkoski YLE-2 ch. E23, 600kW horizontal (also YLE-1 ch. E6, 60kW horizontal).
France: Montpellier TDF-1 ch. E23, 1,000kW horizontal; Carcassonne TDF-1 ch. E64, 500kW horizontal; Bayonne TDF-1 ch. E64, 425kW horizontal.
Norway: There are several low-power (all under 115W) relays on chs. E22, 23, 27, 31, 32, 37 and 51.

From our Correspondents . . .

Andreas Constantinou (Limassol, Cyprus) reports that Middle Eastern stations are available in parts of Cyprus daily. He's had many successes and is now equipping for reception of Stat-T (714MHz). Isik Yildrim (Istanbul, Turkey) is currently receiving good quality sound and vision signals from Stat-T.

Despite the phased close-down of the 405-line network, Brian Renforth continues to find system A DX reception an absorbing occupation, using a Thorn 950 chassis and an elderly ITT receiver. He's also active with v.h.f./f.m. radio.

Satellite TV Reception

Activity and interest in this field continues to increase. My own 4GHz tunable terminal is nearing completion, following the delivery of a 6ft dish (see photograph). The dish is ⅛in. thick, 72in. wide and 12in. deep, with a perimeter welded bead, and is supported by a frame made of Dexion "Speedframe" (a tubular mild steel of 1in. square side) with the arm to support the feed horn projecting over the top. The spun aluminium dish was made by Earth Stations Ltd. of 22 Howie Street, London SW11 4AR – other sizes (e.g. 3 and 4ft) are available from stock relatively cheaply but larger sizes are made to order. Waveguide is also available from this firm – but not the electronics required. Send an s.a.e. with any enquiries – or phone 01-228 7876. Hugh Cocks is using the 72in. petal dish shown last month – his terminal is now in operation, with reception of all three Gorizont video channels. Those who are constructors at heart will find details of a 12ft diameter dish for 4GHz use (not 12GHz) in the August 1972 issue of *QST*.

Important news has come from Chris Wilson (Potters Bar, Herts) who, with a friend, is now receiving signals at 11·64GHz from the OTS-2 satellite. On May 20th they received the standard BBC test pattern, and later the IBA pattern with colour bars. The following day produced the PM5544 pattern with "IBA UK" identification. Fig. 1 shows the general arrangement they are using – quite simple and not too difficult to build provided certain components can be obtained. Basically, the signal from the 1·8 metre dish enters a circular section of waveguide which converts to rectangular. A 10dB cross-coupler with a dummy load at one end and a Gunn diode oscillator at the other is mounted at 90° to the waveguide. The following mixer is a cheap coaxial diode obtained from Birkett. Two versions have been produced, with outputs at 180MHz and 435MHz. The unit originally worked as a 10GHz amateur receiver, but was carefully lifted in frequency until the local oscillator reached 11·46GHz.

The dish was aimed at 173° azimuth, with 30·8° elevation, and signals were eventually resolved. Apart from the test transmissions, programme material is radiated during the evenings, including the scrambled programmes of Satellite TV Ltd. Chris suggests that the fears about close tolerances etc. associated with such equipment are not wholly justified – his results have been obtained using the very minimum amount of test equipment. Further details will be given next month, and we hope that this will encourage other enthusiasts to experiment with satellite reception. Meanwhile, our congratulations to Chris and his friend Grahame Harding on their outstanding achievement.

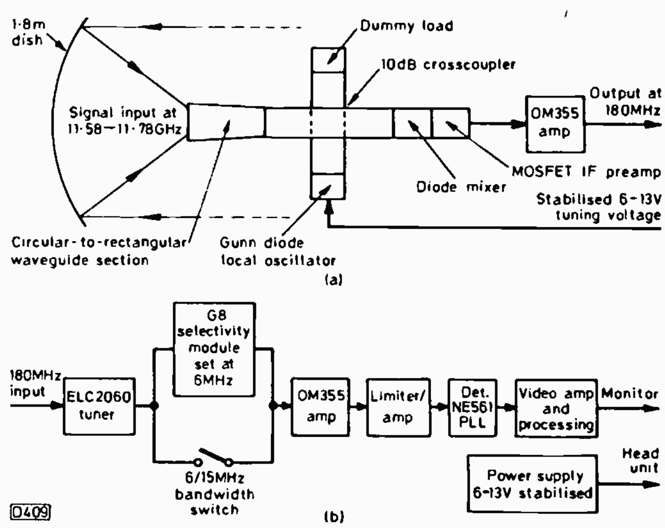


Fig. 1: Arrangement being used by Chris Wilson and Grahame Harding for reception from the OTS-2 satellite. (a) Aerial and head unit – the OM355 amplifier is required only when there's a long cable run. (b) Indoor unit.

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Z64	¼" Jack Socket enclosed. SPNC Switch Contact	6 for £1.00
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1000μf 25v*	8 for £1.00
1000μf 35v	6 for £1.00

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MISCELLANEOUS

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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
PYE 697 Line and power Panel, damaged with some components missing but ideal for spares	£2.20 each, 3 for £6.00
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Phillips G8 Transductor.	£1.20 each. 3 for £3.00
Mullard LP1173, 10 watt. Amplifier module with circuit diagram.	£3.50 each. 2 for £6.00
E.H.T. Discharge probe, with heavily insulated handle, with lead and chassis connector.	60p each. 3 for £1.50

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VCR Clinic

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

Solenoid Troubles

I've had trouble with solenoids recently. The doctor suggested plenty of exercise, but they still play up. One was the play solenoid on a couple of Toshiba V8600s, the fault being intermittent play. Fast forward and rewind were fine, but record was also affected. On closer examination I noted that although the play solenoid operated and moved all the various latches, it would slip back out again and the take-up reel would stop rotating due to the take-up idler pulley dropping out – the play solenoid removes the feed and take-up spool carrier brakes, and applies the take-up spool drive pulley to the take-up turntable. As the play solenoid dropped out, the drive was removed from the take-up spool and the slack sensor initiated the stop function. Why didn't the solenoid stay in?

The solenoids in all current VCRs are dual driven: a holding current is supplied as a bias, a high-value pulse current being applied to operate the solenoid. Checks revealed that both drives were present, but the holding current was not keeping the solenoid in operation. The problem in fact was the adjustment of the solenoid position: the stroke of the solenoid's piston was too far out of the body, with the result that spring tension pulled it back after initial operation. The cure was to adjust the solenoid so that the piston went farther into the body. Measurement is by the distance between the supply spool brake and the turntable. If the brake pad travels too far off, much more than a couple of millimetres, the play function may be intermittent. Check with the service manual.

Sony VCRs are not immune from this trouble either. A C5 that wouldn't play at all came in. Investigation revealed that the pinch wheel was not clamping the tape between itself and the capstan spindle. I must admit that I was a little confused by the setting up procedure, so I did it my way. I'm still not sure why it was out of adjustment – I don't think anyone had touched it. The same C5 had problems with the rewind solenoid: I continue to be amazed at the way in which faults come along in batches.

As with the V8600s, the C5's problem was solenoid adjustment. I think I should also have replaced the rewind idler pulley wheel – it was a bit round at the edges. Performance was restored by adjustment however, and as the customer kept phoning up I didn't have time to order a replacement. **S.B.**

JVC HR7300

A Baird 8930 (JVC HR7300) would neither record nor playback in colour. We tried the machine on playback and found that chroma was entering the converter stage at pin 16 of IC401 (see Fig. 1). There was also a carrier signal at pin 14. The output at pin 12 looked horribly distorted and clipped however. It couldn't have contained anything at 4·43MHz, as the signal didn't get past BPF402. The filter could have been faulty of course, but in this case playback only would have been affected. As there was no 4·43MHz signal, there was no burst to provide the a.c.c. action and the signal at pin 16 was of excessive amplitude. Changing IC401 made no difference.

We next tried recording to see whether this threw any light on the problem. This time there was a 4·43MHz output at pin 12 instead of a 626·9kHz signal – the individual cycles were not visible with the scope displaying one line. We decided to try changing the carrier coupling capacitor C416: this cured the fault, but what was wrong with it remains a mystery – it didn't measure leaky, and wasn't open-circuit since the carrier reaching pin 14 was of the correct amplitude! **M.P.**

Ferguson 3V29/30

A common fault has appeared over the last couple of months on Ferguson 3V29/30 VCRs. The usual complaint is that the machine won't play: what you find is that if play is selected the machine goes straight into the play mode without threading up. Further examination will show that even in the stop mode the drum and capstan motors are both rotating continually. The fault is caused by the after loading switch sticking – it's situated under the video/audio board, on the bottom of the machine (see Fig. 2). The problem appears to be due to the grease used: applying some thin oil to the switch and operating it a few times cures the trouble. **D.S.**

Unusual Head Wear

We've just had our second case of a Toshiba VCR with the head worn in a rather unusual manner. After cleaning, the entire head surface was a dull matt instead of a polished chrome finish – it appeared that the chrome plating had in both cases almost worn off. The result was rapid dirtying of the head, with damage to the tape if this was held in the pause mode for any length of time. Both

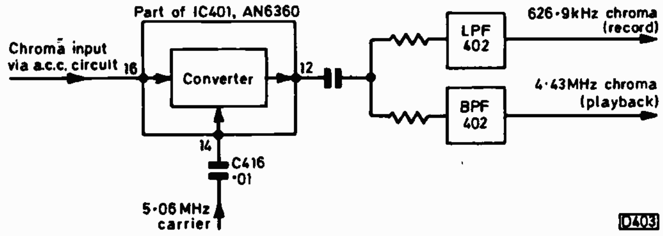


Fig. 1: Colour converter arrangement, JVC Model HR7300.

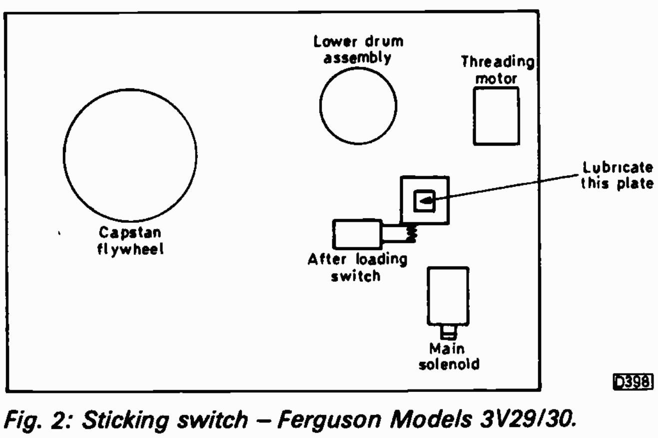


Fig. 2: Sticking switch – Ferguson Models 3V29/30.

customers commented that they regularly used a head-cleaning tape of the dry abrasive type, and whilst we cannot prove that this was responsible we have our suspicions. We don't recommend the use of head cleaning tapes of any type to our customers – I'd be interested in anyone else's thoughts on this subject. **D.S.**

JVC HR7300

The problem with a Baird 8930 (JVC HR7300) was that none of the function keys worked. On this machine the cassette lamp is switched on when the carriage is lowered. If the bulb fails, transistor Q1 on the deck terminal board is turned off and a "high" is applied to the data selector i.c. (IC1, see Fig. 3) to tell the machine not to work. In this case Q1 was open-circuit.

Another of these machines displayed a noise bar on the picture every few seconds, so it seemed that the capstan servo wasn't locking. Our first check was at TP5 on the servo panel, where there should be a trapezoid with a pulse on it. As the pulse was missing, the servo wasn't locking. The pulse is derived from the amplified off-tape control pulse, so our next check was at pin 2 of the HA11711 servo i.c. (see Fig. 4), where there should have been a positive-going pulse. Instead, there was a negative-going pulse – of the correct amplitude. Furthermore, the control pulses at the base of Q1 were severely clipped.

Q1 is normally biased off, the negative-going spikes at its base turning it on to produce positive-going pulses at its collector. On this machine however C55 was leaky: Q1 was biased on therefore, the positive-going spikes at the input turning it off to give negative-going output pulses. The culprit measured different leakage in either direction – it's one of those things that look like a 10kΩ resistor. **M.P.**

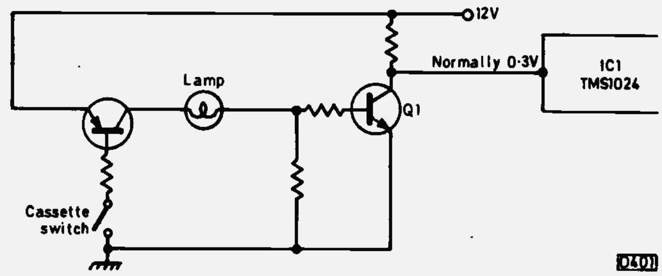


Fig. 3: Cassette lamp system, JVC Model HR7300

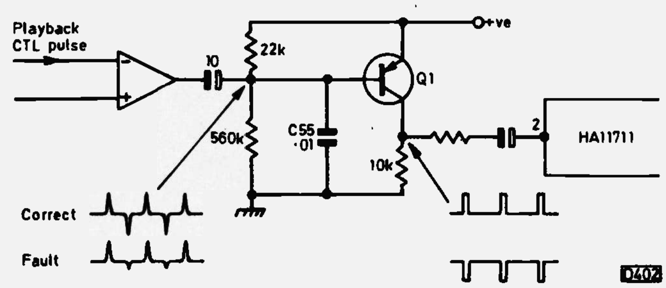


Fig. 4: Capstan servo pulse generator stage, JVC HR7300.

Wideband UHF Aerials

Roger Bunney

THE enthusiast who wants an aerial giving him coverage of the whole u.h.f. spectrum is faced with a bewildering selection of aerials from which to choose. He will also find that there are conflicting claims over aerial gain, and he'll probably receive many a recommendation for this make of aerial or that one. After all, someone who's bought a particular aerial and received a great many stations during a good opening will obviously comment favourably about the aerial of his choice. During "average" conditions he'll have received tropospheric scatter signals (fluttery and fading) from stations perhaps some 300 miles distant, confirming his view of the aerial's excellent performance. Another enthusiast on the other hand will have got similar results using a different make of aerial. If we cosited the two aerials, mounted them at the same height and used the same lengths of feeder, the results would undoubtedly be much the same – the aerials produced by reputable manufacturers give similar performances for a given number of director elements, type of reflector system, etc.

The Long Yagi

The "long Yagi" with multi-element director assemblies has been very popular over the last decade. Much initial research on the system was done by Fuba (W. Germany) who first introduced this type of aerial on the domestic market. Since then the same basic design has been adopted by various continental and UK manufacturers. The latter have tended to modify the director assemblies somewhat, while the continental manufacturers have generally kept to the original look of the thing and its performance characteristics.

The highest frequency that can be received by a long Yagi is determined by the dimensions of its directors. If the directors are cut to say ch. 60, higher frequency signals will not be accepted and pass along the chain but will be reflected. In addition, the directional response of a ch. 21-60 system becomes sharper with increasing frequency until the highest designed-for channel is reached. At this point the beamwidth is typically 22-25° between the −3dB points. Beam width is directly related to forward gain. Thus for a typical wideband long Yagi the lowest gain/widest beamwidth (typically 40-45° at the −3dB points) will be at ch. 21, the performance rising to its most efficient towards the top end of the bandwidth over which it is designed to operate.

Gain

It's the gain figure that generally sells an aerial. But as we've seen this varies with frequency. In the case of a wideband long Yagi, the gain at the group C/D end of the spectrum will be typically some 6dB higher than the gain at the lower end of group A, i.e. ch. 21. The gain of a so-called 91/92 element u.h.f. Yagi of the type shown in Fig. 1 is 10·5dB at ch. 21 rising to a peak of 16-16·5dB at ch. 56 (see Fig. 2). These gain figures are relative to a half-wave dipole. With a reduced bandwidth, to cover say chs. 21-30, the overall gain is higher but still rises with frequency.

DX Considerations

The problem with choosing an aerial system relates to the performance points mentioned above, the local channels in use – and the depth and contents of one's pocket!

Say the local transmitters use the group C/D channels. This might suggest the choice of an aerial covering channels 21-48 (group K). There would be minimal or no gain above ch. 48 however, while the random polar response would mean that the high level local channels would come in off beam. This would result in cross-modulation and the appearance of the local signals on channels elsewhere in the u.h.f. spectrum.

The reduced gain of such an aerial at the lower end of the spectrum would help in discriminating against local group A signals – but would make reception of many distant signals difficult, the group A channels being particularly productive from the DX point of view. The fact that the aerial retained its directional characteristics, albeit with a wider beamwidth, would provide a degree of local channel rejection.

If the local signals are in group B, i.e. in the middle of the u.h.f. spectrum, one has a problem indeed. If you're going to use a single aerial under these conditions, a wideband one would be the best selection. Should the budget permit purchase of group A and group E aerials however the coverage will be that much more efficient (group E covers chs. 39-68). A group C/D system can be adapted for group E coverage by replacing the group C/D reflector with a group B type.

In general then the wideband long Yagi retains its directional characteristics over its design bandwidth, but the gain variation is substantial between the extremes of the bandwidth. For effective DX use at u.h.f., maximum possible gain is obviously wanted. The retention of a narrow horizontal beamwidth is even better.

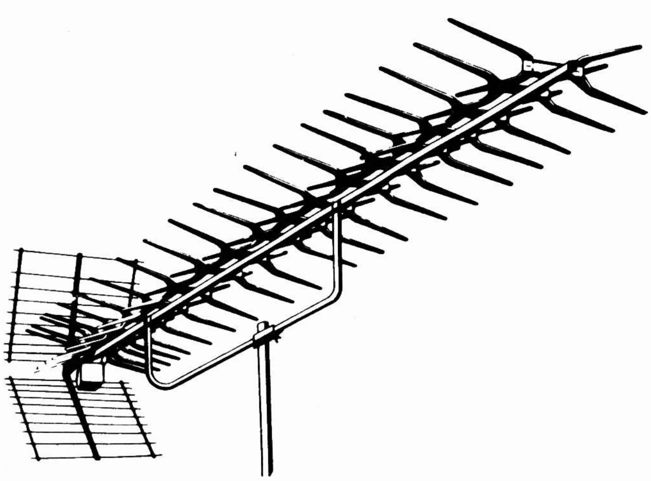


Fig. 1: Typical long Yagi with multi-element director assemblies.

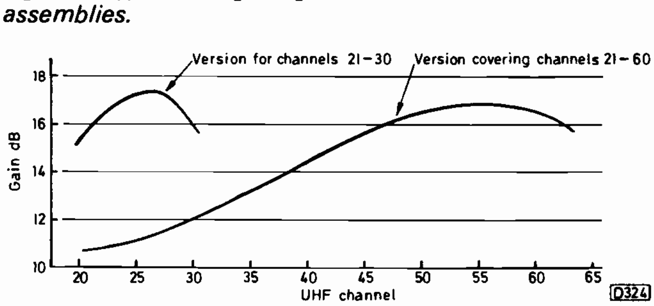
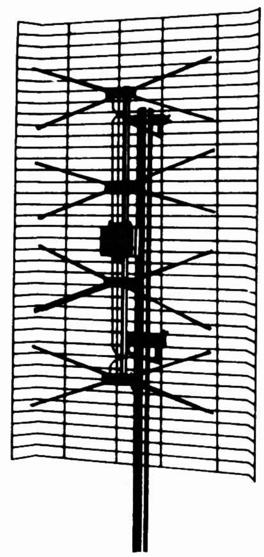


Fig. 2: Gain characteristics of wide and narrow band versions of the type of aerial shown in Fig. 1.



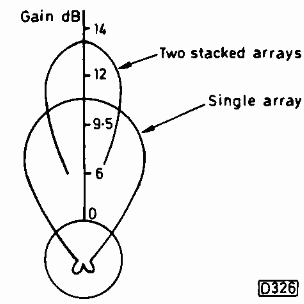


Fig. 3 (left): Typical stacked bowtie aerial.

Fig. 4 (above): Polar characteristics of bowtie arrays.

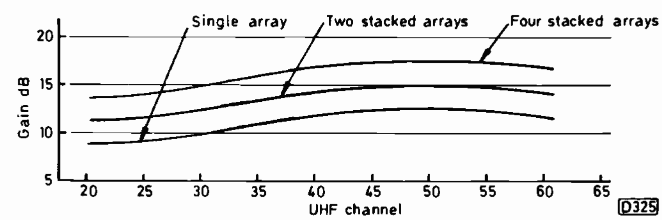


Fig. 5: Gain characteristics of the type of aerial shown in Fig. 3 – single and multi-stacked versions.

