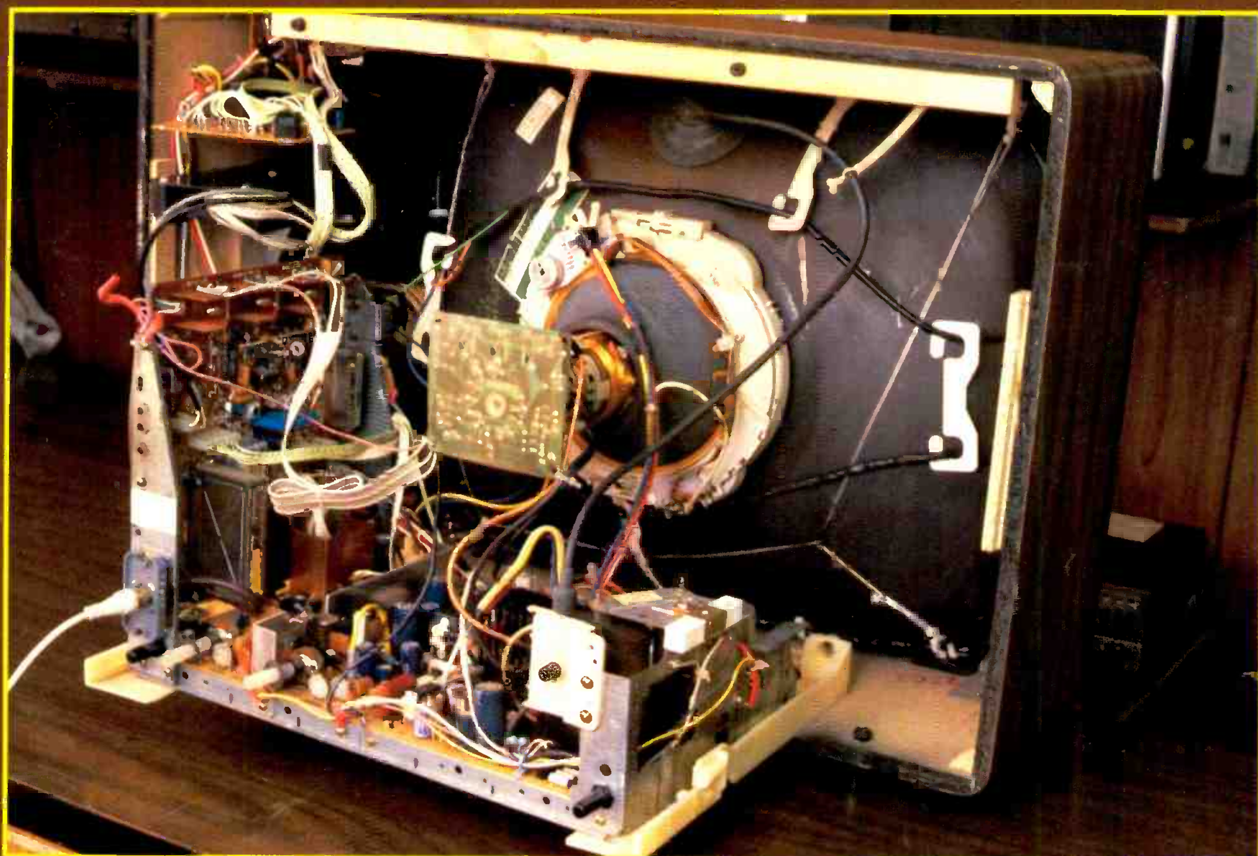
FEBRUARY 1985 Australia $1·80, New Zealand $2·20, Malaysia $5·50 £1·10

TELEVISION

SERVICING·PROJECTS·VIDEO·DEVELOPMENTS

★ EXTRA PAGES THIS MONTH ★



Servicing the Panasonic TC2205

Low-noise 11GHz Converter

Workshop Decoder Alignment

Service Briefs • DX-TV

High-power UHF Transmitters

VCR Clinic • TV Fault Finding

TELEVISION

SUBSCRIPTION SERVICE

A TV licence enables a householder to enjoy viewing without fear of interruption by callers from the BBC detector van. In the same way a subscription to Television enables you to update yourself on the latest developments without fear of interruption because copies have been sold out.

A regular subscription overcomes this problem. You know how annoying it can be when you have a gap in an important series of monthly articles. Why not avoid sell-out disappointment by arranging for Television to be delivered to you direct from the publisher? Just fill in the the order form overleaf and post in the addressed envelope attached. Then leave us to do the rest.

GIFT SUBSCRIPTIONS

A subscription to Television makes an ideal gift for someone in the same line as yourself. All you have to do is complete the appropriate section of the order form and post in the same way. When we receive it, then we take over. We'll even send a card announcing your gift with your own personal message on it.

TELEVISION
Subscription Service
...we'll keep you posted.

TELEVISION

SUBSCRIPTION RATES

	Twelve Months	Six Months
UK, CI, IOM, IR	£11	£5.50
Overseas	£12	£6

AIR MAIL rates available on request.

Please register the Television subscription(s) below:

- I enclose payment (cheques payable to Television) ☐
- Charge my credit card account: ☐

name of card ______________________

valid from ______________ to ______________

Card no. ☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐

Name ______________________ 52 weeks ________ ☐

Address ______________________ 26 weeks ________ ☐

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I would like to arrange the gift subscription to the person named below. (Enter your own name and address above as donor).

Name ______________________ 52 weeks ________ ☐

Address ______________________ 26 weeks ________ ☐

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______________________ Total amount £S ________

GIFT SUBSCRIPTION MESSAGE TO RECIPIENT

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DETACH HERE

TELEVISION

February 1985

Vol. 35, No. 4
Issue 412

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., King's Reach Tower, Stamford Street, London SE1 9LS.

SUBSCRIPTIONS
An annual subscription costs £11 in the UK, £12 overseas (by surface mail). Send orders with payment to Quadrant Subscription Services Ltd., Oakfield House, Perrymount Road, Haywards Heath, Sussex, RH16 3DH.

BINDERS AND INDEXES
Binders (£4·50) and Indexes (45p) can be supplied by the Post Sales Department, IPC Magazines Ltd., Lavington House, 25 Lavington Street, London SE1 0PF. Prices include postage and VAT. In the case of overseas orders, add 60p.

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

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

this month

OUR NEXT ISSUE DATED MARCH WILL BE PUBLISHED ON FEBRUARY 20

P. V. TUBES

TEL: 0254 36521/32611

104 ABBEY STREET, ACCRINGTON

T.T.L. 74LS SERIES

74LS00	58	74LS37	35	74LS92	65	74LS160	90	74LS245	2.30
74LS02	58	74LS38	35	74LS93	60	74LS161	85	74LS251	65
74LS03	58	74LS40	35	74LS107	80	74LS162	4.04	74LS253	95
74LS04	58	74LS42	80	74LS109	58	74LS163	85	74LS257	1.20
74LS05	58	74LS47	85	74LS112	50	74LS164	85	74LS258	95
74LS08	58	74LS48	83	74LS113	44	74LS165	1.50	74LS259	1.70
74LS09	58	74LS49	33	74LS114	70	74LS173	1.32	74LS273	1.90
74LS10	58	74LS51	33	74LS123	80	74LS174	85	74LS283	1.30
74LS11	58	74LS54	43	74LS125	85	74LS175	85	74LS293	1.20
74LS13	37	74LS55	60	74LS126	60	74LS191	1.02	74LS352	1.40
74LS14	46	74LS73	60	74LS132	63	74LS192	1.30	74LS353	1.40
74LS15	33	74LS74	65	74LS138	83	74LS193	1.30	74LS365	75
74LS20	35	74LS75	65	74LS139	65	74LS194A	75	74LS366	82
74LS21	35	74LS76	65	74LS151	85	74LS197	95	74LS367	1.65
74LS22	35	74LS78	65	74LS153	85	74LS240	2.20	74LS368	65
74LS26	44	74LS83A	89	74LS155	65	74LS241	2.20	74LS373	1.40
74LS27	35	74LS86	39	74LS156	1.02	74LS242	2.20	74LS374	1.55
74LS30	35	74LS85	98	74LS157	78	74LS243	2.20	74LS393	1.20
74LS32	90	74LS90	1.22	74LS158	65	74LS244	2.20	74LS670	1.78

VOLTAGE REG.