Stacked Bowtie Arrays

An alternative approach is to use a type of u.h.f. aerial with a gain variation of only 3dB over the whole bandwidth and considerably more gain at the lower end of the spectrum than a wideband long Yagi. A type of aerial that's been in use for many years is the stacked bowtie/collinear system – such as the Wolsey Colour King and others (see Fig. 3). The gain of a single such array (with four bowtie dipoles and a common reflector) over the bandwidth varies from about 10dB up to a shallow peak of some 13dB. This is only a moderate gain figure, and the horizontal beamwidth is alarmingly wide – typically 65° at the −3dB points.

One advantage of this type of aerial is its wide vertical beamwidth. Often the signal strength of the three/four local channels varies at a receiving site. Adjusting the aerial height may similarly alter the signal levels. With four stacked bowties arranged one above the other such variations are smoothed out. The result is a much more even response.

It's possible to use low-loss combining filters (not the traditional combining harness) for wideband u.h.f. operation. Assuming that equal lengths of coupling feeder are used to give in-phase signal combination, a power gain of 2·6dB can be obtained over the whole band. If we combine two stacked bowtie arrays in this way, we will achieve a gain of about 13dB at the lower end of the bandwidth rising to some 15·5dB at the high gain part of the coverage (see Fig. 5). If we mount them side by side the horizontal beamwidth will be reduced to typically 30°. The low band gain at 13dB is some 2·5dB up on a wideband long Yagi – it's almost equivalent to that of two stacked long Yagis!

The cost of this improved efficiency is interesting. Since the construction of a bowtie array is simple and relatively inexpensive, even allowing for the combining filter, the overall cost of a double stacked bowtie array is less than the cost of a single long Yagi. The wide vertical beamwidth is a further advantage, resulting in improved overall performance compared to a long Yagi. True, the latter has higher gain – but concentrated in a relatively small part of the spectrum. It's been demonstrated that weak, scattered u.h.f. signals can be quite height conscious, resulting in the signal level obtained at one height being reduced at greater or lower heights. For the true connoisseur, four such bowtie arrays can be stacked and combined using an appropriate filter. The system gain is most attractive.

Conclusion

My conclusion is that a twin (or quad) stacked bowtie system will give a better and more consistent overall performance, particularly where scattered trans-horizon signals are being sought. I'd naturally be interested in the comments of those using the different approaches discussed here – even better the observations of those who may have changed from one to the other.

Servicing the Rank Z718 Chassis

Part 1

John Coombes

THE first models to use the Z718 chassis were released in early 1975. They were fitted with an 18in. Toshiba 110° in-line gun c.r.t. Subsequent models were fitted with 20, 22 and 26in. tubes of the same type. Production began to be phased out when Rank went over to the use of the 20AX tube with the T20 chassis, which was introduced in late 1977.

Power Supply Arrangements

The Z718 chassis is capable of giving good results. It was introduced before current standards of reliability came about however. Quite a lot of faults can and do occur, though the line output transformer is fortunately reliable. One of the most common faults is no results, which can be caused by many things. To be able to deal with this sort of thing it's essential to appreciate the basic arrangement of the chassis, and to this end a simplified block diagram of the power supply, line timebase and EW modulator sections is shown in Fig. 1. As with any set, the line output stage is the heart of things. More so with this than with most solid-state chassis however, since a very simple, non-stabilised h.t. power supply circuit is used. Stabilisation of the width/e.h.t. against mains voltage variations is achieved by linking the EW modulator control circuit to the h.t. line via 4R58/4R61. Stabilisation against varying load conditions is achieved by feedback from the e.h.t. circuit to the EW modulator control circuit.

The c.r.t.'s first anode, heater, focus and e.h.t. supplies are all derived from the line output transformer which also produces, in conjunction with the EW diode modulator circuit, a 30V supply. A regulated 12V supply for the low-voltage stages is derived from this 30V rail. In early models the line oscillator was supplied from the 30V line via a constant-current circuit (4VT13 and associated components): in later sets it's supplied from the 12V rail. This means that the line oscillator requires a start-up circuit. The line driver stage also requires a start-up supply – once the set is running normally, its supply is obtained via 5R6 from the mid-point in the line output stage. Start-up supplies are provided by 4C18 and 5C3 respectively – as these capacitors charge at switch-on, the line oscillator and driver stages are provided with enough current to get them working.

Protection is provided by fuses and an overload trip. 7FS1 will blow in the event of a short in the mains input or degaussing circuit, while 7FS2 will blow in the event of a short in the h.t. circuit. 5FS2 will blow in the event of a short in the line output stage. In some sets this fuse is omitted – 7FS2 will then provide the necessary protection. If 5C3 goes short-circuit, 5FS1 will blow to protect the line driver stage – a slightly different arrangement is used in the larger screen models, in which the fusible resistor 5R25 will go open-circuit. The overload trip operates in the event of excess current flowing in the line output stage. When it operates, transistors 5VT4/5 switch on, removing the drive to the base of the line driver transistor 5VT1 and thus shutting the set down. If the fault is temporary, switching off and on again will restore normal results. The trip is intended to operate in the event of an excessive load on the 30V rail as well as a fault in the line output stage itself – a short-circuit transistor in the field output stage for example.

Circuit Features

The mains input and h.t. supply circuits are shown in Fig. 2 and the line output stage in Fig. 4. If you are handling any number of these sets it's as well to appreciate the e.h.t./tube supply arrangements as well – see Fig. 3. The rectifier circuit 5D2/5C19 produces a supply which is fed to the first anode control network via a constant-current circuit. These sets use a stick rectifier rather than a tripler, the e.h.t. current path being via this rectifier (5D4), the overwinding on the line output transformer, 5D3, 5R7, 4D16 (which is forward biased via the first anode supply) and 4R50. 4D16 provides the beam limiting action: in the event of excessive beam current this diode switches off and the c.r.t.'s grids are biased negatively. Since 4R50 senses the beam current, the voltage developed across this resistor is used to provide anti-breathing feeds to the field timebase (via 4R10) and the EW modulator control circuit (via 4R86/4R72). Rapid e.h.t. fluctuations are sensed by 5VT6, whose base is connected to the e.h.t. lead's screen – this provides a capacitive coupling. The correction signal thus obtained is fed to the EW modulator control circuit via 5C25. Forward bias for the base of 5VT6 is provided by 5R20 which is in series with the focus unit.

As Fig. 4 shows, a balanced, two-transistor line output stage circuit is used, i.e. a 900V positive-going line flyback pulse is present at the collector of 5VT2 while a 900V negative-going pulse is present at the emitter of 5VT3. The field timebase is quite complex, using a total

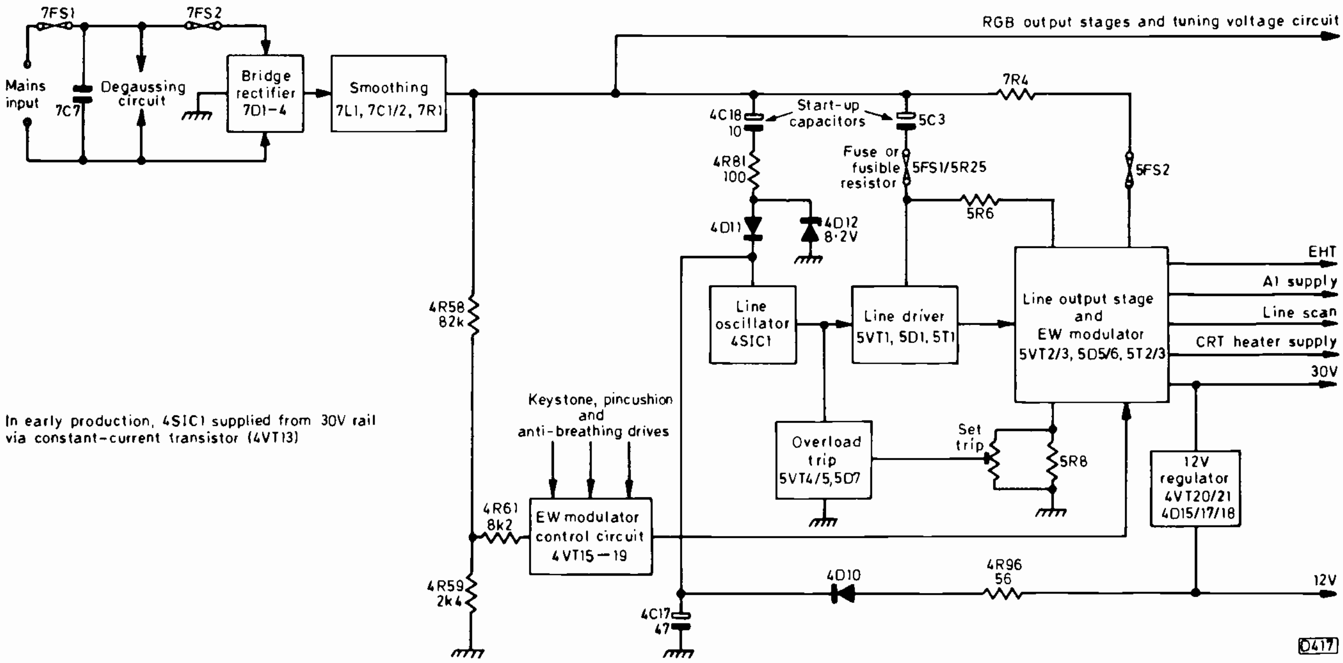


Fig. 1: General arrangement of the h.t. supply, line timebase and EW modulator circuits in the Rank Z718 chassis.

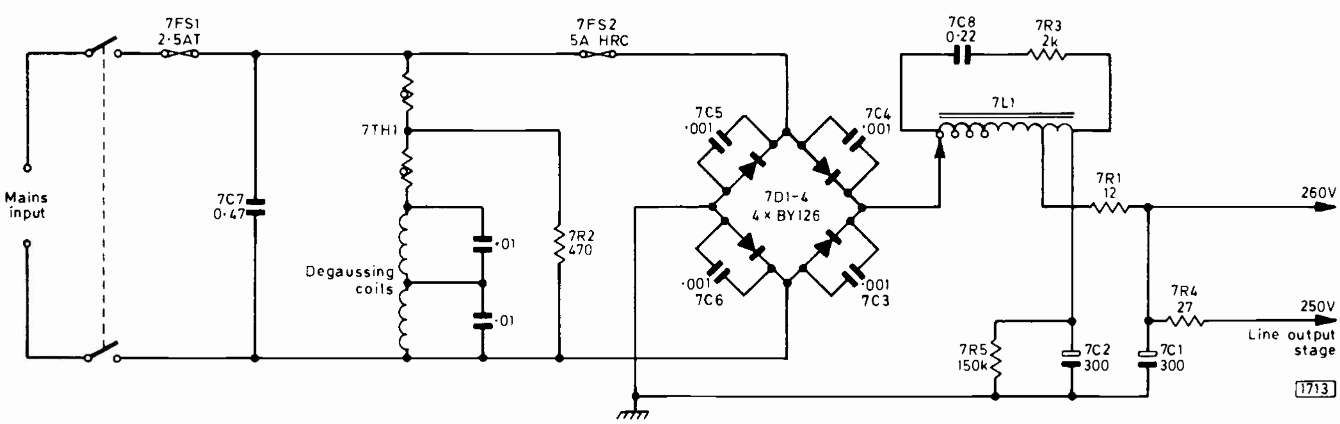


Fig. 2: The mains input, degaussing and h.t. circuits.

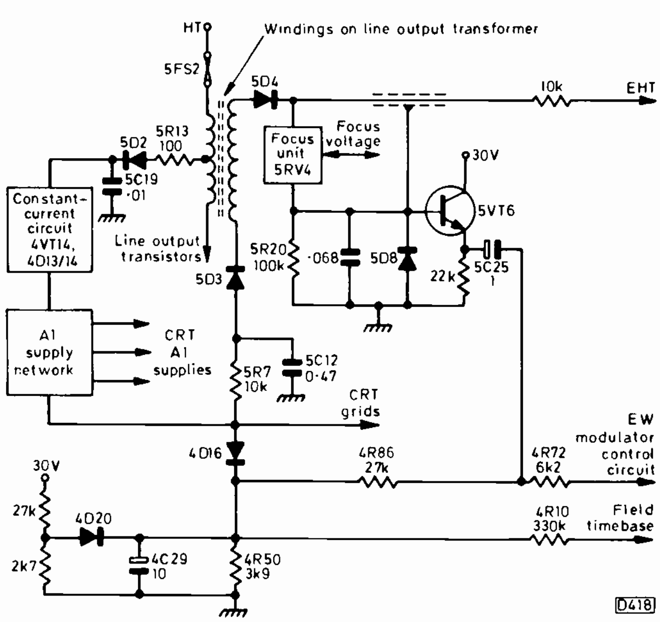


Fig. 3: The e.h.t., focus, c.r.t. first anode, grid bias, anti-breathing and beam limiting circuits.

of ten transistors: the driver/output stage circuit is of the type originally devised by RCA – with two drivers, and with one output transistor conductive during the whole of the forward scan while the other one conducts during the second part of the scan only. Since the audio output stage is fed from the 30V rail, the supply is applied via a constant-current transistor. There's a Mullard three-chip (TBA560C/TBA540/TCA800) decoder, with class A RGB output transistors. The latter share a common emitter load transistor which is used to set the black level.

Power Supply Faults

So much for the basic features of the chassis. Now to specific faults, starting with simple power supply problems.

In the event of a dead set, start by checking at the mains on/off switch. You may find it open-circuit. Next check fuse 7FS1. If this has blown, the mains filter capacitor 7C7 could well be short-circuit. Then move over to 7FS2. If this is open-circuit, check the bridge rectifier diodes 7D1-4 and their protection capacitors 7C3-6 for shorts. The reservoir and smoothing electrolytics 7C2 and 7C1 respectively could also be shorting. If 7C1 is short-circuit, 7R1 could be open-circuit. If there's no h.t. and the fuses are intact, 7L1 could be open-circuit. In the event of 7FS2 blowing intermittently, replace the electrolytic can 7C1/2.

If the problem is a hum bar, inspect the power supply panel for cracks in the earth connections and check 7C1/2 for leakage. These capacitors can leak very badly – all down the panel and over the chassis.

If the degaussing circuit is not working, the dual thermistor 7TH1 could be dry-jointed or open-circuit – it's best to check by replacement. If there are purple patches in the corners of the screen, 7R2 could be open-circuit. This often burns a ring around itself and must be replaced with the correct type. Also check whether the degaussing coils are open-circuit.

Dead Set – Line Timebase Not Working

If the set is dead 7R1 could be open-circuit due to a fault in the line output stage. If the power supply is in order however we are faced with three possibilities: a fault in the line oscillator/driver/output stages, failure of the start-up systems to operate, or the overload trip operating.

The first step is to check for h.t. at pins 2 and 3 of plug/socket 5Z2. This will confirm that the power supply is in order. Next check 5FS1/5R25 (depending on panel – Z904 or Z904A respectively) and 5FS2. If the former is open, check 5C3 by substitution, check 5VT1/5D1/5C4/5C5 for shorts, then suspect shorted turns on the driver transformer 5T1. If 5FS2 is open-circuit, it could well be that one of the scan-correction capacitors 5C15/5C14 is short-circuit. A less likely possibility is shorted turns in the line output transformer.

If the fuses are in order, try turning the set overload trip control 5RV3 fully anticlockwise. If the set then operates normally, check the condition of the control's track and set it up correctly.

Checking through the Line Timebase

If the set still fails to work, it will be necessary to check through the line timebase. Check for a short-circuit to chassis at pin 3 of the TBA950 sync/line oscillator i.c. (4SIC1). This is it's d.c. supply pin. A low-resistance reading here could mean that 4C17 is short-circuit, or that the i.c. is defective. If a high-resistance reading is obtained, check the i.c.'s chassis connection (to pin 1). If this is in order, the i.c. could have failed or it might be receiving no supply or the start-up system might not be working. Try bridging 4C18 with a 5·6kΩ, 5W resistor as a check on the latter point. If this restores normal operation, 4C18 is probably open-circuit. If this gets the line timebase working but nothing else happens, check the EW modulator diodes 5D5/6, the 30V reservoir capacitor 5C8 and 5C24. Check also for dry-joints on pins 6 and 8 of the line output transformer or for a break on the board.

If bridging 4C18 makes no difference there could be something wrong with the power supply to the chip. Check for about 8V at pin 3. If this voltage is absent, check for h.t. at the positive side of 4C18 then check for continuity etc. at the other side – the things to check here are 4R81/4D11/4D12 plus the d.c. continuity to pin 3.

If 4SIC1 and its supplies are in order, there should be a pulse output at pin 2. These pulses should be about 1·5V peak-to-peak. If you find that they are about 8V, check for an open-circuit between pin 2 and the base of the driver transistor 5VT1 – there could be a poor connection at pin 6 of plug/socket 4Z2, or 5R23 could be at fault. Alternatively 5VT1 or its emitter diode 5D1 could be open-circuit. If on the other hand you find that pulses of about 8V are present at pin 2 of the chip when pin 6 of 4Z2 is disconnected, check for a short-circuit at the base of 5VT1. If the pulse output at pin 2 of 4SIC1 is correct, it's time to make further checks in the line driver stage.

Disconnect one end of 5R6 and connect a 5·6kΩ, 5W resistor across 5C3. If this restores normal operation, either 5C3 or 5R6 is open-circuit. Note that 5R6 is a small, carbon resistor which is intended to act as a fuse, i.e. if you find it burnt or open-circuit, suspect a fault in the line output stage – the transistors could be defective or the base balance coils 5L1/2 incorrectly set.

If the set still does not run with 5C3 bridged, check for pulses at the collector of 5VT1. No pulse output should lead to a check on 5VT1 and the associated components. If the pulse voltage is all right, disconnect 5Z1-11 to remove the h.t. from the line output stage and check for 1·6V pulses across the base and emitter of the two line output transistors. If these pulses are missing, check the transistors, the components in the base circuits and the condition/setting of the balance coils, also the line driver transformer 5T1.

In passing, if difficulty is experienced in setting up the output transistor base balance coils, i.e. if the reading jumps about or will not go low enough, the driver transformer should be replaced. The procedure is to connect a meter on the 2·5V a.c. range across 5R6 and adjust the coils for a minimum reading of about 1V.

If, with 5Z1-11 disconnected, 1·6V pulses are present at the bases of the line output transistors, check the transistors and the flyback tuning capacitors 5C9/5C10. Also check 5R8 which could be open-circuit, the continuity of the line output transformer windings and if necessary try a replacement transformer.

If the pulses at pin 2 of the TBA950 line oscillator chip are only 0·4V, check 5D1 then suspect a fault in the overload trip circuit. Check the zener diode 5D7 for being short-circuit, the values of 5R15/5R16, the setting and condition of 5RV3, 5VT4/5 and the electrolytics 5C22/5C23.

If the pulses are normal at around 1·5V, replace 5Z1-11 and disconnect pin 8 of plug/socket 4Z2 to remove the load on the 30V supply. If the line timebase now works and the tube's heaters light up, check for shorts across the 30V rail. Removing pin 3 of plug/socket 3Z6 will eliminate the decoder; disconnecting 4R32 will eliminate the field driver and output stages; removing the green link wire on the Z906 panel will isolate the 12V regulator.

If the line timbebase does not work with pin 8 of 4Z2 disconnected, remove the e.h.t. cap (beware of the shock risk). If the line timebase now works, the e.h.t. stick 5D4 is probably faulty – though it has been known for the tube to be defective. If the line timebase still doesn't work, check the output transistors for short-circuits, the focus unit 5RV4, the first anode supply rectifier 5D2 and its reservoir capacitor 5C19 for being short-circuit, the scan coils and for shorts generally.

This systematic check through the line timebase may seem to be a rather elaborate procedure. It helps however when a difficult case has been taken back to the workshop and a scope is used for checking. In the field one would take short cuts.