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

'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		

I.C. SOCKETS

DIL to DIL

8 way	22
14 way	29
16 way	32
18 way	32
20 way	32
22 way	32
24 way	34
38 way	45
40 way	84

DIL to QUIL

14 way	32
16 way	34
18 way	37

QUIL to QUIL

14 way	32
16 way	36

MAINS DROPPERS

DECCA 20	2.48
DECCA 27R/47R	1.40
DECCA 56R/6R8	1.40
R.B.M. A823 56R/68R	94
R.B.M. 161	82
GEC 2000/2018	70
GEC 27840	64
PYE 713/15 3R5/15/45R	1.80
PYE 725/31 3RO/56R/27R	1.84
PYE 725 56R/27R	1.04
PHILIPS 210/5050 30R/125R/2k85	1.75
PHILIPS 210/5051 -/118R/148R	93
PHILIPS G8/5081 47R Section	50
PHILIPS G8/5083 2R2/68R	95
THORN 1400	1.20
THORN 1500	1.38
THORN 1600	1.77
THORN 3500	94
THORN 8000	1.24
THORN 8500	1.36
THORN 9800	1.30
DECCA 3R9 Modulohm	60

NEW VALVES

30FL2	1.70	EF183	99	PCF800	1.38	PL508	2.90
DY802	98	EF184	1.09	PCF801	1.13	PL509/19	
DY86/7	66	EH90	1.02	PCF802	1.12		5.30
ECC81	1.08	EL34	3.50	PCF805	1.80	PY88	81
ECC82	98	EL84	1.05	PCF806	1.30	PY500A	2.30
ECC83	1.07	EY86/7	68	PCF808	1.63	PY800/1	69
ECC84	80	EY500A	1.50	PCH200	1.45	UCH81	2.25
ECC85	98	EZ80/1	56	PCL82	1.20	UCL83	1.82
ECC88	1.35	GY501	1.45	PCL84	1.20	UY85	1.35
ECF80	80	GZ34	3.50	PCL86	92	PL802T	4.00
ECF82	88	KT66	8.50	PCL805	1.09	40KD6	5.30
ECH81	1.60	KT88	12.00	PD500	2.93	21LU8	3.00
ECH84	1.66	PC92	3.00	PFL200	1.86	17DW4A	1.60
ECL80	84	PC97	1.65	PL36	1.87	3AT2B	5.00
ECL82	1.30	PCC85	85	PL81	94	12BY7A	3.75
ECL86	1.99	PCC805	1.40	PL83	1.43	12HG7	3.20
EF80	95	PCF80	1.00	PL84	84		
EF86	1.96	PCF200	1.35	PL504	1.65		

THERMISTORS

VA1104	75
VA1040	75
VA8650	55
VA1039	35
GEC Dual Posistor	1.68
GEC Dual 2040 (CK1)	1.98

THERMAL CUT OUT

THORN 3000 2A Metal	1.60
GEC 2040 Metal	2.50
THORN 8000 Plastic	2.35

L.E.D's

5mm Red, Green, Yellow	14
T1 ¾ Amber	22
T1 3mm Red, Green, Yellow	14
Flashing Red CQX21	62
CQX22	66
3 Colour VJ18P	76
Panel Clips 3mm	4
5mm	4

CRYSTALS & FILTERS

6Mhz	74
5.5Mhz	74
4.3Mhz	1.30
8.8Mhz	1.30
9.94Mhz	6.00
10.692Mhz	6.00

MULTITURN POTS

100K	55
GEC TCE	55
PHILIPS G8	
DECCA, RANK	55

SERVICE WITH A SMILE

DISC CERAMIC CAPS

8kV (12kV)
39pF, 200pF, 150pF, 220pF, 180pF, 250pF — 40p

63V/100V
A range of pref. values 22pF-4700pF — 8p

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"	19.50
PHILIPS 320	8.70
PHILIPS 210/300 Mono	10.00
PHILIPS G8	8.75
PHILIPS G9	7.75
PHILIPS G11	13.50
PYE 697 (Printed)	14.50
PYE 713/731	10.00
PYE 725 90°	10.50
PYE 169	10.00
DECCA 80/100	8.58
DECCA 1700	9.00
DECCA 1730	8.58
DECCA 2230	8.58
GEC 2110	16.75
GEC 2040	9.50
ITT CVC 1-9	10.85
ITT CVC 25/30/32	8.65
ITT CVC 20	8.60
THORN 3000 EHT	9.95
THORN 3000 SCAN	7.95
THORN 8000	11.33
THORN 8500	11.33
THORN 9000	10.65
THORN 3000/3500 Mains	10.00
THORN 1591	8.68
THORN 1691	9.68
THORN TX10	12.50
THORN 1615	9.75
PHILIPS KT3	9.70
RANK BUSHRANGER	£10.00
PYE 741	8.20
B+O (2000, 3000)	12.70
B+O (3000 EHT)	18.90