We still have some power supply line faults to consider

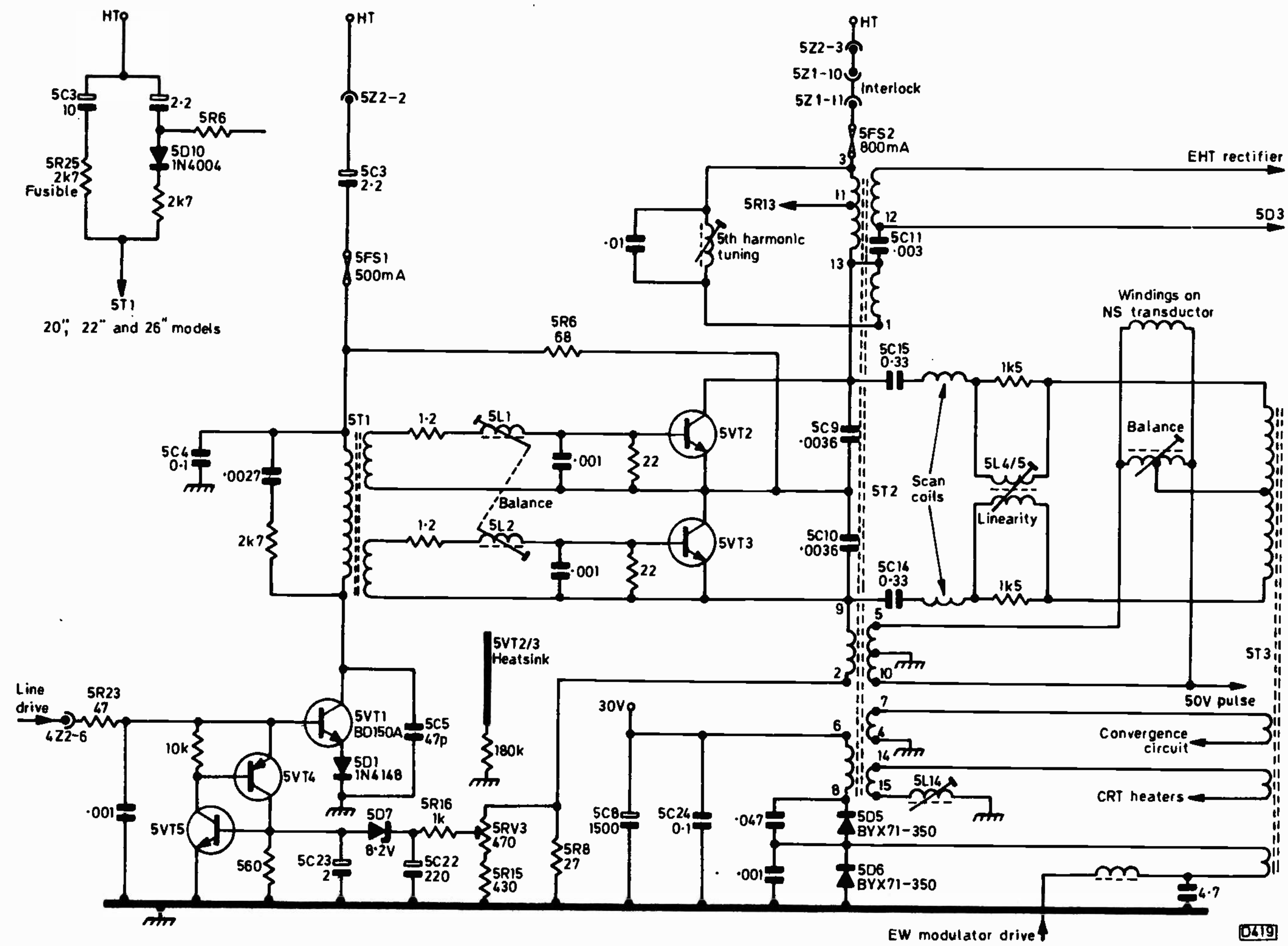


Fig. 4: The line driver and output stage circuits. The driver transistor 5VT1 is type BD150A. BU205 line output transistors were fitted in 18in. sets: larger screen models have BU208 line output transistors.

– and a couple of tips. If 5D5/6 go open-circuit, there'll be no 30V supply and the line timebase will not get started. The 8·2V zener diode 4D12 in the line oscillator start-up circuit could also have this effect if leaky. Another possibility – which in fact is quite probable – is that the 12V regulator circuit has failed. The usual suspect here is the 910Ω bias resistor 4R77, which changes value or goes open-circuit. In the earlier timebase panel, check the line oscillator chip's constant-current feed transistor 4VT13 – by replacement. It is important to use a fin type so that the heatsink can be connected – leaving this off can cause intermittent loss of sound and raster. Also check this transistor's emitter resistor 4R42 (200Ω) for open-circuit or changed value (to about 2kΩ).

The tips are to check the earth link between the timebase and the line output panels – it may be open-circuit or have a high-resistance joint – and the connections on 5Z1-10/11. These latter can be dry-jointed, and another possibility is that the plastic cover has stretched, breaking the wire that links these two points. If a replacement convergence board has been fitted, you may find an incorrect plug connection.

E.H.T. but no raster occurs when the surge limiting resistor 5R13 in the c.r.t.'s first anode supply rectifier circuit goes open-circuit.

Miscellaneous Line Timebase Faults

Finally this month a few miscellaneous line timebase/line scan faults. A loud line whistle can usually be cured by replacing the line linearity coil 5L4/5. In the event of focus troubles, check pin 9 on the tube base for corrosion, the focus unit 5RV4 by replacement – ensure that the plug-in lead is connected and not broken in the socket – and finally check 12R1 (100kΩ) on the tube base. Excessive width/bent verticals can be caused by the EW modulator diodes 5D5/6. If the EW pincushion, keystone and width controls are ineffective, check 4VT19/18/17 in the EW modulator control circuit. The output transistor here (4VT19) tends to go open-circuit while 4VT18/17 go short-circuit. If necessary check the EW modulator transformer 5T3 by replacement.

Low brightness or flickering between light and dark can be a tricky fault to locate. If it's not in the decoder, check 4R47 (110kΩ) and 4R46 (240kΩ) in the constant-current circuit feeding the first anode presets. Burns around the undersides of these resistors can cause the intermittent condition.

No colour or intermittent loss of colour can also be caused by the circuits we've been considering. The output from the 12V regulator may be unstable for example (check 4VT20), or the line hold (4RV13) or line phase (4RV14) controls may be incorrectly set or faulty (check the condition of the carbon tracks). The TBA950 could be faulty, but most important check 4C24 (0·01μF) which decouples pin 13 – it can cause a momentary loss of colour on caption change or a more extended loss of colour. The tuner can also be responsible (see later).

Teletopics

JVC's COMPACT VHS SYSTEM

JVC have now officially announced their new compact VHS cassette and VCR system, which was first mentioned in this column last March. The new system is at present in NTSC form only, but has already been released on the Japanese market. Plans are to introduce it in the USA later this year and in Europe and other overseas markets early next year. The compact VHS cassette is known as the TC20 (NTSC version) and has a record/playback time of twenty minutes. The dimensions are 92mm in width, 59mm in depth and 23mm in height, i.e. it's smaller than a standard audio cassette in width and depth, but higher in order to accommodate the half inch tape. It can be used in a conventional VHS machine in conjunction with an adapter in the form of a standard VHS cassette. The compact VCR, which JVC claim is the world's smallest and lightest home-use recorder, is called the HR-C3. It's weight (without battery) is 2kg, the dimensions being 183mm in width, 215mm in depth and 75·5mm in height – just 37 per cent of the size of JVC's smallest currently available standard portable VCR. The new system has already been adopted by eleven other Japanese companies, including Akai, Fuji, Hitachi, Matsushita, Mitsubishi, Sharp, Tokyo Sanyo and major tape manufacturers.

Miniaturisation of the HR-C3 has been achieved through increased use of i.c.s on high-density PCBs and the development of ultra-flat brushless direct-drive motors, new switch-mode power supplies, miniature r.f. converters, new audio heads and a new parallel loading system. JVC believe that the new compact system will give a further boost to the popularity of the VHS format. When the EC30 625-line, 50-field version of the cassette is introduced it will have a playing time of half an hour.

SEIKO's TV WATCH

And now the TV you wear on your wrist – well the display part, anyway. A subsidiary of the Japanese Seiko company, Suwa Seiko, have shown a prototype combined television-wristwatch which weighs only 1·75oz (without the strap). Production is expected to start in about six months' time, but a UK launch would not be till some time next year due to the need to develop a version suitable for use with UK TV standards.

The wristwatch section consists of a watch with digital display, calendar, stopwatch and alarm plus a liquid-crystal TV display. The drive circuitry for the TV display is in the watch section, but the receiver itself is pocket-sized and is linked by a lead. Earphones which double as an aerial are used for the sound. The 1·2in. screen has 32,000 picture elements, giving a definition equivalent to about 200 by 150 lines. The price of the complete watch-receiver in the Japanese market is expected to be around £225.

ZOOM TV

Tandberg were back in the consumer TV market at the recent CETEX exhibition, with a range of colour sets from 16 to 26in. in screen size. One of the most interesting sets was their latest 16in. colour portable, which has a zoom feature – at the touch of a button the width and height can be increased so that the centre 65 per cent part of the picture expands to occupy the entire screen area, i.e. the centre section expands to the same size as with a 20in. tube, without any perceptible loss of picture sharpness, thus overcoming the biggest disadvantage of a small-screen portable set. The contrast adjusts automatically. This image enlargement facility can also be selected by remote control. It's also an advantage when films in Cinemascope are being transmitted and for making details in educational programmes etc. easier to see.

BATC CONFERENCE

The British Amateur Television Club will be holding its biennial convention at The Post House, Leicester on September 5th. Admission is free and the doors open at 11 a.m. General Secretary Trevor Brown comments that readers of *Television* will be more than welcome. The Convention will include lectures and video tapes on subjects related to Amateur Television, including material on satellite TV. There will also be display and trade stands and demonstrations of equipment.

LASERVISION LATEST

As expected, there's been a slow start to buyer/rental interest. The standard player is on offer at prices of around £450, with the de luxe remote control version at some £500. Rediffusion are offering the basic player at a rental of £15·95 a month. The discs are selling at £15-16 – Rediffusion are offering them on rental at £1·95 for the first night and £1 for each extra night.

A new disc production process is now in use at the Blackburn plant. Instead of stamping out the discs, a liquid organic lacquer is poured into a master mould: when the lacquer is exposed to light it hardens, transferring the master information to the lacquer layer.

Meanwhile in the US RCA have introduced a new range of Selectavision video disc players, including a budget model and two versions with stereo sound. There have been substantial reductions in suggested list prices, with the cheapest machines now retailing at around £150. It's been suggested that this price cutting could have been a contributory factor in the decision to postpone the world-wide launch of the VHD disc system.

VINTAGE RADIO AND TV

The latest Vintage Wireless Company catalogue is a substantial affair running to over 90 pages. The extensive list of valves in particular should enable much vintage equipment to be kept going. Enquiries to The Vintage Wireless Company, 64 Broad Street, Staple Hill, Bristol BS16 5NL – the catalogue is priced at £1·50 including post (via surface mail overseas). The company also offers repair, overhaul and restoration services for vintage radio receivers.

NEWS FROM FIDELITY

The latest introduction by Fidelity is an alternative, factory produced back panel with a built-in adaptor to enable their TV sets to be used with a 12V or 24V battery. The panels are for dealer fitting and are expected to sell to consumers at around £40.

Fidelity's first VCR, a VHS machine, is due for launch this September, to be followed later by a teletext-equipped set. The company returned to profit during the second half of the financial year to March 31st, with a jump in turnover for the complete year of 71 per cent. Chairman Jack Dickman comments that the results confirm the success of the company's TV-led strategy for recovery. There's been a decline in demand for the monochrome portables, but the successful launch of the colour set range has more than compensated for this.

TWO-OUTLET PREAMPLIFIER

Antiference have added a mains-operated, two-outlet signal preamplifier to their comprehensive XtraSet range. The amplifier is designed to provide dual TV outputs or, in conjunction with an aerial combiner, TV/f.m. radio outputs. Performance figures are as follows: bandwidth 40-860MHz; noise figure less than 3·5dB; gain at each output 7·5dB at v.h.f., 6·5dB at u.h.f.; isolation between outputs 16dB. The suggested retail price of the XS2VU is £16·40 plus VAT.

DIGITAL TV

Last November we included an article on a system devised by ITT Semiconductors, Freiburg, W. Germany for handling and processing the signals in a TV set in digital form. Further details of the VLSI i.c.s developed for this purpose have since been released, and the complete system was presented at the Paris Components Show earlier this year. The VLSI chips also now have type numbers, as follows.

MAA2000 central control unit (a microcomputer)
MAA2100 video control unit – carries out A/D and D/A conversion of the video signals
MAA2200 video signal processor
MAA2300 audio A/D and D/A converter
MAA2400 audio signal processor
MAA2500 deflection control unit.

Various names for the system have also been coined – Digivision and Digitt 2000. Not being familiar with digital coding arrangements, we made one small error in the article mentioned above – the seven-bit video signal from the A/D converter is Gray-coded, not grey-coded . . .

GEC MOVES

GEC (Radio and Television) have moved to new premises at Sefton Park, Bells Hill, Stoke Podges, Slough, Berks SL2 4HB. The service department has returned to its old location at East Lane, Wembley, Middx HA9 7PQ.

TV-VCR COMPATIBILITY

In the June letters column E. Trundle drew attention to a report in the latest issue of the Philips Service publication *Link* on the problem of random horizontal bars when using a TDA3560 decoder chip in conjunction with an off-tape signal. The basic cause of the problem is incorrect video signal clamping. Mullard have since commented that the originally recommended value for the three clamp capacitors is 0·1μF. A lower value (0·022μF) is employed in the versions of the Philips KT3 and K30 chassis that use the TDA3560, and this can aggravate the problem. In persistent cases Mullard suggest that the value of the clamp capacitors can be increased to 0·47μF (use either aluminium electrolytic or tantalum bead capacitors). Their view is that to use 10μF, as suggested by Philips, could cause other problems. Another recommendation is to increase the value of the luminance input coupling capacitor (to pin 10) to 0·1μF – Mullard consider that this modification on its own should clear the trouble.

SPECTRUM REVIEW

The government has announced that an independent review is to be conducted into the use of the 30-960MHz spectrum, to report by next June (with an interim report by September). One aim is to help ministers in deciding on the future use of the bands at present used for the 405-line TV services. The government is anxious to encourage an early expansion of the radiotelephone services, while additional dual-frequency channels for land mobile services have been recommended by a parliamentary committee.

HIGH-GRADE BETA TAPES

Sony have introduced a range of high-grade Beta videocassettes that provide a higher r.f. output (+2dB) together with a reduction in bar noise and dropouts. The Dynamicron HG series tapes have a smoother magnetic surface, with 2dB and 3dB improvements in the video and colour signal-to-noise ratios respectively. The new cassettes, which are available with 130 and 195 minute playing times, cost 15-20 per cent more than standard versions of the tapes.

TRANSMITTER OPENINGS

The following relay transmitters are now in operation:
Banff (Grampian) BBC-1 ch. 39, Grampian Television ch. 42, BBC-2 ch. 45, TV4 (future) ch. 49.
Charlbury (Oxfordshire) Central Independent Television ch. 41, BBC-2 ch. 45, TV4 (future) ch. 47, BBC-1 ch. 51.
Eskdale (N. Yorkshire) BBC-1 ch. 39, BBC-2 ch. 45, TV4 (future) ch. 49, Tyne Tees Television ch. 52.
Polperro (Cornwall) TV4 (future) ch. 53, BBC-1 ch. 57, Television South West ch. 60, BBC-2 ch. 63.
Thurso (Caithness) TV4 (future) ch. 53, BBC-1 ch. 57, Grampian Television ch. 60, BBC-2 ch. 63.

The above transmissions are all vertically polarised.

IN BRIEF

Production of colour TV sets at the National Panasonic plant in S. Wales is being increased from 120,000 to 200,000 a year. Panasonic's aim is an increased share of the W. European market . . . The French manufacturer Thomson-Brandt, which was originally part of the W. European VHS joint video venture, has reached a separate agreement with JVC to assemble VCRs under licence. The production target is 100,000 machines next year . . . The latest issue of *Which?* reports on Beta, VHS and V2000 VCRs. Eleven current machines were tested and *Which?* found little difference in the picture and sound quality. It recommends giving careful thought to the type of timer incorporated and the other facilities available, in particular good rapid picture search . . . Wigfalls are closing 47 branches and selling the rental contracts to Visionhire. The slimmed-down Wigfalls chain will be concentrated in the midlands and north.

All Good Clean Fun

Les Lawry-Johns

FIRST a story about Mr. Bee, a busy little fellow who likes to know how everything works. In other words he pokes his nose into everything, and has a go even at complicated things that frighten lesser mortals (like you and me). His TV set is a 14in. colour portable fitted with the Philips KT3 chassis, and is of adequate size for the small room he occupies. When it went wrong he took it to his friend Raymondo, an experienced engineer who spends his days in a fully equipped workshop surrounded by thousands of TV sets and VCRs that await his expert attention. Mr. Bee complained that the picture had shifted across and couldn't be centred. He then left as quickly as he'd come.

Raymondo spent many hours checking likely suspects, then many more checking unlikely ones. Eventually he cried "enough, enough!", and phoned Philips Service who advised him to check all the things he'd already checked and then suggested he let them know what it turned out to be.

So, lonely and dispirited, he turned once more to the off-centre picture. Quite by chance there was a degaussing coil on the bench, and Raymondo picked it up and shook it at the set in anger, switching it on by habit. To his amazement the set's screen became blotched, with wrong colours. He waved the coil at it again, and the screen became even more impure. This was the last straw, and Raymondo shouted "you're not supposed to do that. When I degauss you you're supposed to become pure, not impure".

Next he turned to the task of purifying the screen, and as he did so the picture shifted over to its correct position. During all the hours he'd spent he'd not thought of the purity magnets. Why should he? Who'd shifted them in the first place and why?

Mr. Bee should clearly be questioned. So when he came back Raymondo pounced. "Why did you alter the purity magnets you silly bugger?"

"I had to. The purity was atrocious after we changed the room around."

"Where did you stand the set?" asked Raymondo carefully.

"On top of one of the hi-fi speakers . . ."

Fancy Falling for That One

I should laugh at others. Look at the one I fell for the other day. My face is still red.

In came this Pye colour set fitted with the 725 chassis – the one with the vertical boards that always seem to stick in the runners when you're sliding them out or sliding them back in again. It's worse when you take the panel out altogether, because when it comes to replacing the panel you just can't seem to get the angle of the top bit of the jigsaw right to permit entry. I've just about got it worked out now after some four or five years. A bright young lad who had nothing to do with TV work showed me how to do it in thirty seconds a long time ago, but I still had difficulty long after he'd departed. We've handled so many now however that they no longer give us heartaches, and this one wouldn't either if only I'd stopped to think and remember for a moment. But I didn't.

The 800mA h.t. fuse (F971) had failed and I immediately suspected the BU208 line output transistor. A quick check showed that it was indeed short-circuit. I don't like replacing line output transistors in this chassis because the fixing screws are often stubborn and I certainly won't ask son-in-law Douggie to help with their removal again (remember his "no problem" when he hit the screws an almighty bang and bloody nigh shattered the panel?). This time the screws didn't offer too much resistance however, and a new BU208 was soon fitted. There didn't seem to be any shorts, so we fitted a new fuse and switched on. The fuse glowed a pretty red and the new BU208 gave up the ghost.

"Fool" I said, taking the panel out again. In went my last BU208, then I unhooked the tripler and fitted a 150Ω wirewound resistor across the fuse holder to limit the current in case it was still excessive. It wasn't, so like an absolute idiot I fitted a new tripler and connected the meter across the fuse holder, switched to the 500mA range. Switch on and the needle goes right over – I removed the meter probe just in time to save the BU208.

So I started talking to myself. "Disconnect the tripler and we're laughing. Connect it up again and we're crying. There must be a short in the tripler or something it supplies. We've changed the tripler so that's out. What else is there?" Fool, idiot, maniac. The c.r.t. first anode supply reservoir capacitor C563 (0·1μF, or 100nF if you prefer it that way), which is charged by the clipper diode in the tripler. Fancy forgetting a simple thing like that. Easy to do however as C563 hides under the top of the line output stage screening box. It was short-circuit of course, and a 1·25kV replacement put things to rights and allowed us to refit the old tripler – with apologies to it of course.