RECTIFIER TRAYS

THORN 950 Mk II	4.25
THORN 1400 3 Stick	5.20
THORN 1500 3 Stick	5.20
THORN 1500 5 Stick	5.29
THORN 1600	4.95
THORN 3000/3500	7.98
THORN 8000	5.28
THORN 8500/8800	7.15
THORN 9000	7.93
DECCA 1730/1830	4.48
DECCA 30	6.76
DECCA 80	6.60
DECCA 100	7.50
UNIVERSAL ITT or REMO	6.00
GEC 2100	7.40
GEC 2200 (20AX)	6.50
GEC 2040/2028	6.60
GEC 2110 Pre Jan '77	7.00
GEC 2110 Post Jan '77	7.00
PHILIPS G8 Short Focus Lead	6.75
PHILIPS G8 Long Focus 550	6.75
PHILIPS G9	6.37
Pye/Philips K3 Tripler	10.65
PYE 691/3	6.58
PYE 713/4 Lead	8.79
PYE 713 Doubler 5 Lead	8.79
PYE 731/725	7.60
R.B.M. A823 (plug in) AV	7.60
KORTING (similar to Siemens TVK1)	7.32
ITT KB CVC5/9	6.90
ITT KB CVC20/25/30 (Mullard)	5.95
RRI T20	6.80

RECTIFIER STICKS

TV11	90	TV18	1.10
TV13	93	TV20	1.23

REPLACEMENT ELECTROLYTICS

PYE 169 (200/200/100/32)	3.40
PHILIPS 320 (400/400/200V)	2.74
DECCA 30 (400/400/350V)	3.40
DECCA 80 (400/350V) DECCA 100 (800/250V)	3.97
DECCA 1700 (200/200/400/350V)	4.83
PHILIPS G8 (600/300V)	2.30
PHILIPS G9 (600/300V)	2.21
PHILIPS G11 (470/250V)	2.90
PYE 691/7 (200/300/350V)	2.70
PYE 731 (600/300V)	2.31
RBM A823 (2500/2500/30V)	1.66
RBM A823 (600/300V)	2.83
RBM Z146 (300/300/350V)	3.55
RR1 T20A (220/400V)	2.00
ITT CVC5/9 (200/200/75/25)	2.98
ITT CVC 20 (220/400V)	2.00
GEC 2110 (600/250V)	1.94
GEC 2040 (1000/2000/35V)	1.19
GEC 2040 (300/300/150/100/50)	4.10
THORN 3500 (400/40V)	30
THORN 950 (100/300/100/16/275V)	1.83
THORN 1400 (150/100/100/100/150/320V)	2.79
THORN 1500 (150/150/100/300V)	2.20
THORN 1500 (12/300V)	31
THORN 3500 (175/100/100/400/350V)	2.78
THORN 3500 (1000/63V)	86
THORN 3500 (1000/70V)	86
THORN 8000/8500 (2500/2500/63V)	3.38
THORN 8000/8500 (700/250V)	2.31
THORN 8000/8500 (400/350V)	2.56
THORN 9000 (400/400V)	3.28
GEC (200/200/150/50)	2.64
PHILIPS 69 2200/63V	1.25
THORN 4700 P/C 25V	1.20
THORN 1591/1691 4700/25V	1.20

CAPACITORS AXIAL

Volts	Mfd	Price			
			63V	1	12
6V3	33	9		2.2	12
10V	22	10		4.7	12
	47	10		10	11
	100	10		15	12
	220	15		22	13
	470	20		47	19
16V	33	11		100	23
	68	11		220	37
	220	16		470	49
	1000	27		1000	58
	3300	53		2200	94
25V	10	11	*100V*	10	13
	22	13		22	15
	47	15		47	20
	100	15		100	36
	220	29		220	70
	470	30	*450*	1	33
	1000	55		4.7	30
	2200	51		10	30
	4700	98		22	65
40V	10	10		33	75
	22	10	*500*	10	32
	400	48	*600*	0.1	41