Even Dafter

I then went on to commit another howler. On a simple Pye 163 chassis – the large-screen hybrid monochrome one, not the portable. A development of the 169 if you remember. It came in because of intermittent loss of signals, both sound and vision, the screen going completely blank when the fault occurred, leaving a clean raster.

I immediately assumed that the fault was late in the i.f. strip, first because the sound also went, and secondly because there was no noise on the screen as there should be if the i.f. stages were working. So I patiently plodded through the i.f. stages and they all seemed to be in order, confusing me no end. Next I injected signals from my trusty (and old) Advance signal generator. The bars proved that the i.f. stages were in fact working, and that the a.g.c. circuit was incorrectly set up – hence the absence of the expected noise. So I accused the tuner and fitted a new one.

On came the picture and sound. For ten minutes. They then went off again, and a meter check showed that there was no tuning voltage. Shouldn't this have left the tuner operative, albeit without programmes? At last we consulted the circuit, and realisation hit us. The 11V supply for the tuner is also obtained via the 22kΩ, 2W resistor at the top of the chassis. Once again I'd overlooked a simple and extremely common fault – common because the resistor originally fitted is not man enough for the job. Perhaps the intermittency had led me astray. Perhaps the lack of noise on the screen. Perhaps, perhaps. But the fact is that I should have waited for the signals to disappear and then checked the tuner unit voltages in the first place, not jumped to hasty and wrong conclusions.

E. Knell and the Bush Ranger

Mrs. Knell paid us another visit recently. This time I wasn't frightened of her because I'd found out that her real name was Elaine Knell, not Eskimo Knell as I'd so foolishly thought those few months back. She had with her a small, white Bush Ranger portable, and gave me a radiant smile. "I hope you're feeling better now. You looked a little groggy last time I called" she said in her soft, seductive voice. I looked at her perfect, rather pointed teeth.

"To tell you the truth I thought you were a man eater" I confessed.

"Opportunity would be a fine thing" she said. "I couldn't have frightened you that much surely?"

"Well you see it was the name. I thought it was that lady who lives in the Yukon and eats men for breakfast, and Dead Eye Dick and Mexican Pete rode down to the Rio Grande to get away from her."

"Oh, I see! Those old rugby songs my dad used to sing. Beautiful songs – filthy songs. But haven't you got it mixed up? They didn't ride away from her, they found her near a big wheel that went round and round."

Now she was getting mixed up, so I thought we'd better get down to business.

"When are you – I mean what's wrong with the little white set?"

"Oh, nothing much. It's just that the sound comes on for a second or two and then goes off. Probably something loose."

"O.k. Mrs. Knell. Leave it with us till about five. We'll make it talk by then."

I could hear Honey Bunch singing softly in the background. "I tort I saw a pussy tat a cweeping up on me." So Mrs. Knell made her graceful exit and I had to explain the whole thing to H.B. "I thought she was Eskimo Knell, but she's only a vampire after blood."

"Don't you worry. The only female that's going to have your blood is me, and if you don't get cracking I'll have it right now."

"You're so sweet" I murmured.

And so I started the long drawn out battle with the Ranger. I removed the rear cover and the aerial panel, slackened the top fixings and the tube base socket, stood the set on its side and gained access to the plug-in i.f. panel – thinking there was a poor edge connector contact. Switch on and the sound comes up loud and clear. Then stops.

I located the intercarrier sound i.c.'s output pin and applied a hum test with my test prod. A loud, clear hum. So the audio output stage was intact. I applied a test signal to the i.c.'s input pin and there was no response. So a new chip was fitted. Not all that simple as there are variants of the TBA120 and the only one I had in stock was of the wrong type. Raymondo was eventually able to supply the correct version (I thought). Still no sound.

I heaved a sigh and started on the tedious business of removing the capacitors around the chip and testing them separately. Two of the $0{\cdot}02\mu F$ disc ceramics showed leakage, one associated with the input and the other with the d.c. volume control. Fit two new capacitors and again switch on. There didn't appear to be any sound until I rotated the tuner slightly. The sound then came in on a knife edge, with a cracked quality suggesting that the quadrature coil L15 needed readjustment. Doing this didn't make any difference. I never thought it would.

So I gave up and refitted the original chip. The sound burst through loud and clear and stayed on. I hate disc capacitors marked 0·02.

Mr. Knell came in at five o'clock. A little grey man. Looked as though he needed a transfusion.

Letters

NEON TESTERS

It is not true that with a neon tester "the only insulation between you and the live test point is the neon itself" (letters, June). When a neon strikes it becomes a virtual short-circuit, the only limit on the current flowing through the user's body being the high-value (1MΩ) series resistor in the body of the screwdriver. Without this series resistor, the user could experience a severe if not fatal shock depending on the voltage being tested. The series resistor will provide protection should the type of neon your correspondent regards as unsafe go short-circuit. I feel that these points should be made in the interests of safety.

K. C. Duncan, F.S.E.R.T.,
Bolton, Lancs.

LUXOR AND PHILIPS

Reference was made in the *Teletopics* column in your May and June issues to relations between this company and Philips. The discussion to which you refer in your June issue took place many months ago, and I would like to emphasize that the two companies are no longer talking about mergers or takeovers or, as they say in Sweden, "any kind of fusion".

Dennis Swannack,
Managing Director, Luxor (UK) Ltd.,
Slough, Berks.

WHERE DID WE GO WRONG?

Your leader "Backing and not backing winners" (June) brought back several recollections. In the late 50s and early 60s for example EMI produced some of the best early computers – I maintained one of them, a hybrid valve/transistor device code named CP407, for two years at British Leyland. We had some funnies due to heater-cathode shorts in the double triodes etc., but the germanium transistors used in the card reading buffer stages behaved wonderfully. The clock frequency was only 100kHz, and the printers and tape decks were weird and wonderful – ½in. tapes and printers run on a system of Bowden cables. We nevertheless managed to do the whole payroll for BL on the machine in the early 60s. The machine was then improved, with much faster card readers and 1in. Ampex tape decks, and I for one thought that EMI were on to a winner. It was not to be.

About 1965 ICL came along with the 1900 series which I also maintained. Very good they were. Then IBM produced their 360 series and never looked back. What did happen to our great start in the world of computers in the UK? ICL have had financial problems for many years, but their machines were excellent.

The basic question is what went wrong with British engineering? It seems to be the same with cars, motorcycles and everything else. When I was with BSA we produced everything from a superb bicycle to heavily embossed guns for Indian rajahs. Now it's all gone – and the same will happen with the car and electronics industries unless we're very careful. Driving through Bridgnorth, Shropshire the other day I was reminded of RGD when they went there from Newton Row, Birmingham. Later Decca tried their luck in Bridgnorth – it's now an efficient company called Tatung, and the workers have to work or go!

Will the wheel turn full circle? I doubt it, because I think I know and understand the Englishman of the 80s.
A. H. Hurley,
Rednal, Worcs.

A Satellite TV Installation

Part 1

Steve Birkill

I WAS approached by Sonic Sound Audio Holdings PLC about the installation of a satellite TV receiver terminal in November last year – they'd heard about my work with the 4GHz Soviet TV satellites, and wanted to be amongst the first to be able to offer the general public any kind of satellite TV reception facilities. Sonic Sound had seen an inferior demonstration of Russian TV via satellite, using unmodified American TVRO (Television, receive-only) hardware, and wanted to offer a fully engineered system at a retail price significantly less than £4,000.

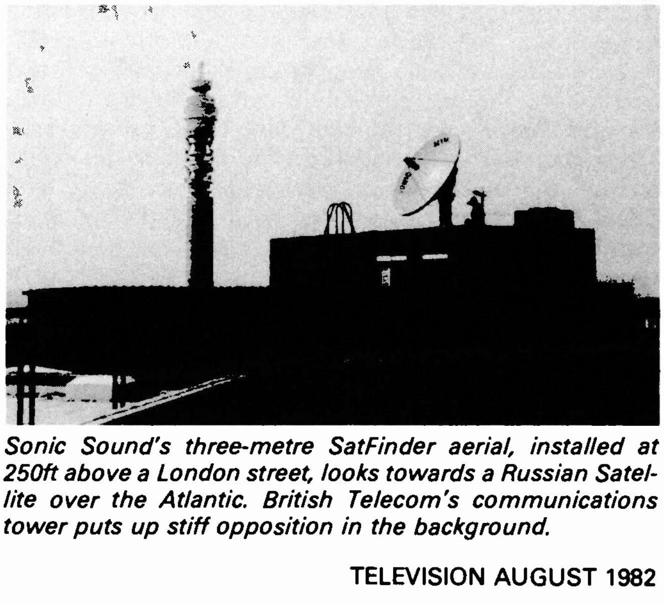
As part of their extensive network of communications satellites, the USSR operates a Gorizont (horizon) class satellite at a geostationary orbit of 14° west, over the Atlantic. One of this satellite's three permanent TV channels delivers a 3·675GHz spot-beam whose footprint covers most of Europe – it's intended to serve the "Moskva" chain of satellite-fed broadcast relay stations throughout the western Soviet Union. Towards the UK this beam's EIRP (equivalent isotropically-radiated power) is in the region of 41dBW (decibels above 1W). This is some 15dB (over thirty times power ratio) stronger than any TV carriers on the Western Intelsat system, and thus introduces the possibility of reception on what, for 4GHz, is a "small" terminal – in this case a parabolic aerial with an aperture of the order of two metres.

The programme carried by this spot-beam channel is the Soviet Central Television's "1-Programma" – the Moscow equivalent of BBC-1. The vision modulation is f.m., in a nominal channel bandwidth of 34MHz. A 2Hz triangular waveform is added for energy dispersal, and subcarriers at 7 and 7·5MHz carry the TV programme sound and a radio programme channel respectively, with both sound circuits using pilot-tone controlled companding.

Sonic Sound's chairman, Lionel Astor, visited my home and saw the 14 or so satellite TV channels available full-time with varying degrees of picture quality. We discussed the requirements for noise-free colour reception, and settled on a 2·4-metre terminal with a 120°K low-noise amplifier for the system to be put on the market. This specification would ensure a margin against threshold even at the end of a satellite's life, when the EIRP degrades to around 34dBW, and would also permit reasonable quality reception of the hemi/zone "spare" transponder (3·825GHz) and the global beam transponder (3·875GHz) used for Intervision-Intersputnik programme exchange – the satellite has a total of six transponders. To have obtained saleable quality from the strongest non-Soviet 4GHz signals – French TV via symphonie or Saudi Arabian and Sudan TV via Intelsat – would have called for an aerial in the six-metre range. This was considered a little ambitious at the time, though a possibility for the future. A demonstration terminal was required at one of Sonic Sound's many West End premises however, so I suggested that they go for a three-metre dish to bring all three of the Gorizont transponders safely above the noise threshold.

The Aerial

Time was of the essence for Sonic Sound. Finding no three-metre dish with mount readily available in the UK, they turned their attention to the US home terminal market. There is no DBS (direct broadcasting by satellite) in the USA, but a growing number of individuals operate "back-yard" terminals in the three- to five-metres range – quite legally – giving them access to the multiplicity of specialised TV programme channels distributed by the US domestic communications satellites to cable TV systems throughout the country. Much of the hardware for these "home TVROs" is cheap and cheerful, particularly the aerials, but I was able to recommend the three-metre SatFinder as a well-engineered unit. It has a five-section fibreglass reflector on a galvanised steel polar



Sonic Sound's three-metre SatFinder aerial, installed at 250ft above a London street, looks towards a Russian Satellite over the Atlantic. British Telecom's communications tower puts up stiff opposition in the background.

The goal: high quality reception of Soviet Central Television's channel one.

A bonus: Gorizont's channel ten global beam, which serves Intersputnik signatories, including Cuba. To find its way back to London after two satellite hops and a visit to Moscow this news package must travel 98,000 miles!

mount, with remote motorised steering or hand-crank operation, and is capable, with a small modification, of accurate geostationary tracking within better than 0·1°. A hand-cranked system was immediately ordered from the US: apparently the air freight cost more than the aerial, but within a week it was assembled and ready for testing at the company's London warehouse.

The Electronics

I'd meanwhile been preparing the electronics part of the package. A purpose-built system would have been ideal, with an integrated low-noise down-converter mounted at the dish and a compact set-top unit to deliver an output on a standard TV channel. My own system was experimental however, and time was against the development of a prototype ready for production. US-made receivers may seem cheap by satellite TV standards, but considering the technology used they are expensive, the real bargain being the low-noise amplifiers with gallium-arsenide f.e.t.s. These units, with waveguide and ferrite isolator input, provide a gain of 50dB, virtually flat from 3·7–4·2GHz (at least), with a noise figure of less than 1·5dB. A bit like overkill for a single-channel installation maybe, but the most economical solution in the short term. So a commercial dual-conversion satellite receiver, low-noise amplifier (LNA) and feed horn were imported. The LNA was specified as a 120°K unit, that is its internally generated noise power is equivalent to that of a matched resistive source at an absolute temperature of 120° Kelvin (−153°C) at the input flange.

In accordance with US domestic practice, the feed horn was designed for plane polarised waves. It was readily adapted for the Soviet satellite's right-hand circularly polarised signals by using a quarter-wave dielectric vane polariser. Receiver modifications were straightforward, but it was here that early entrepreneurs had sacrificed performance for cheapness. We went the whole way.

The mains transformer was changed to one with a 240V primary. The video de-emphasis components were changed to give the 625-line CCIR characteristic. The video filtering was modified to improve the response. A trimmer potentiometer was added to give fine adjustment of the demodulator's tracking range – a common problem with the popular divide-by-two/phase-locked-loop type of demodulator. The a.f.c. loop was adapted to incorporate controlled frequency feedback to handle the Russian dispersal, which is wider in deviation and much slower than that used in the USA and is the cause of the periodic pulsation and bursts of impulse noise seen on unmodified receivers. The video output was changed to give a true 75Ω source impedance. The audio demodulators were retuned from 6·2 and 6·8MHz to 7 and 7·5MHz, and a pilot-tone controlled expander module was inserted in the 7MHz output (when used as the primary sound channel on the other two transponders the 7·5MHz signal does not employ companding). A variable-gain i.f. preamplifier was added to cope with the 500ft cable run from the roof to the showroom. Finally a ch. 36 u.h.f. modulator was included to enable the output to be viewed on a standard SECAM TV set as well as on monitors. We stopped short of building in a SECAM-to-PAL transcoder, since triple-standard monitors and receivers are now commonplace amongst the London video community.

The Site

The site chosen for the aerial was the highest point of Central Cross, the new Thorn-EMI building in Tottenham Court Road, some fifteen storeys above the street level. Sonic Sound have three retail stores in this block, and the receiver would be installed in the West End Audio Visual Centre at 22-24 Tottenham Court Road, with cable distribution to the other premises.

The view of the geostationary orbit was unmatched. Centre Point subtended around 20° to the south east, well below the orbit's elevation at that point, and a total of 150° of the arc was visible from eastern to western horizon. Our problem was not the southern sky but over our right shoulder, where the Telecom Tower looked down on the sight from not half a mile distant. An impossible site for satellite work you might say, being so close to all that microwave radiation. Consulation with British Telecom however revealed that our wanted channel, centred at 3·675GHz, was gratifyingly clear of any Telecom frequencies, though we might expect interfering carriers throughout the 3·8–4·2GHz region of the downlink band.

Acting on this information we went ahead with the installation, secure in the knowledge that the principal channel would be clear of interference but with a strong possibility that the signals from the other transponders would be unusable.

Inside the Philips VR2020

Part 4

Brian Dempster

THE feed/rewind and take-up/wind spools are each fitted with their own motor. It might be thought that these motors need to be powered during wind or rewind only. Both motors require torque at all times during tape motion however, the amount of torque depending on the mode selected and the current supplied to the motor. To increase the torque the current provided by the relevant drive transistor is increased and vice versa.

Whenever tape movement is selected, the wind and rewind motors have a fixed polarity voltage applied to them so that they try to rotate as shown in Fig. 28. The actual voltage applied to each motor depends on the mode selected. It is important to appreciate that a motor may have a voltage applied to it such that it wants to rotate in the opposite direction to the direction of tape movement. In this case the motor's contribution is to add tension to the tape: the motor is then referred to as the pulled motor, the motor driving the other spool being the pulling motor. Brakes must also be applied to each reel at the appropriate times.

Table 1 lists the required motor conditions for each operating mode. The required states are all brought about by commands from the microprocessor control panel to the motor control panel.

Fig. 29 shows the basic motor control circuit. The nominal motor currents for each mode are preset by potential divider networks at the inverting inputs of a pair of operational amplifiers. The outputs from these amplifiers drive the transistors supplying the motors. Different resistance ratios are employed for the various modes, the basic method of obtaining the correct motor conditions being the application of a logic high to the appropriate resistor network.

Feedback is applied to the non-inverting inputs of the operational amplifiers. This takes the form of a voltage proportional to the motor current. In the wind and rewind modes this feedback is also cross-coupled to the other motor to maintain the correct tape tension. In addition, alternative output stages are selected for the pulling motor in these modes. A more detailed description of these changes is given later.

There are two protection circuits on the motor control panel. One produces another inverse motor stop signal (see "safety features" in Part 3) if the take-up spool stops during play/record or wind/rewind or the 15V or 12V l.t. lines fail. An inverse motor stop signal, delayed by ten seconds, will also occur if there's incorrect current in either the wind or rewind motor or the wrong combination of brake and pressure roller occurs in any mode.

The second protection circuit operates five seconds after the first one, producing a switch-off signal which disables the 12V, 15V and 35V lines. These lines can be restored only after unplugging from the mains for thirty seconds or so and removing the cassette. When a cassette is not fitted, the switch-off signal is shorted to chassis to ease fault-finding.

The protection circuitry is shown later (see Fig. 34). Another signal – inverse stop information – is produced for the microprocessor to tell it when tape motion has ceased. The reason for this will be explained later.

The motor control panel is in effect an interface for the microprocessor panel. The overall motor control system circuit is pretty formidable, so we'll separate it into more easily digestible sections, dealing with the various input and output signals in turn.

Threading and Unthreading

Thread in and thread out signals are used to set and reset a bistable respectively (see Fig. 30). The bistable's Q output switches on or off a transistor whose collector load is the threading relay's coil. Thus once set, the bistable keeps the relay energised via the transistor: unthreading is the reverse action of course.

The direction of rotation of the threading motor is determined by two more relays on the threading switches panel. These are in turn activated by drive transistors which receive inputs from optotransistors at the limits of threading and unthreading. The threading motor is an a.c. type with two sets of windings: whichever is selected determines the direction of rotation. When thread in or thread out signals come from the microprocessor, the threading motor remains on until the action has been completed – indicated by threaded-in or threaded-out signals respectively. These signals come via the threading direction relays from LED/optotransistor devices situated near the end and start of the threading track. A NAND

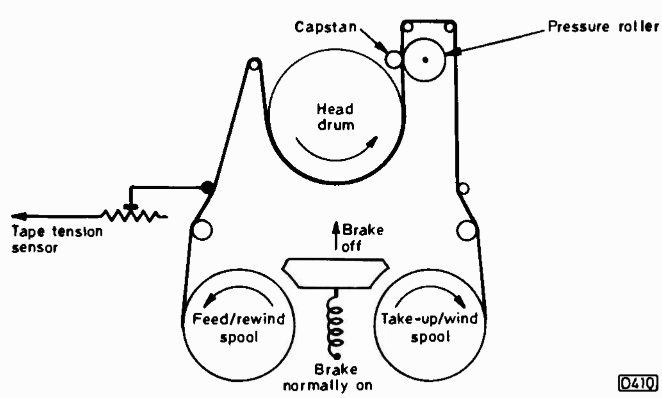


Fig. 28: Layout of the tape transport system.