POLYESTER CAPS

250V 0.01mF, 0.1mF, 0.22mF — 12p

400V 0.01mF, 0.1mF, 0.22mF — 12p

TANTALUM CAPACITORS

6.3V	47mF	42
	100mF	90
16V	10mF	22
	22mF	28
	47mF	1.03
25V	22mF	46
35V	0.1mF	13
	0.22mF	13
	0.47mF	13
	1mF	13
	2.2mF	17
	4.7mF	26
	10mF	57

MIXED DIELECTRIC CAPS

Volts D.C.

250V	0.91mF	1.15	*1250V*	0.1mF	59
400V	0.22mF	29	*1500V*	0.0047mF	32
600V	0.1mF	38		0.022mF	30
1000V	0.01mF	24		0.033mF	62
	0.047mF	46		0.005mF	65
	0.033mF	33	*2000V*	0.0052mF	1.20
	0.1mF	35	*2500V*	0.0022mF	50
	0.22mF	66			
	0.47mF	98			

CONVERGENCE POTS

3W/5R-6RB-10R-15R-20R
50R-100R-200R-500R — 60

METRIC CONVERGENCE POTS

PHILIPS G8
5R-10R-15R-20R-50R — 60

FUSES

	Per type	Pack of 10
1¼" QUICK BLOW		
100ma		73
250ma-500ma-750ma-1A		60
1.5A-2A-2.5A-3A-5A		60
1¼" ANTISURGE		
250ma, 500ma, 600ma, 630ma, 750ma, 850ma, 1A, 1.25A, 1.5A, 2A		1.70
2.5A, 3A, 5A		2.70
20mm ANTISURGE		
80ma		4.80
100ma		2.50
160ma, 200ma		2.20
315ma, 500ma, 630ma, 800ma, 1A, 1.25A, 1.6A, 2A		1.30
2.5A, 3.15A, 4A, 400ma, 5A		1.90
20mm QUICK BLOW		
100ma, 250ma, 500ma, 630ma, 800ma		90
1A, 1.25A, 1.6A, 2A, 2.5A, 3.15A, 5A		60
1" MAINS		
2A, 3A, 5A, 10A, 13A		1.00

NEW MONO TUBES

MULL. A31/510 110° 12"	18.50
MULL. A34/510 110° 14"	20.00
A50/120WR 110° 20"	15.00
A61/120WR 110° 24"	17.50
VEGA 12" 90° (Jap Types)	15.00

MULLARD COLOUREX*

18" A47/343X	59.00
19" A49/120X	53.00
20" A51/110X	53.00
22" A56/120X	46.00
25" A63/200X	55.00
26" A66/120X	65.00
26" A67/120X	65.00
22" A56/500X	60.00
A51 570X	72.00
A56 510	67.00
A66 510	92.00

WHILE STOCKS LAST

NEW TUBES

ATX 56-001	95.00
ATX 51-00X	95.00
A56/610	95.00

REBUILT COLOUR TUBES

ALL AVAILABLE EX-STOCK DN GLASS FOR GLASS EXCHANGE FROM TRADE CDUNTER. SOME TYPES AVAILABLE WITHOUT EXCHANGE FOR SMALL GLASS CHARGE

17" A44/271X	32.00
18" A47/342X (Low Focus)	32.00
18" A47/343X (Stnd Focus)	32.00
20" A51/110X	30.00
19" A49/120X	30.00
22" A56/120X	30.00
22" A55/14X	30.00
25" A63/200X	34.00
26" A66/120X	34.00
26" A67/120X	34.00
22" A56/140X (410X) 110°	36.00
26" A66/140X (410X) 110°	36.00
20" A51/161X	60.00
22" A56/510X	50.00
A56 540X	89.00
A66 540X	75.00
A66 500X	64.00