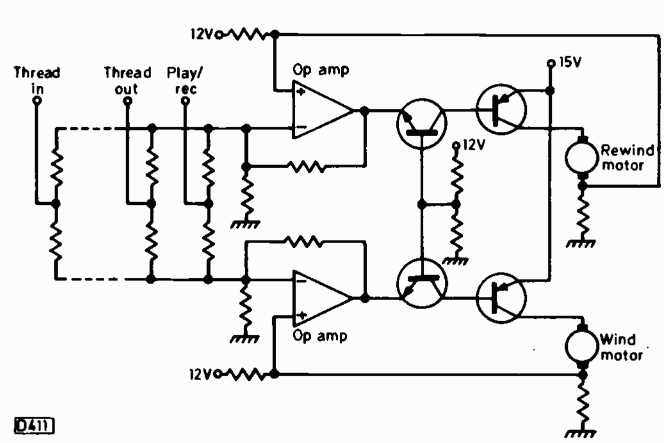


Fig. 29: Basic motor control circuit.

Table 1: Conditions for each operating mode.

Mode	Rewind motor	Wind motor	Brake	Drum motor	Threading motor	Pressure roller
Stop (unthreaded)	Off	Off	On	Off	Off	Out
Threading in	On (slight torque to prevent tape loops)	On (slight torque to prevent tape loops)	Off	On	On	Out
Threaded in stop	Off	Off	On	On	Locked	Out
Play/record	On (torque determined by tape tension sensor)	On (constant torque to take up tape)	Off	On	Locked	In
Rewind (threaded)	On (high torque determined by rewind speed)	On (slight torque to prevent tape loops)	Off	On	Locked	Out
Wind (threaded)	On (slight torque to prevent tape loops)	On (high torque determined by wind speed)	Off	On	Locked	Out
Unthreading	On (low torque to return tape to cassette)	On (low torque)	Off	On	On reverse	Out
Rewind (unthreaded) and go to	On (very high torque determined by rewind speed)	On (slight torque to prevent tape loops)	Off	Off	Off	Out
Wind (unthreaded) and go to	On (slight torque to prevent tape loops)	On (very high torque determined by wind speed)	Off	Off	Off	Out
Eject and load	Off/on/off*	Off/on/off*	On/off/on*	Off	Off	Out

*To take up loops and tension cassette.

gate prevents threading or unthreading when the machine is in the fast forward or fast rewind mode or the brake is on.

A reset circuit consisting of an *RC* delay and a transistor initiates a short threading action when the mains is applied.

Inverse Record and Playback

So far as the motor control panel is concerned, the two logic 0 inverse record and inverse playback signals do the same thing (see Fig. 31): they activate the pressure roller solenoid and switch the tape tension information to the rewind motor control amplifier. The record or playback command is sustained until either mode is no longer required.

The tape tension information consists of an analogue signal which is derived from a LED/optotransistor arrangement. As it leaves the feed/rewind spool, the tape passes over a spring-loaded roller. This varies the amount of light reaching the transistor, which in turn produces a decreasing voltage with increasing tape tension. When inverted, this signal is suitable for application to the rewind motor control amplifier. If the tension is too great, the current fed to the rewind motor is reduced and vice versa. This action is required in only the play or record modes, and is switched in by the NAND gate. The wind motor torque is constant during record and playback.

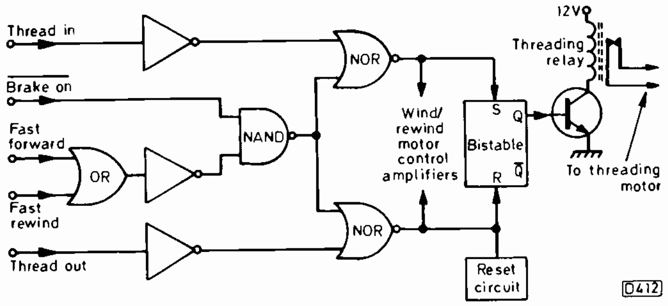


Fig. 30: Method of controlling the threading motor.

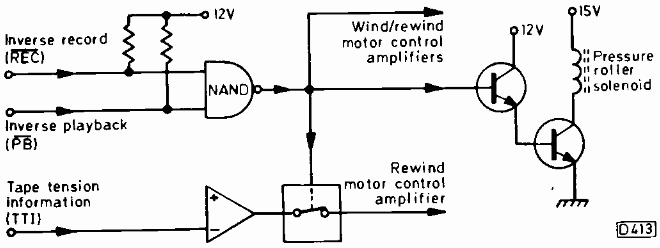


Fig. 31: Use of the inverse record and playback signals.

Fast Wind and Rewind

Fast wind and rewind are a little more complex than might at first be thought. When either of these modes is selected the microprocessor releases the reel brake – the brake is held on by a spring when the brake solenoid is de-energised. The wind and rewind motors are then both powered at low torque to pretension the tape, and after 300msec the appropriate motor is rapidly accelerated to full speed (unless the not threaded input is present, in which case the speed is somewhat slower). In addition, the tape tension (drag) must be kept at the correct value regardless of the amount of tape on each spool, and a constant wind/rewind speed is desirable. The relevant circuitry is shown in Fig. 32.

When fast wind or rewind is selected a voltage is applied to the junction of either R5/6 or R7/8. At the same time the microprocessor releases the brakes. The voltage applied to the resistors just mentioned causes both motors to produce an equal torque to tension the tape: this removes any loops but doesn't cause movement. Amplifiers 1 and 2 ensure that transistors T4 and T5 conduct moderately, passing current through each motor. After about 300msec T1 or T2 turns on, in turn switching T3 or T6 on. The "+11" supply to these transistors can be as high as 30V or so (see later). T3 or T6 then turns off either T4 or T5 respectively, and the wind or rewind motor is driven at high torque to give fast tape speed.

Current is still supplied to the pulled motor to provide tension, which should ideally be related to the torque of the pulling motor. This is done as follows. Assume that fast forward has been selected. T5 will be cut off, with T6 supplying the motor (the voltage at the emitter of T6 will depend on the speed of the wind motor – see Fig. 33). As T5 is cut off, the feedback from R10 will have no effect on the speed. The voltage across R10 will still be approximately proportional to the wind motor torque however. During wind or rewind diodes D1 and D2 form an OR gate (they are biased via inverters 1 and 2) which closes switch 3. As a result, the voltage across R10 is fed via R3 to the input of the operational amplifier that controls the rewind motor. Any increase in the wind motor torque thus decreases the current flowing in the rewind motor, reducing the drag and maintaining correct tape tension.

If fast wind is selected whilst the tape is unthreaded, there's less drag on the tape and a greater degree of cross-coupling is required. For this purpose S2 is closed, shorting out R3. In addition, the unthreaded input voltage closes S1, placing R2 in parallel with R1, while D3 is forward biased connecting R9 in parallel with R4. This makes the torque of the pulled motor drop off at a greater rate as winding/unwinding proceeds.

Amplifiers 3 and 4 monitor the current flowing in both motors in all modes to determine whether it's above or below a given value. This information is fed to the protection circuit (see Fig. 34).

Pulling Motor Speed Control

Next, pulling motor speed control. Wind motor tacho pulses derived from another LED/optotransistor arrangement operated from the wind spool are amplified and fed to two cascade connected D-type bistables (see Fig. 33). The output from the second bistable is at a quarter of the wind tacho rate and is fed to the microprocessor which counts the pulses to update the tape counter. The output from the first bistable is at half the wind tacho rate and is fed to transistor T1, which along with R2, D1, C1 and R3 form a pulse counting discriminator giving an output voltage proportional to the input pulse frequency. With no pulse input, T1 is saturated due to the base bias applied via R1. As a result its collector voltage is low, reverse biasing D1 and in turn isolating C1. When a tacho-derived pulse is applied to the base of T1 via the coupling capacitor T1 is momentarily turned off, allowing C1 to charge via D1 and R2. When T1 turns on again, C1 discharges via R3. The more frequently T1 switches off, the higher the average voltage developed across C1.

This voltage is used to bias transistor T2, whose collector is connected to a regulator fed from the 35V rail. The harder T2 conducts, the lower its collector voltage and the lower the voltage developed across C2. This latter voltage, via D2, is the "+11" supply. Obviously then this supply can rise to a higher voltage than the nominal 11V. The actual voltage, which supplies T3 and T6 in Fig. 32, will be inversely proportional to the speed of the wind motor. If this speeds up the motor supply voltage falls and vice versa.

To produce a higher motor torque during unthreaded tape movement, T3 is turned on placing R4 in parallel with R3. This reduces the average voltage across C1 and thus the conduction of T2 so that the "+11" voltage rises.

Braking and "Go to"

At the end of fast forward or rewind the microprocessor applies the brake by de-activating the reel brake solenoid. Spring action then brings ingeniously designed rubber blocks into contact with both spools, ensuring that the pulled motor is braked more heavily at first to prevent the formation of tape loops. Transistor T3 or T6 (Fig. 32) is turned off and the motor concerned begins to slow down. The back-e.m.f. produced by the motor turns on D4 or D5, the negative voltage being fed via zener diode Z1 and D6 to the base of transistor T1 in Fig. 33. This in turn reduces the "+11" voltage to near zero.

Transistors T3 and T6 (back to Fig. 32) now both have zero voltage at their bases, their emitters being slightly above this. At the same time the back-e.m.f. from the wind/rewind motor is driving one of the collectors negative. Being pnp devices, either T3 or T6 will conduct, connecting the pulling motor's live terminal to chassis. This produces rapid deceleration.

When the "go to" operation is selected, the machine carries out fast tape movement in the appropriate direction in the unthreaded state, i.e. at maximum speed. The inertia of the system could cause overshooting of the requested tape counter reading at high speed, so when a reading within one hundred units of that requested is reached the microprocessor produces a slow wind signal. This turns on T4 (Fig. 33), overriding the "high if not threaded" signal and turning off T3. This increases the average voltage on C1, increasing the conduction of T2, and by reducing the "+11" supply the tape speed is considerably reduced. When the required tape counter reading is reached, the microprocessor removes the fast forward/rewind signal and stops the tape.

The slow wind signal also occurs when the stop button is pressed or the end of the tape is reached with the machine in the fast forward/rewind modes.

Safety and Protective Features

Before ordering the machine to go from one mode to another the microprocessor must satisfy itself that tape motion has ceased. It does this by monitoring the state of the wind motor via the inverse stop information signal, i.e. the condition at the collector of transistor T7 in Fig. 33. When wind tacho pulses are present at the base of T5, C3 will not charge sufficiently for T6 and T7 to turn on. When the wind motor stops, T5 is off and C3 charges via R5. T6 and T7 then turn on, producing the inverse stop information signal.

If the wind motor stops during record, playback, fast forward or rewind, the 15V or 12V supplies fail, or the tape transport conditions in any mode (including standby) are incorrect, an inverse motor stop signal is produced on the motor control panel. Incorrect tape transport conditions produce the inverse motor stop signal after a delay of ten seconds. In addition a signal known as switch-off is produced five seconds after inverse motor stop. The switch-off signal energises a relay in the power supply, removing the 12V, 15V and 35V lines. Fig. 34 shows the circuitry involved in producing the inverse motor stop and switch-off signals.

The base of T1 is fed from a circuit which analyses the tape transport conditions. Under normal operating conditions the voltage here is high. T1 conducts therefore and

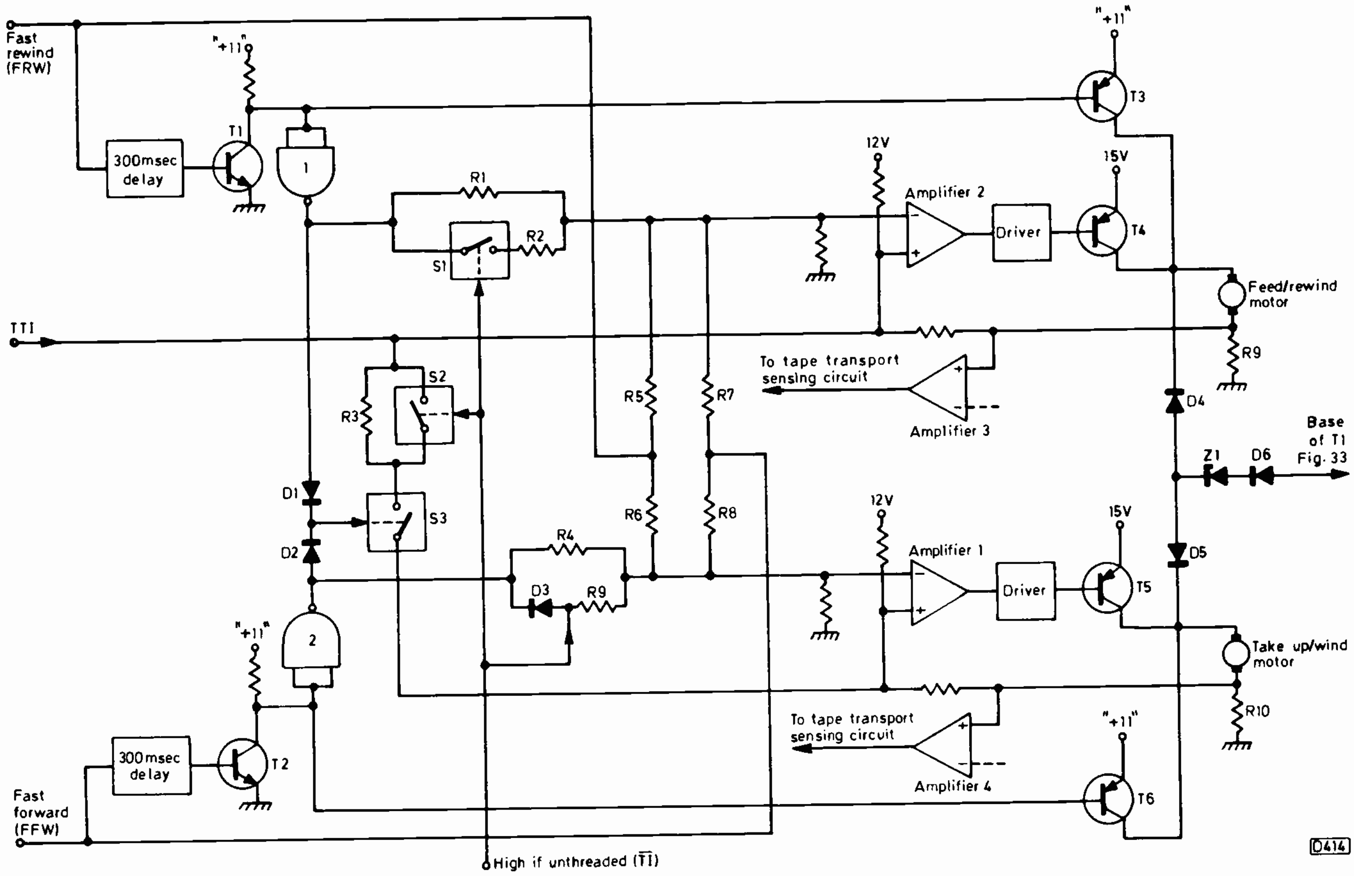


Fig. 32: Feed/take-up motor control circuit.

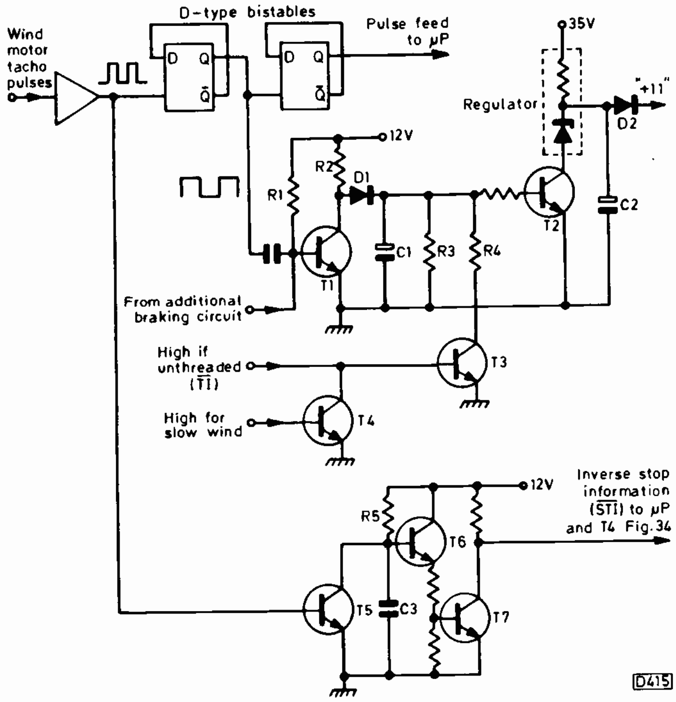


Fig. 33: Pulling motor speed control and inverse stop information circuits.

there's no voltage across C1, nor at the output from Amp 1, across C2 or at the output from Amp 2. Assuming that all other conditions are normal, there'll be no voltage across C3 or C4 either and T3 will be off.

T3 will switch on if there's an output from Amp 1 or a voltage across C3 or C4. R2/C2 provide the five-second switch-off signal delay. It should be clear by now how the circuit works when an abnormal condition is sensed,

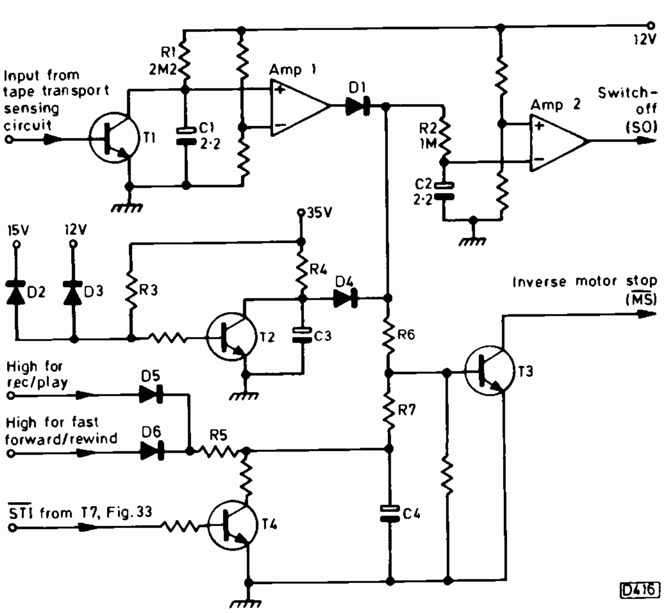


Fig. 34: Generating the protection signals.

generating the required protection command outputs. If the 15V or 12V rail falls to zero, D2 or D3 respectively will conduct, removing the bias at the base of T2 to produce the protection signals. If the wind motor stops during record, playback, fast forward or rewind, T4 will be turned off, allowing C4 to charge via D5 or D6.

The conditions which are considered by the circuit that provides the input to the base of T1 are as follows: (1) Is the machine in record/playback? (2) Is the brake off? (3) Is the pressure roller on? (4) Is the rewind motor current above a certain value (output from Amp 3 in Fig. 32)? (5) Is the wind motor current above a certain value (output from Amp 4 in Fig. 32)?

Routine TV Receiver Tests: ITT CVC5-CVC9 Series CTVs

S. Simon

THE first ITT colour chassis in the UK were the hybrid CVC1 and CVC2. They were basically the same, the former being a dual-standard version. Very reliable these hand-wired chassis were, and kind to their tubes. After all these years the writer has never had to replace the tube in one of these sets, though this may partly have been because they were not produced in great numbers and we don't have a lot of them on our books. This is by way of an introduction however, since our concern in the present article is with the subsequent CVC5 hybrid chassis and its offshoots, the CVC7, CVC8 and CVC9. Much has already been written about these chassis in the magazine, and the issues in which a more detailed treatment can be found are mentioned at the end. What we are concerned with here, in keeping with the purposes of this series of articles, are simple checks for quick diagnosis of common faults. Nor do we want to get tangled up in the many detailed differences between these chassis. The basic arrangement remained the same, which helps us to provide a summary of initial tests.

Dead Set

There are five valves, which we will consider in a moment. First however let's make a point that can be confusing if you are not familiar with this chassis. The valve heaters are fed from a tapping on the mains transformer, which also supplies the l.t. bridge rectifier and the tube's heaters (see Fig. 1). The transformer does not supply the h.t. rectifier (there may be one or two in parallel). We come to our first caution therefore: a set may appear to be dead, i.e. not a sign of life in the tube or the valve heaters, but be very much alive from the h.t. point of view. If you think that the remedy for the dead set condition lies in the cluster of wirewound resistors and fuses at the top of the chassis, you are likely to encounter plenty of h.t. but no solution to the problem, which is far more likely to be located on the mains input panel where the 315mA transformer fuse F3c is probably open-circuit. There are no dropper resistors in the heater chain.

The five valves used are the PL509 line output valve, PY500A efficiency diode, PCF802 line oscillator valve, PCL805 field timebase valve and PCL86 audio valve. This is the order in which they are connected in the heater chain. Note the positions, with the PL509 first. This means that if the PY500A decides to develop a heater-cathode short, something that does happen, the PL509 will be subjected to the full heater line voltage which should have been shared by all the valves, i.e. it will light up nice and bright for a brief period. It may survive the ordeal if the PY500A blows itself clear (open-circuit cathode) or the 315mA fuse fails in time. It may. The naughty bit is where you find the PL509 with an open-circuit heater and fit another valve which is then subjected to the same ordeal. The rule is that if the PL509's heater is found to be open-circuit, view the PY500A with suspicion and replace both if in any doubt (a meter may not show a short).

Also check the boost reservoir capacitor C310h (0·47μF) which is farther down the panel, virtually under the line output transformer. This 1kV capacitor is a prime source of trouble and should be looked upon as a "must" when making a routine test on a dead set. Let's just say that again – a dead set, not sound but no raster. This is because there's a sound muting circuit that mutes the sound till the line output stage comes into operation. If an initial meter check from the top cap of the PY500A or PL509 to chassis gives a low reading – it should be over 200kΩ – make another check, on the low ohms range, across the tags of C310h which is vertically mounted beneath the valves. This can save much time and heartache and is one of the first things to do.

This is not to say that a short recorded here is definitely due to C310h. Only that it's likely to be. The PY500A could be internally shorted, or the pulse-type harmonic tuning capacitor C308h (210pF) which is connected between the cathode of the PY500A and chassis could be short-circuit. Check the appearance of this capacitor – it will usually be obvious if the fault lies here. A replacement must be rated at 8kV or more, and should be of the disc type for reliable operation. In moving on like this to the line output stage we have run ahead of ourselves however.

Fuses and Wirewounds

There are three fuses on the CVC5's mains input panel. One is the 4A delay fuse F1c which follows the mains switch. After this comes the mains filter capacitor C257c, which is a prime suspect if the fuse has died a violent death. In later versions of the chassis a different type of mains filter is used – there's just a single 1μF capacitor. A word about this. If it's yellow, it will almost certainly be rated at 220V a.c. and is suspect. We've quite often seen clouds of grey smoke issuing from one of these sets even though the picture and sound continue, unaffected. The cause is the filter capacitor leaking (not shorting). The capacitor often puffs itself out, the set continuing happily without it. Use a replacement clearly marked 250V a.c. or over.

The other two fuses are the 1·25A delay type that feeds the degaussing circuit (only) and plays no part in the set's operation other than the regular demagnetisation of the tube at switch on. The 315mA fuse that feeds the transformer has already been mentioned. It's worth noting that in later versions of the chassis there's a built-in thermal cut-out in the transformer housing. So if the fuse is intact but the tube and valve heaters remain unlit, check the continuity of the primary winding and repair the cut-out if necessary.

The various h.t. fuses are grouped at the top centre where the wirewounds live. With the chassis hinged down, the right-side 400mA delay fuse (later changed to 630mA) is the one of most interest. It's in the supply to the line output stage, and is the one which will fail if the aforementioned PY500A or line output stage capacitor

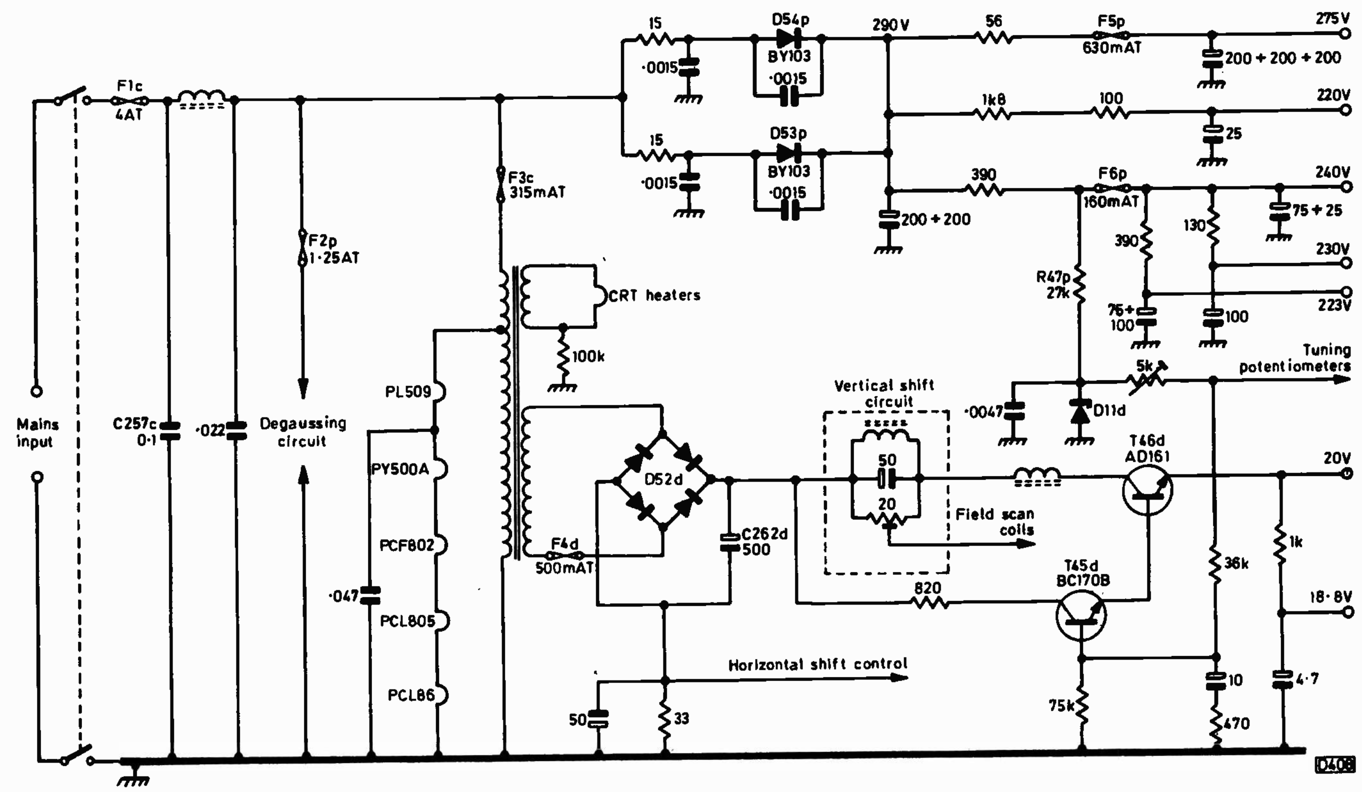


Fig. 1: Power supply circuits, ITT CVC5 chassis. Some models have only one h.t. rectifier. Modifications in later versions include extra fuses and fusible resistors, use of a simpler mains filter and omission of the 18·8V rail.

trouble is present. If it's open-circuit, make the checks previously described, starting with the resistance check from the top caps to chassis.

If the complaint is no sound, it's likely that one of the wirewounds will be found sprung open. If so, check the PCL86 valve down on the left-hand side before soldering the resistor up, because amongst the habits of this valve – apart from causing loud noises and operating intermittently – is the propensity to short internally on odd occasions; i.e. if there's an intermittent short, soldering up the wirewound will restore the sound but the same thing will happen again.

There's another fuse half way down the left-hand side. It's the 500mA delay fuse F4d in the a.c. supply to the l.t. bridge rectifier. This will often be found open-circuit, but the symptoms with the earlier CVC5 and later CVC8 etc. chassis will be different. In either case there'll be no signals of course. With the CVC5 there will be no drive to the RGB output transistors which will thus be cut off. So there'll be e.h.t. but no raster. With the CVC8 and later chassis, absence of the l.t. supply will leave the RGB output transistors hard on with the beam limiter in action, i.e. there'll be a bright raster but no picture.

The l.t. bridge rectifier may consist of four separate diodes or a single encapsulated unit. Whichever type is fitted, it or they are suspect if the fuse has failed. It's fairly easy to check the bridge once the two a.c. inputs have been identified. With the meter switched to the low ohms range, a figure of about 20Ω should be recorded with the red probe connected to the output, i.e. the positive side of the reservoir capacitor C262d, and the black probe connected to one of the a.c. inputs. The reading should be higher when the probes are reversed. Likewise with the black probe connected to the chassis side of the bridge and the red probe to one of the a.c. inputs a reading of about 20Ω should be obtained, higher when the probes are reversed. At no time should a direct short or zero resistance reading be obtained other than across the a.c. inputs.

The output from the bridge is applied to the AD161 series regulator transistor T46d via the vertical shift circuit. Drive for the AD161 is provided by the BC170B transistor T45d. Stabilised 20V and 18·8V outputs are taken from the emitter of the AD161. It's interesting that the BC170B obtains its turn-on bias from the h.t. line, via the tuning voltage stabiliser circuit, i.e. the zener diode D11d and its 27kΩ feed resistor R47p. So if this resistor (the p indicates that it's mounted up on the top centre power section) goes open-circuit, not only do we get an inoperative tuner but the l.t. supplies are also shut down. The same thing happens when D11d goes short-circuit – it's at the bottom left on the main board, and should be an LZ36B or TAA550B.

The l.t. supply circuit is suspect when the picture is spoilt by hum bars (dark horizontal bands). In this event the AD161 is the prime suspect, the electrolytics taking second place on the check list.

Poor Connections

This series of chassis is subject to poor connections, particularly in three areas. One is at the bottom i.f. strip, the result in this case being intermittent signals. The edge connectors of the i.f. modules, where they fit into the main board, are a good starting point, and slight movement of the modules will often reveal which is suspect.

The second source of trouble is on the upper part of the board, to the left of the tube, where the RGB output stages are situated. Quite often the complaint is that one of the primary colours varies – there's typically a sudden preponderance of one colour, say green, which flashes on and off for a brief period, possibly helped by a thump on the cabinet. Going over the soldering on the right-hand edge is most likely to clear the fault, though the trouble could be on the area to the inside of the transistors. Less likely, but still possible.

The third source of dry-joint trouble is at the line output transformer connections to the subpanel on which the transformer is mounted. Not often on the main board. To gain access, remove the line output stage screening cover – it's secured by a single screw, which should be removed to allow the cover to be eased off, clear of the protruding focus lever, and out of the top slots. The subpanel is then exposed and the connections can be closely examined for poor soldered contacts. The symptoms produced by such poor earthing etc. can be weird and wonderful. Also difficult to describe. In short, if very peculiar faults are encountered, check this subpanel before complaining that say the teeth of a sabre-tooth tiger and not much else are present on the screen. In case you are wondering why such odd things should occur, the point is that the pulse feeds from the transformer to various parts of the set can be affected.

Whilst in this area we should mention the sudden (perhaps gradual) loss of focus that necessitates moving the focus lever to one end of its travel. This denotes a change in the value of the series resistor connected to the end of the control concerned. It's normally the top 4·7MΩ resistor that changes value. The exact value is not critical.

Field Timebase Faults

One of the most common complaints is that the picture rolls for some time after the set is first switched on. This is an indication that the PCL805 has aged, and a replacement should put matters to right. The PCL805 can also be responsible for total field collapse, and generally this valve and diode D46f (OA91) are responsible for most field timebase troubles. It takes only a moment to check the diode. It's wired with its cathode to chassis and its anode to the cathode of the triode section of the valve, and connecting the red probe to chassis and the black probe to pin 3 of the valve should produce a fairly low reading that should increase when the probes are reversed. The diode can go open- or short-circuit: in the former case there's field collapse, in the latter loss of field sync. A more robust type of diode should be fitted. The height control is also suspect, and should be replaced if erratic operation is experienced.

Summary

All in all then these are reliable sets with predictable habits. As a result, servicing is rarely a headache (I wish I hadn't said that). There's one fault that can cause head scratching however, and although it doesn't often occur it's worth bearing in mind. If the PL509 overheats, with severe lack of width or maybe no raster at all, spare a thought for the manner in which the PCF802 line oscillator valve is supplied. If the voltage at the anode of the pentode section of this valve (pin 6) is low, the drive to the PL509 will be seriously reduced. The point is that there's a start-up supply, from the 240V h.t. rail via R402h, but once the line output stage comes into operation the supply is derived from the boost line via R403h (180kΩ). This latter resistor tends (not very often) to go high, thus reducing the line drive below the correct level.

For a more detailed treatment of these sets, see the November and December 1975 and the January 1976 issues.

Extras for the Hitachi VT8000

Derek Snelling

THE VT8000 was for some time the basic Hitachi VCR. It was complemented by the VT8500, a more expensive machine that offered the following additional features: full infra-red remote control, an improved timer, slow and fast playback (half and twice speed), and tape indexing. The latter puts a signal on the tape at the beginning of each recording, so that when the tape index function is selected the machine stops at these points on either fast forward or rewind, thus making it easy to locate the various different recordings made on a tape.

In all other respects the two machines are identical – so much so that some of the VT8500's facilities, i.e. half and twice speed and tape indexing, can be added to the VT8000 merely by inserting missing components in the holes already marked for them and making minor alterations to the print. This article describes how to do this. In addition, later versions of the VT8000 differ from earlier ones in that the play light flashes when visual search is selected and the plug-in remote control performs all functions (in early versions it operated only pause and frame advance). These modifications are also included.

The flashing play light is a simple modification requiring the addition of only four components to the front switch panel. These are Q2002 (2SC2021), R2017 (8·2kΩ) and R2018 (200kΩ) plus a 1N4148 diode – see Fig. 1. If you decide to retain the red play LED, proceed as follows – if you wish to change to a green play LED, as Hitachi did on later models, see note later.

Fit Q2002, R2018 and R2017, fit a link in the position marked R2029, and incorporate a 1N4148 diode with its anode to the base of Q2002 and its cathode to one of the holes for R2016. Connect a wire from the collector of Q2002 to the anode of the play LED, another wire from R2018 to pin 22 of the clock i.c. (IC101), and finally a wire from the cathode of the 1N4148 diode to the collector of Q911 on the main board.

The circuit works as follows. During play, Q2002's base is earthed via Q911, thus keeping Q2002 turned off and preventing the pulses from pin 22 of the clock i.c. (the colon output) being applied to the play LED which remains alight. During visual search the collector of Q911 rises towards 9V, with the result that the pulses from IC101 switch Q2002 on and off. This alters the voltage across the play LED which then flashes.

Unfortunately, due to the diode's forward resistance and Q911's collector-emitter resistance the base of Q2002 is not completely earthed. So some experimenting with the values of R2017 and R2018 may be necessary to prevent the LED flashing during play – it depends on the LED's current consumption. The values given worked on my machine. The current consumption of a green LED is much higher, so if you decide to use one of these use a 47kΩ resistor in the R2018 position and change R2010 to 820Ω.

Full Wired Remote Control

The control buttons on these Hitachi VCRs operate by varying the resistance applied to an A/D converter which converts the input to a form the microprocessor i.c. can understand. As a result, no matter how many functions are performed by the front control panel or the remote control unit only two wires are required between these items and the system control panel. The resistors used are contained in a thick-film assembly – one on the front switch panel board and another in the remote control unit. Since the assembly is already fitted to the two-function remote control unit supplied with earlier models, all that's required to turn it into a full remote control unit are the extra switches and buttons.

The spaces for the switches are already present in the PCB while the holes for the buttons are already in the plastic front. The layout of the resistor chain is shown in Fig. 2. Remove the metal trim and fit as many or as few switches/buttons as required. If the fast or slow buttons are fitted, the fast/slow modification described below should be carried out. As the buttons are connected to the various pins of the resistor network by wires, you can choose the switch layout to suit yourself. Any calculator type switches can be used. You could, using the thick-film resistor unit, make a keypad or control box to your own design.

Fast/Slow Play

The fast/slow speed modifications require work on the visual search board at the rear of the machine, the main board underneath and the addition of two switches on the front control panel.

On the front control panel, fit switches in positions S2009 and S2010 (part no. 5633351 – buttons 6053421). Remove the black plastic oblong next to the frame advance cut-out in the front panel to enable the buttons to be fitted.

On the main board, remove the link from the collector of Q506, then cut the print and fit a diode with its cathode to the emitter of Q506 as shown in Fig. 3. Fit links to positions K621, K622, K626, K629, K630 and K636, then fit the following items (see Fig. 4.):

Q506	2SA673C	R573	47kΩ
Q512	2SC2021	R579	100kΩ
Q523	2SC2021	R580	100kΩ
D503	DAN201	R631	47kΩ
D506	DAN201	R632	220kΩ
D507	1N4148	R633	100kΩ
D508	1N4148	R634	10kΩ
D509	1N4148	R635	10kΩ
D518	DAN201	R654	220kΩ preset
R572	47kΩ	R655	220kΩ preset

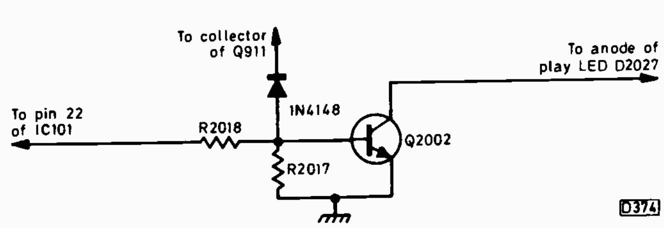


Fig. 1: Flashing play light modification.

R663	47kΩ preset
R664	22kΩ preset
VR502	500kΩ part no. 5005024
Knob for above, part no. 6283041	

Change R536 from 120kΩ to 8·2kΩ. The DAN201 diodes are three-terminal devices consisting of two diodes with a common cathode connection – a pair of 1N4148 diodes can be used instead. A point to note is that D503 is used to mute the sound during fast and slow play – if you wish to retain the sound during these operations, omit D503. Listed equivalents for the 2SC2021 are types 2SC458D, 2SC945P and 2SC1740R, but most general-purpose npn transistors will probably do. If you use miniature presets you'll find that the holes are not quite right, but provided you use the enclosed plastic type the legs can be bent sufficiently to fit.

Finally the visual search board. It's first necessary to determine whether your machine is fitted with the early or later type of board. The later type has four straight edges, whereas the early type had only two with cut-outs in the other two.

In the early type, remove the link joining R1102 and R1103 and the link in position C1105. Alter the print and fit R1175 (22kΩ), R1176 (100kΩ) and D1115 (1N4148) as shown in Fig. 5. Then add C1105 (0.0047μF), R1102 and R1103 (220kΩ presets) and a wire link to TP502 on the main board.

In the later type, remove the link fitted to R1102 and the link adjacent to pin 7 of IC1102 (see Fig. 6). Fit a 22kΩ resistor as shown and a wire to TP502 on the main board. Remove link K1135 and fit the following parts: IC1103 (μPD4001), D1102/3/4 1N4148, C1105 0·0047μF, R1102/3 220kΩ presets, R1159 4·7kΩ, R1160 10kΩ and R1167 10kΩ. Note that D1103 is fitted in the position formerly occupied by K1135, and R1160 is situated adjacent to R1164 by plug PG1101.

Following these modifications, the circuits must be set up. Using a tape previously recorded on the machine, select play and check that playback is still normal. If you cannot get the machine to track correctly and the tracking control appears to have no effect, check Q506 and associated components – this transistor switches in the normal tracking control during play and disconnects it during fast or slow speed operation.

If play is normal, select fast speed. Check that the tape speeds up. If it doesn't, try adjusting the fast capstan preset R664. If this has no effect check Q523 and associated components. Note that you will almost certainly have bands of noise moving up or down the screen at this point.

If fast is o.k., select slow speed and check that the tape slows down. If not try adjusting R663, and if necessary check Q512 and associated components.

If this all checks out we can move on to the actual setting up. First the capstan speeds. Two procedures are given, with or without the use of a scope.

Without a scope: Short together TP509 and TP510 on the main board (near IC504). Play back a tape and select fast. Adjust R664 so that any bands of noise are as near stationary as possible (this should occur in the centre part of the track). Select slow and repeat using R663. Remove the shorting link. Check that any bands of noise do not move in either fast or slow.