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

SLIDER POTENT

Lin or Log
470R-1K-2K2-4K7
10K-47K-470K — 65

SKELETON PRE-SET POTS

Standard or miniature Horizontal or Vertical
100R-2M2 — 16p

MIDGET CONTROLS

Insulated Spindle Length 44mm

Log or Lin Without Switch
5K-10K-25K-50K-100K-250K-500K-1M — 54p

With D.P.S.T. Switch
Log: 5K-10K-25K-50K-100K 250K, 500K, 1M, 2M — 97p

Dual gang Controls — 1.25

16mm Rotary Controls 10K, 22K, 100K, 1M, 10K — 39p

THICK FILM RESISTOR NETWORK

THORN 3500 (5 pin connection)	1.98
PYE 731 (6 pin connection)	2.20
THORN 9000 (Circuit Ref. R704/7)	1.98

WIREWOUND RESISTORS*

4W 1R-10K	24p
7W 1R-22K	26p
11W 1R-22K	29p
17W 1R22K	32p

(Preferred values)*

EVER READY BATTERIES

HP2	26	PP6	82
HP7	12	PP7	82
HP11	24	PP9	84
HP16	13	R6PP	17
PP3	42	R14PP	26
PP3-C	53	1289	45

STOP PRESS

Special Prices

5¼" Floppy Disc

	1-10	10-40	50-90	100+
SS/SD	1.61	1.17	1.12	1.05
SS/DD	1.70	1.23	1.17	1.10
DS/DD	2.00	1.44	1.37	1.29

SERVICE MANUALS (Zero VAT)

THORN 1590/1	4.00	VIDEO 3V00	24.00	110	3.90
1615	2.95	3V22	24.00	PHILIPS G8	8.50
1640/1	5.00	3V29/30	33.00	G9	4.20
9000	8.20	DECCA 30	4.75	G11	3.90
9800	6.80	80	5.35	K30	3.90
Tx9	16.50	70/90	3.90	KT3	3.90
Tx10	19.20	100	4.80		

CARBON RESISTORS*

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

Sold in packs of 10 per type i.e. per value

RECHARGEABLES

EVER READY

RX6 (HP7)	1.10
RX14 (HP11)	1.95
RX20 (HP2)	2.15
RX22 (PP3)	3.75
Universal Charger	6.00

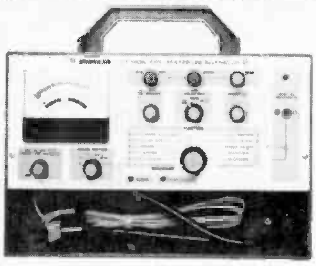
INCREASE YOUR PROFITS IMPROVE YOUR SERVICE WITH RELIABLE COST EFFECTIVE TEST EQUIPMENT

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

Our top selling instrument is designed to readily test the various characteristics and rejuvenation of both colour and B/W C.R.T's.

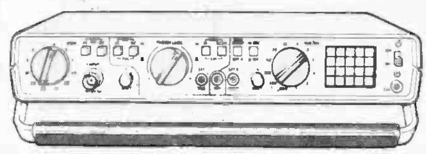
- ★ Tests for shorts and leakage between electrodes.
- ★ Tests cathode emission characteristics.
- ★ Separately checks condition of guns.
- ★ Removal of shorts and leakage between electrodes.
- ★ Checks heater warm-up characteristics.
- ★ Rejuvenation of low emission cathodes with automatic timing.
- ★ Super rejuvenation with manual control.
- ★ Complete with tube base adaptors.

Size: H 230mm W 330mm D 120mm.



PRICE £186 + £27.90 VAT

THE VERY LATEST SC110A LOW POWER, FULLY PORTABLE OSCILLOSCOPE.



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Full Sized Performance

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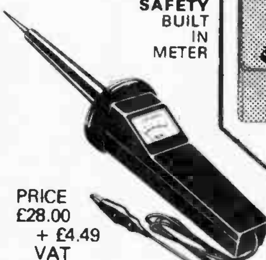
Measures up to 40 K.V. D.C. with **SAFETY** BUILT IN METER



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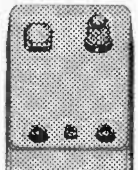
LOPT TESTER



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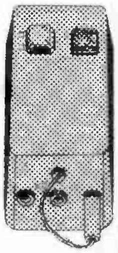