Using a scope with external trigger input: Connect the scope to TP501 and the external sync input to TP513. Short together TP509 and TP510. Play back a tape and select fast. Adjust R664 so that the sample pulse is stationary on the ramp – see Fig. 7(a). Then select slow and adjust R663 so that the sample pulse is again stationary – see Fig. 7(b). Note that at half speed the pulse occurs on alternate ramps only. Remove the shorting link and check that the sample pulses remain stationary about half way up the rising ramp.

Next the tracking adjustments. Play back a tape and select fast. Adjust the fast tracking preset R655 so that any noise band on the picture moves off the screen. Select slow and set the slow tracking control VR502 to mid-position. Adjust the slow tracking preset R654 so that any noise band on the picture moves off the screen.

Finally the VD pulse adjustments. Play back a tape and select slow. Adjust R1102 and R1103 (fitted to the visual search board) to remove any vertical jitter on the picture. This is a very delicate adjustment, and with some TV sets, e.g. ITT models, it's not always possible to remove the jitter completely.

This completes the setting up. You should now be able to go straight from play to fast or slow without any loss of picture – if you get a rolling band of noise for a few seconds before the picture settles, the appropriate capstan speed control needs slight adjustment. The picture quality obtained at fast or slow speed should be similar to that in normal play. Note however that the slow speed may in particular not be very good on tapes recorded on a different machine, though adjustment of the slow tracking control VR502 should help.

Tape Index Modification

The tape index modification is as follows – changes to the front switch panel and the audio panel are required.

Beginning with the front switch panel, i.e. the panel with the controls mounted on it, fit the following parts: R2001 15kΩ, R2003 10kΩ, C2002 10μF (25V) and D2003 DAN201. In addition, cut the print by D2001 as shown in Fig. 8. Remove the plastic cover fitted to the memory switch to enable it to be switched past the off position to the tape index position. Leave the panel out and proceed to the audio board at the side of the machine.

Remove the link fitted in the IC403 position, the capacitor in the C456 position and the link adjacent to R466, then fit a link in the position marked K411. Amend the print and fit a diode as shown in Fig. 9. Fit the following parts:

Q417/8/9	2SC2021	C458	100pF
Q420	2SC2021	R461	33kΩ
Q422	2SC2021	R462	82kΩ
D412	1N4148	R463	220kΩ
D415	1N4148	R464	33kΩ
C443	1μF, 50V	R465	560Ω
C444	22μF, 10V	R466	2·2Ω
C452	10μF, 16V	R473	56kΩ
C453	0·047μF	R474	4·7kΩ
C454	10μF, 16V	R475	220kΩ
C455	10μF, 16V	R476	10kΩ
C456	330pF	R477	4·7kΩ
C457	10μF, 16V	R478	100kΩ

Also IC403 HA1406 (part no. 5350251) and L404 12μH (part no. 5152075). Connect a wire from PG405 pin 1 to CN405 1 on the front switch board and a wire from PG405 2 to CN405 2.

Finally a new tension arm/tape index head assembly

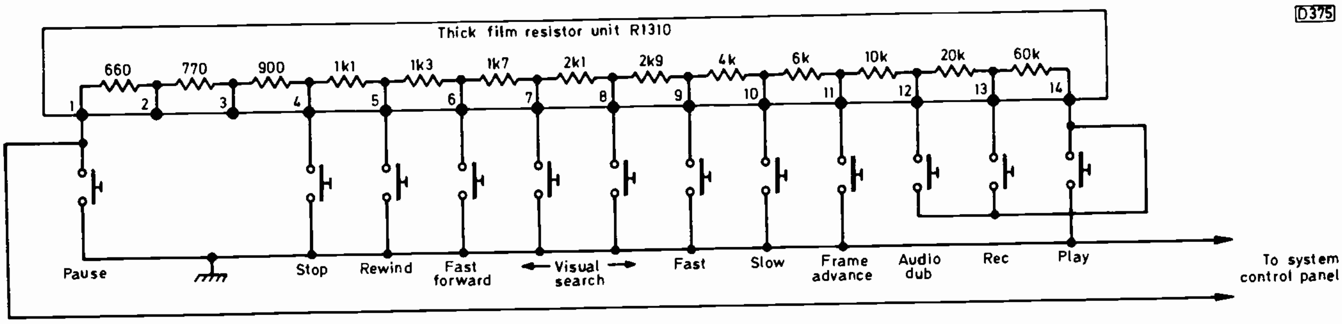


Fig. 2: Control button circuit.

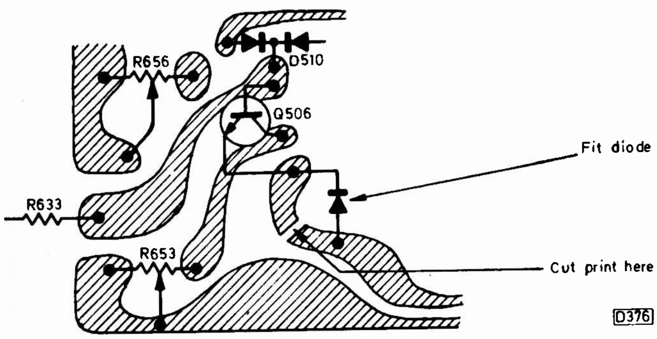


Fig. 3: Fast/slow modification, main board.

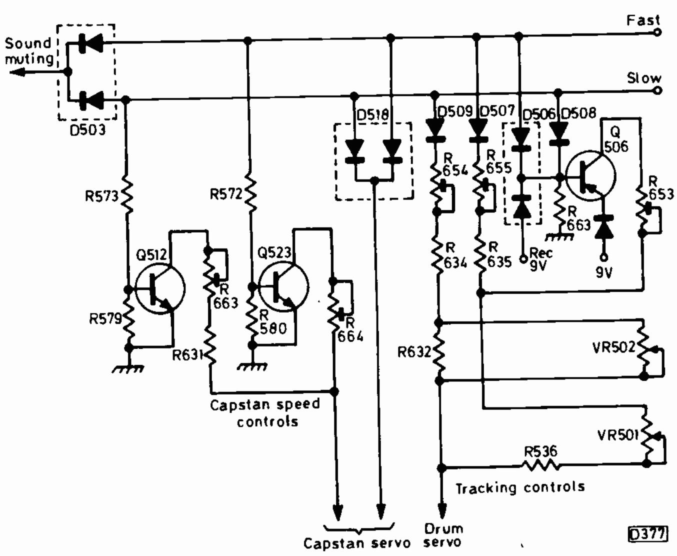


Fig. 4: Fast/slow play circuit extras on main board.

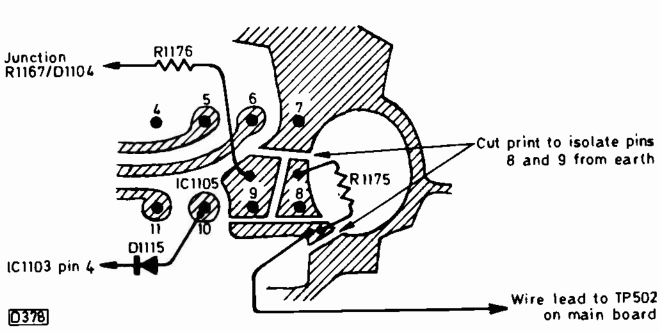


Fig. 5: Fast/slow modification, early visual search board.

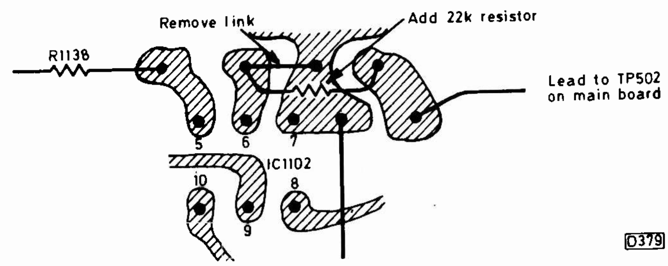


Fig. 6: Modification to later visual search board.

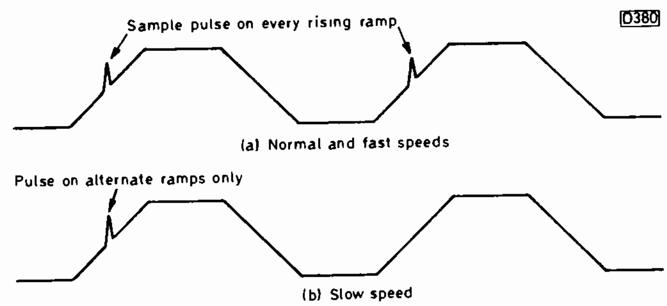
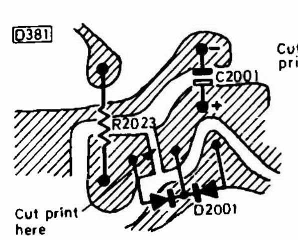


Fig. 7: Fast/slow setting up with an oscilloscope.



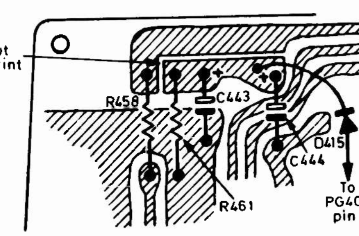


Fig. 8 (left): Tape index modification, front switch panel.
Fig. 9 (right): Tape index modification, audio board.

(part no. 7041821) must be fitted. Remove the cassette housing by undoing the four fixing screws, and the circlip securing the old assembly. The new assembly can then be fitted – the circlip is not needed due to the different design of the nylon mounting on the new assembly. No alignment is required. Replace the cassette housing, and connect the head to PG407 on the audio board.

The VCR can now be reassembled and tested. During recording, a signal is applied to the tape for about two seconds after loading is complete via the full erase head. During fast forward or rewind this signal is detected by the index head which feeds a pulse to the microprocessor i.c. to tell it to stop the tape. This happens only when the memory switch is set fully to the left of course, i.e. in the tape index position.

To test, set the switch to index, zero the counter and start recording. When the counter reaches five, stop the machine then start another recording. Repeat this at 10. At 15, stop and select rewind. If all is well you should find that the machine stops at 10, 5 and 0. Similar results should then be obtained on fast forward. If you encounter problems, refer to the circuit and check voltages. In addition you can check that on record you get a pulse of approximately two seconds duration at the base of Q402 just after loading. This pulse will not be very large, but will indicate that the signal is being put on the tape so that the fault is probably on the detector side.

Video at CETEX

Steve Beeching, T.Eng. (C.E.I.)

YOURS truly accompanied by Elaine managed to spend a couple of days at the CETEX trade show at Earl's Court at the end of May. I hope that the following notes will be of interest to those of you who didn't manage to make it.

Quite a few of the VCRs on show were what I call "cover" versions – I still look upon Ferguson machines as cover versions of the JVC ones, technically anyway. Not that any effort is made to conceal the fact that for the present at least they come off the same assembly lines. Teleton were showing a new release that's obviously a Toshiba V8600: odd that, since the V8600 is being discontinued as stocks run out. I still admire the Toshiba V8600/V8700 machines – the systems control electronics are superb, with a very novel interface for the infra-red or cable remote control arrangements, and of course the four-head system gives super stills and slow motion. JVC produced VHS recorders were also being shown by Telefunken – they have v.h.f./u.h.f. tuners. The front panel styling is very German, and you may be interested to hear that I've had through my hands imported machines with identical styling to these Telefunkens but with Ferguson written on them instead.

Varied Reception

I had some fun at the show, and some experiences that can't quite be classified in this way. On the Cap Ten stand for example I mentioned a problem one of my customers had with an NEC machine. The very day it was delivered to him and set up a tape jammed in it. He wanted to play films from my library, so he asked me to repair the machine which I did. Now the machine came from somewhere near Birmingham, so I suggested to Cap Ten that the distance between there and Newark would not exactly assist with the provision of a good back-up service. Perhaps they would give me a spares and service account? I was politely told that they backed only dealers who sold their products and that anyway they did their own servicing. My feeling is that Cap Ten is another video company that will have to learn by its mistakes.

The easiest way to get ignored on the Philips stand was to jump up and down in front on their VR2025 shouting "it's a Grundig!". Didn't I say so some time back? Anyway, there'll be an improvement on the V2000 front. Then there was the LaserVision disc. Very good pictures, but will the public go for it? Or for Russian TV via satellite for that matter – they don't show much Tom and Jerry in Russia you know!

New Equipment

Sony had their C6 on show, but no mention of the C9: perhaps they've lots of C7s to get rid of yet. Mind you, they don't seem to want dealers – you couldn't get on their stand without an invite. The C6 is a very large machine, but the new portable SLF1 looks good and seems to produce very good pictures – Sony are certainly masters at that. Did you know that this machine threads the tape clockwise and not anticlockwise as per standard Beta? Not only that but, don't tell anyone, it also approaches the VHS M-wrap technique. As one threading pole pulls the tape around clockwise, another takes it a short distance anticlockwise to the capstan drive spindle: not quite M-wrap, but getting there. The mechanical arrangement is still Beta compatible, with the advantage of being compact. The height of the SLF1 is not much more than the depth of the cassette compartment, and the width not much more than that of the cassette, but oh my isn't it deep?!

Hitachi receive the Beeching Award for the greatest number of model changes in the shortest time – 8000, 8300, 8500, 8700, 9300, 9500 and soon to follow the 9700. As a customer once remarked, "with Granada doing them as well you'd have thought they'd have got it right by now!"

We wandered on to the Akai stand. Now I don't think we have the plague, but no one asked us what we wanted. All by myself I found a new machine that makes timer programming easier by putting the instructions on the screen. I couldn't fathom it out however, and as no one seemed interested in showing me I came to the conclusion that it was suitable only for accomplished computer programmers and not for the general public.

Hence to my friends on the JVC stand, where I had a play with two new colour cameras. The GX44 is small and cheap, with an electronic viewfinder – definitely good value. The GX59 was also new, a cut down version of the fantastic S100. It looks a bit like the Sony HV3000 in its styling, even to the extent of having auto-fade, something that's not available on any other JVC camera. The star of the JVC stand was the new HR7650 VCR, which is technically more advanced than the HR7700 – there's a microprocessor in the capstan servo for insert and assembly editing. Had an argument on the stand with a chap over the popularity of simultaneous TV/f.m. stereo broadcasting and the effectiveness of the HR7650 to cope with it. He turned out to be fellow scribe Barry Fox. The HR7650 also has this audio select switch which switches between tuner and line – it means that you can record video plus mono audio from the VCR's tuner, or switch the audio switch over to line and record stereo from an external source, obviously an f.m. tuner. None of the other stereo VCRs, apart from Ferguson, could do this.

As we all now know, the launch of the JVC VHD disc has been postponed till next April. My feeling is that when it does come it will be more than just a disc player, more of a sophisticated video games unit as well. In the States, Atari have announced a computer console to interface with VHD players . . .

Toshiba were showing a new range of TV sets with an isolated chassis. This would make them suitable for receiver-monitor conversion, and I may well do this and publish the results. The new V9600 VCR features front loading, cue and review, picture pause and styling in the hi-fi class. At a suggested price of £359, what more is there to say? It's bound to take the market by storm if Toshiba can bring in enough during the autumn. I hope that Toshiba don't loose the support of their dealers by selling through the discount outfits.

Hotel Shows

Two major VCR manufacturers, Sanyo and Panasonic, held hotel shows instead of having stands at Earl's Court. Sanyo revealed a down-market machine for autumn release. It has monochrome picture search, still frame and a recommended price of £349. The VTC5300 is still available at £369. There was also a portable kit, a nice little recorder plus tuner and power unit. The problem is that you have to buy the camera as well, and the performance of this is not particularly good – green at low levels and pink white highlights, in fact not very good colour at all.

A fairly tired pair finally arrived at the Panasonic show. Now Newark Video are not Panasonic dealers, though we support them by maintaining their products – to our high standard. Having seen the latest range I've decided that we ought to be Panasonic dealers. There will be a top of the range NV7800 to supplement the NV7200 and NV2010, and two basic machines – the NV360 and NV333, the latter with a suggested price of about £420. There were also some industrial models on show, and noises coming from the USA hint of editing machines with flying erase heads on a six-headed drum. Also the forerunner of another Beeching prediction – dynamic track following on a VHS machine. This has got to come eventually. I suggest that when high-quality Video Fi equipment starts to appear in two-three years' time we'll find DTF on both VHS and Beta machines.

That book's now finished and should be available early next year – the title will be *Domestic Videorecorder Techniques – a Guide to Service Manuals*. Now that it's off my plate I'll be able to devote more time to reporting on VCR faults and technology for the magazine.

TEST CASE

236

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.

The market for large-screen monochrome TV sets has shrunk markedly in recent years. Monochrome portables on the other hand are steady sellers, though at prices around the £50 mark we fear that neither the manufacturer, the importer (with only one or two shining exceptions, the vast majority are foreign made) nor the dealer can be making much money out of them! Plastic cases, minimal component count and super-definition are the characteristics of these little sets.

A while ago a very nice, slightly older model came into the workshop. Made by ITT and housed in a real plywood cabinet, it was a 15in. set fitted with the VC402 chassis. This is almost identical to the better known VC400 and VC401, but is a mains only version. The problem was simple – a dead set. A fault of this sort is not usually difficult to diagnose and, armed with a multimeter and a circuit diagram, one of our technicians waded in. The power supply is quite straightforward, consisting basically of a mains transformer, a bridge rectifier and a series regulator which provides a stabilised 11V l.t. line – see Fig. 1.

It soon became clear that the series regulator transistor T1 was cut off, with 18V or so at its emitter and nothing at its collector. The driver transistor T101 must be conductive for T1 to turn on, and since T101 receives its base bias from the 24V boost supply a start-up system is required to get the whole thing going. Hence the presence of C101, which charges at switch on, momentarily providing T101 with enough base bias via D106 to get the ball rolling.

Rightly or wrongly, a start was made by replacing T1 and T101 – to no avail. Another kick-start capacitor was shunted across C101, again without result. Time to put the soldering iron down and start to think! On further investigation it was found that the 11V line was coming on momentarily at switch on, then dying as C101 charged. It was appreciated that until the 24V line had risen sufficiently for T101's base voltage to be higher than 11V, the conduction of the two transistors would not be established. So our suspicion was that the problem lay in the 24V supply. D14 and C75 were found to be o.k. however. So what was going on? Answer next month, with another puzzle.

ANSWER TO TEST CASE 235
— page 492 last month —

Last month found us dabbing around a TDA3560 decoder chip in a brand new Thorn TX10 chassis. The problem was no colour, and the only result when the colour-killer was overridden was out-of-lock colour which didn't respond to adjustment of the 8·8MHz oscillator trimmer CV601. We'd replaced the crystal, the chip and the trimmer, and confirmed that the chroma input was present and correct, also the sandcastle pulse and the l.t. supply. Those voltages quoted in the manual were all within tolerance.

We found by foul means (hooking extra trimmers into the oscillator circuit) that we could get the crystal to run at the correct frequency, but the a.p.c. loop wouldn't lock up and synchronise. Finally we got out the scope to look at the various waveforms. The subcarrier was present at pins 25 and 26, which are associated with the crystal, so we moved on to pins 23 and 24 which are linked to the burst phase detector. There are only four components here, an *RC* time-constant network and a couple of filter capacitors (C619 and C621), and we'd already replaced the electrolytic in the *RC* network. Pin 24 presented us with a large line frequency pulse with some spurious oscillatory component sitting on it! Aha! The 0·1μF decoupler C619 must be open-circuit. It wasn't though. What we found on closer examination was a hair-line crack in the print running from pin 24 to C619/R628.

In cases of this sort, it's worth bearing in mind that the reactance of an 0·1μF capacitor at 4·43MHz is 0·36Ω and at 15·625kHz 102Ω.

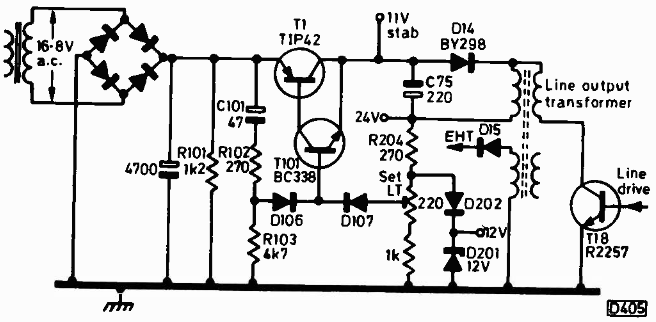


Fig. 1: Power supply arrangements used in the ITT VC402 chassis. C101 discharges via R101 at switch off.

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TELEVISION AUGUST 1982

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The Rediffusion Mk. 4 Chassis

Part 2

Stephen Clay

OUR subjects this month are the timebase and power supply arrangements used in the Mk. 4 chassis. Later articles will deal with the remote control and frequency-synthesis tuning systems used in some models.

Timebase Panel

The sync separator and line generator actions are provided by an ITT TDA1950 i.c. The field sync pulse output is integrated and used to control the oscillator in an SGS-ATES TDA1470A field timebase i.c. – this is similar to the widely used TDA1170. The field oscillator frequency is set by a fixed resistor and capacitor, so that the only field timebase adjustments are for height, linearity and shift.

The line frequency output from the TDA1950 passes via a BF819 line driver stage to a fairly conventional transistor line output stage using a BU208A. The line output transformer provides a reference pulse for the flywheel sync circuit in the TDA1950 i.c., also the tube's heater, first anode, focus and e.h.t. supplies. Deriving these voltages from the line output stage instead of the switch-mode power supply ensures that the tube is cut off in the event of failure of the line output stage. A separate e.h.t. tripler and integral thick-film focus unit are used – the large capacitors in the tripler together with the e.h.t. bleed resistance give better e.h.t. regulation than that obtained with a diode-split line output transformer, where only the inter-winding capacitance is used. A conventional high-level diode modulator circuit is used to provide EW pincushion distortion correction in sets fitted with 110° tubes. The correction parabola generator circuit has adjustments for width and pincushion amplitude.

A crowbar thyristor is connected across the TDA1950's 12·5V supply. In the event of a fault condition that results in the beam current exceeding 3mA, the thyristor is fired, thus closing down the line timebase and removing the tube's supplies.

Sync/Line Oscillator Chip

A block diagram of the TDA1950 i.c. is shown in Fig. 5. One reason for selecting this i.c. for use in the Mk. 4 chassis was its very good performance with VCRs – the type of i.c. that uses count-down circuitry can give problems in this application. There are two sync separators, one for line and one for field sync. This gives excellent synchronisation under noisy signal conditions – the picture has to be almost lost in the noise before sync is lost. Noise gating and signal filtering are also incorporated within the i.c.

The line sync pulses and the output from the line oscillator are fed to the first phase comparator. The d.c. correction voltage produced by this detector is applied to the oscillator via the filter network connected between pins 13 and 16, thus controlling the oscillator's frequency. This phase-locked loop ensures that the oscillator is locked to the sync pulses, 3RV2 providing preset frequency adjustment. The oscillator's output is also compared, in the second phase detector, with the reference flyback pulse from the line output transformer. The d.c. correction voltage produced by this second phase detector is used to alter the timing of the output pulse fed to the line driver stage. This d.c. correction voltage can be varied by

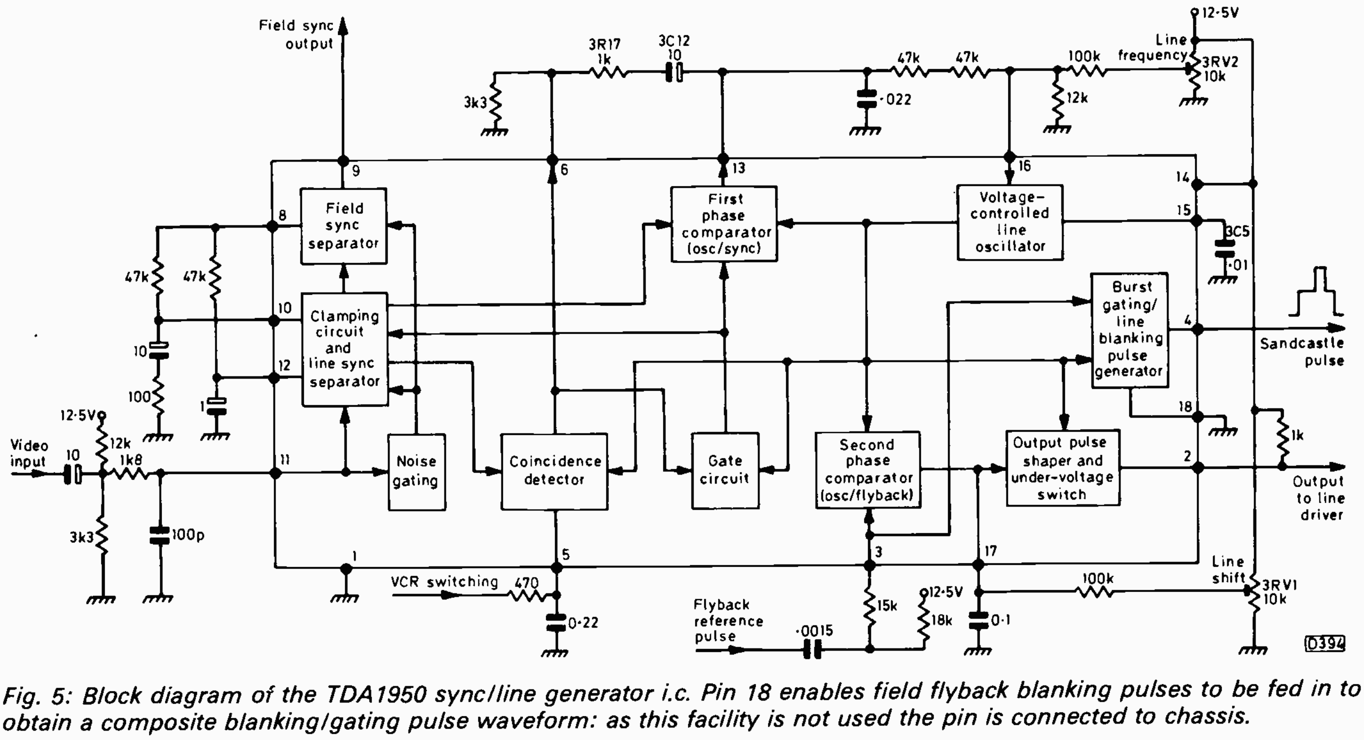

Fig. 5: Block diagram of the TDA1950 sync/line generator i.c. Pin 18 enables field flyback blanking pulses to be fed in to obtain a composite blanking/gating pulse waveform: as this facility is not used the pin is connected to chassis.

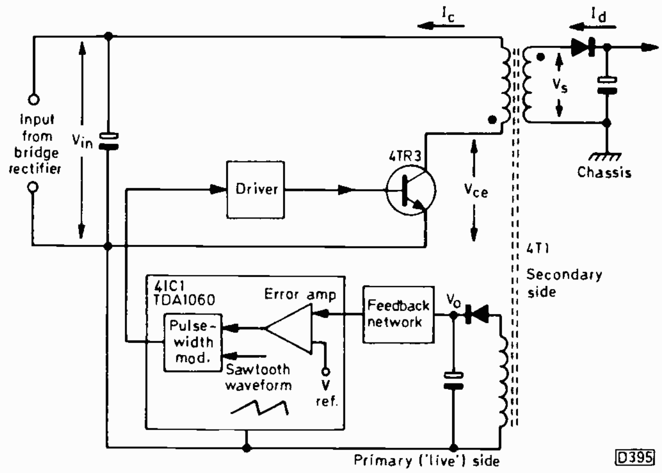

Fig. 6: Basic arrangement of the chopper power supply.

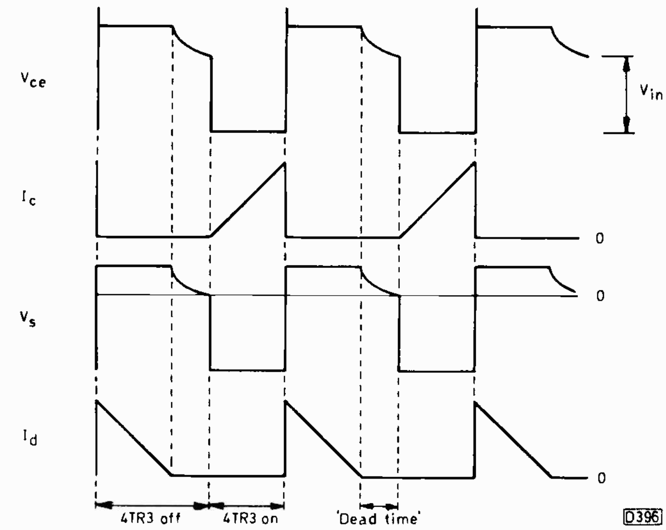

Fig. 7: Power supply waveforms.

3RV1 to give fine adjustment of the line phasing and hence horizontal picture shift. The idea of using a second phase detector in this way is to compensate for different delay times in the line output stage.

A sandcastle pulse is produced in the i.c. by adding the oscillator's output pulse to the line flyback pulse. This composite pulse is fed to the TDA3300B decoder i.c., where the narrow line oscillator component is used for burst gating and the wider flyback component for blanking. Using the line oscillator's output directly ensures that the burst gating is not affected by the setting of the line shift control or by variations in the timing of the flyback pulses.

The oscillator's output pulses and the incoming line sync pulses are also compared by an additional coincidence detector. When the oscillator has locked to the sync pulses, the time-constant network 3C12/3R17 is added to prevent wavy verticals with weak signals. The detector also switches in a gating pulse circuit to further improve the noise immunity. For VCR operation the con-

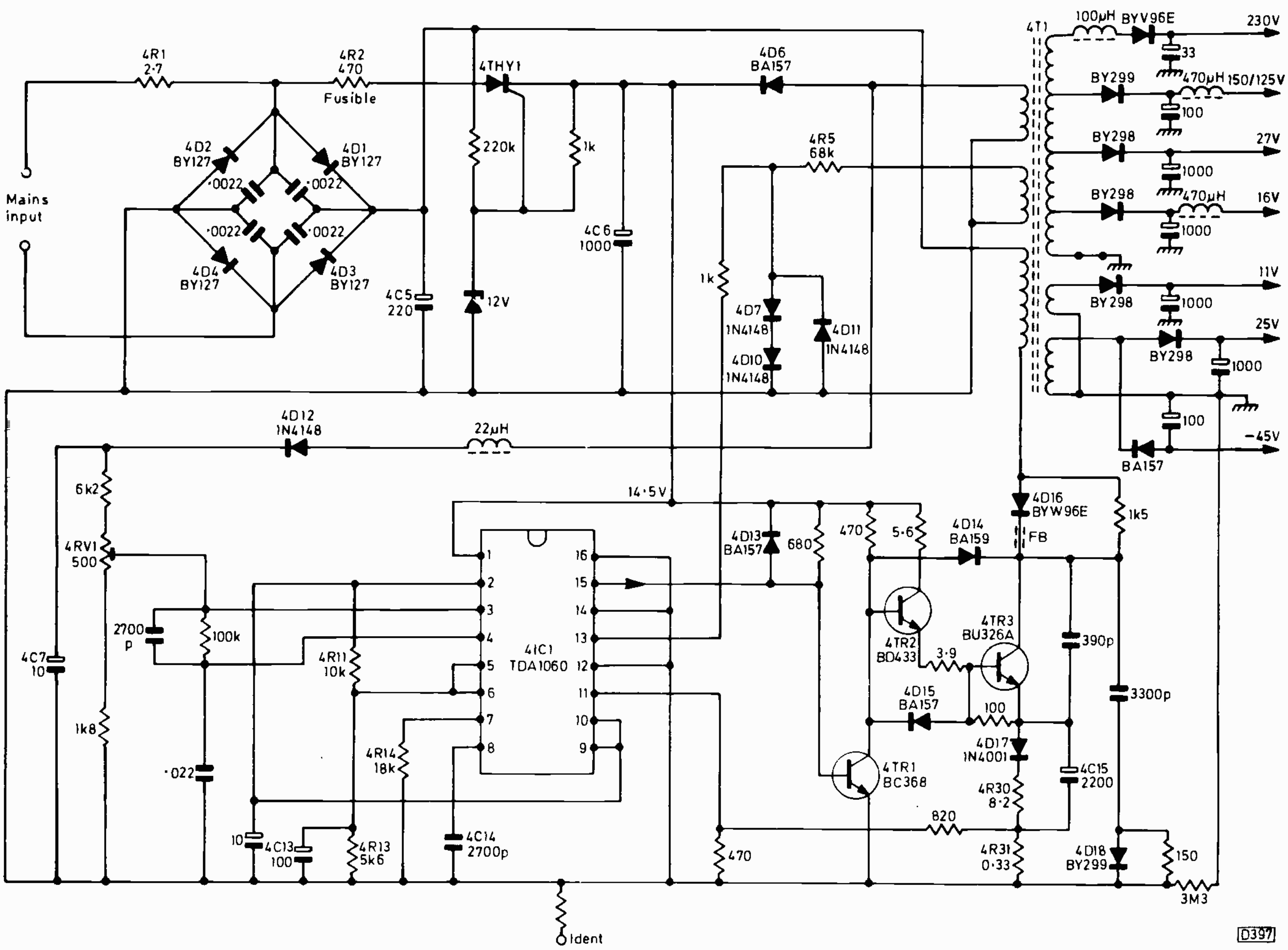

Fig. 8: Full circuit of the switch-mode power supply. The different versions of the board have different value resistors connected to the ident pin so that they can be automatically identified by the production test equipment.

trol loop has to be able to respond to the less stable off-tape line sync pulses. For this purpose a disabling voltage is applied to pin 5, so that the time-constant of the first phase control loop remains short.

The Power Supply

The Mk. 4 chassis uses a self-contained switch-mode power supply with the chopper transformer providing mains isolation. Since the supply has its own oscillator which is not locked to the line frequency, there is no need for an extra transformer to feed back synchronising information – an incidental advantage is that fault-finding is that much simpler. The high chopper frequency of 25kHz means that a relatively small transformer can be used – the frequency is limited largely by the switching time rating of the high-voltage transistors currently available. Secondary windings on the transformer feed rectifiers which provide 230V, 150/125V, 27V, 25V, 16V, 11V and −45V supplies.

The basic arrangement of the supply, which operates on the flyback converter principle, is shown in Fig. 6. A feedback voltage Vo which is proportional to the output voltages is produced by rectifying and smoothing the pulses produced across an additional winding (tightly coupled to the output windings) on the live side of the transformer. An error amplifier in the TDA1060 chopper control i.c. compares Vo with an internally generated reference voltage. The output from this error amplifier is one input of a pulse-width modulator, the other input being an internally generated fixed-frequency sawtooth. The result of "mixing" these two inputs in the pulse-width modulator is a variable mark-space ratio output whose on/off times depend on the feedback voltage. This output is fed via a driver stage to the chopper transistor 4TR3, varying its conduction period.

The waveforms in this circuit are shown in Fig. 7. From these it can be seen that current flows in the output circuit(s) only when there is no current flowing in the input circuit, i.e. when the chopper transistor is switched off. This has the advantage that the transistor's turn-on losses are low, since the chopper transistor turns on at zero current. The outputs are fail safe for 4TR3 being either short- or open-circuit.

Full Circuit

Fig. 8 shows the full power supply circuit. The Mullard TDA1060 i.c. was designed for switch-mode power supply applications – not just in TV receivers. The mains bridge rectifier 4D1-4 produces some 330V across its reservoir capacitor 4C5, while for start-up purposes thyristor 4THY1 produces about 12V across 4C6 for pin 1 of the i.c. Once the power supply has started up, the supply for the i.c. is derived from 4D6, 4THY1 then being reverse biased. 4C13, 4R13 and 4R11 form a slow-start circuit so that the duty factor of the output pulses increases slowly: gradually increasing outputs are thus obtained from the supply.

The feedback voltage (Vo) is obtained from 4D12/4C7 and fed to pin 3 of the i.c. via 4RV1. The output from pin 15 of the i.c. is applied to the chopper transistor 4TR3 via a driver stage. When the voltage at pin 15 is low, 4TR1 is off and 4TR2/3 are on. Therefore current flows in the primary winding of the chopper transformer 4T1. When the voltage at pin 15 is high, 4TR1 switches on: 4TR2's base is thus grounded and the drive to 4TR3 is removed – 4D15 conducts to remove the stored charge in 4TR3, thus ensuring that it switches off quickly, while 4D17, 4R30 and 4C15 provide a small standing d.c. voltage at the emitter of 4TR3 to ensure that it remains off. The sawtooth generator's frequency is determined by 4C14 and 4R14.

Protection Arrangements

Protection of the power supply is required should a short-circuit on one of the output lines occur due to a fault elsewhere in the receiver. This condition is detected by an additional winding on the output transformer, again tightly coupled to the output. The waveform developed across this winding is clipped by 4R5/4D11/4D7/4D10 and fed to pin 13 of the i.c., which responds to an overload by preventing 4TR3 being turned on. Once the stored energy in the transformer has been dissipated, this inhibiting action ceases and the circuit continues to function normally – assuming that the short on the output, due for example to a flashover, has been removed. If the short-circuit is still present the circuit shuts down again.

To provide protection against excessive current through the chopper transistor, the voltage developed across 4R31 is applied to another i.c. inhibit input – pin 11. This stops the circuit action completely until the power supply has discharged. The power supply then starts up again, with the slow-start action – assuming that the fault has been cleared.

It's desirable that in the event of a permanent fault the power supply should be totally disabled rather than cycling off and on. Any condition that causes the i.c.'s supply from 4D6 to drop will result in the i.c. taking its supply from 4THY1 instead. So a fusible resistor is connected in series with 4THY1. This will go open-circuit should 4THY1 be asked to provide the supply for the chopper control circuit continually.

90° Version

Since the 20in. tube fitted in the smaller-screen, 90° versions of the chassis does not require pincushion distortion correction, the EW parabola generator and diode modulator circuits are omitted in these sets. This means that width control must be provided by alternative means – a variable inductor is connected in series with the line scan coils in place of the diode modulator transformer. The field scan coil impedances differ, so there are component value changes around the TDA1470A i.c. in these models. Similarly, because of the different line scan coil impedances there's a different line output transformer plus component value changes in the line driver and output stages.

The line output stage used in the 90° version requires a 125V h.t. supply instead of the 150V the 110° version requires, so the power supply panel is fitted with a different chopper transformer. Links on the timebase and power supply panels ensure that an incorrect combination of panels will disable the supply to the line output stage.

Safety

The mains isolated chassis makes servicing of most of the receiver safer, but it's essential that a separate isolation transformer is used when carrying out servicing on the mains side of the switch-mode power supply – this includes the mains switch, degaussing circuit, etc.

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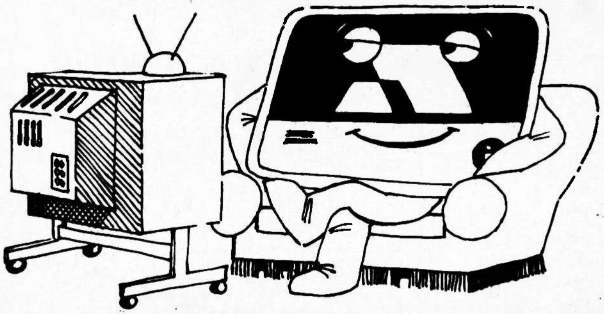

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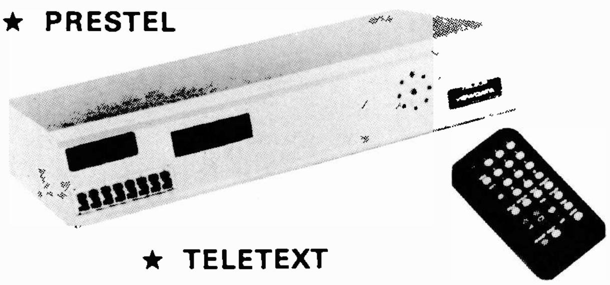

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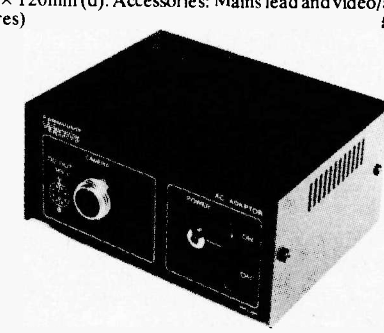

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