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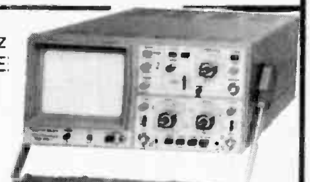
HAMEG HM 203-5 20MHz DUAL TRACE OSCILLOSCOPE



SPECIFICATION:

- *BANDWIDTH DC-20MHz
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- *TIMEBASE 40nS to 0.2S CM
- *TRIGGER DC-40MHz Auto-Normal-TV
- *CALIBRATION OUTPUT
- *CH1 ADD AND INVERT FACILITY
- *ALT/CHOP SWITCH
- *LARGE RECTANGULAR SCREEN 8 × 10 cms.
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- *SIZE 285mm × 145mm × 380mm.
- *SUPPLY 110-125-220-240V AC 50-60Hz

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OC45	50p
OC71	30p
OC72	50p
OC200	180p
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TAG06-60	42p
TAG521-200	72p
TAG4443	76p
TAG4444	76p
TIP29	15p
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DIODES	
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LOW PROFILE SOCKETS	
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40pin	25p
ZENERS	
400MV	
BYZ88 Range 2V7 to 39V	6p
1.3W Zeners	
BZX61 Range 2V7 to 39V	12p
VOLTAGE REGULATORS	
7805	35p
7812	35p
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7818	35p
7824	35p
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LM723	32p
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79HGKC	670p
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74LS367	52p
74LS399	85p
74LS670	130p
LINEAR IC'S	
LM324	30p
LM380	60p
LM381	100p
LM709Dil	30p
LM723	32p
LM741Dil	15p
LM741 Met	45p
LM3900	25p
NE555	20p
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AN-240P	150p
AN-360	120p
AN-7110	150p
AN-7114	170p
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AN-7120	150p
AY3-1270	680p
AY3-1350	300p
AY3-8910	360p
AY3-8912	400p
AY5-3600	670p
CA270	40p
CA3046	60p
CA3048	190p
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CA3086	25p
CA3089E	150p
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CA3130E	80p
CA3130S	100p
CA3140E	45p
CA3189E	250p
CA3240E	90p
HA-1156W	160p
HA-1197	160p
HA-1306W	220p
HA-1319	250p
HA-1339	220p
HA-1342	200p
HA-1366WR	200p

HA-1368	190p
LA-1201	120p
LA-1365	170p
LA-3301	180p
LA-3350	150p
LA-4031	140p
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LA-4101	140p
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LA-4420	150p
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MC1327	70p
SAS560	110p
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SN76023N	140p
SN76033N	150p
SN76110N	70p
SN76115	70p
T2800D	52p
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TA-7137P	110p
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TBA520	75p
TBA530	80p
TBA540	75p
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TBA750	100p
TBA800	35p
TBA810S	60p
TBA820	75p
TBA920	80p
TBA950	80p
TBA990	80p

TCA270	40p
TCA800	80p
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TDA2540	75p
TDA2560	75p
TDA2593	100p
TDA2690	80p
UPC-555H	60p
UPC-556H	80p
UPC-575C2	100p
UPC-577H	150p
UPC-592H2	120p
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UPC-1032H	70p
UPC-1156H	200p
UPC-1181H	120p
UPC-1182H	150p
UPC-1185H2	250p
MEMORIES	
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2716	300p
2516	200p
2532	400p
2732	400p
2764	700p
4116	75p
4164	380p
6116	600p
6802	220p
6809	600p
6821	150p
6840	320p
6850	130p
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VALVES

Type	Price (£)
DY802	0.88
DY86/87	0.75
ECC81	0.95
ECC82	0.65
ECC83	0.75
ECC84	0.65
ECC85	0.90
ECC88	0.95
ECF80	0.95
ECH81	0.75
ECH84	0.75
ECL82	0.75
ECL86	0.98
EF80	0.65
EF86	1.60
EF183	0.75
EF184	0.75
EH90	0.94
EL34	3.25
EL84	0.69
EL509	5.50
EM87	2.55
EY86/87	0.67
EY500A	1.65
PCC84	0.50
PCC85	0.65
PCC89	0.74
PCC189	0.85
PCF80	0.75
PCF86	1.25
PCF200	1.95
PCF801	1.45
PCF802	1.00
PCF806	1.20
PCL82	0.90
PCL83	2.50
PCL84	0.90
PCL86	1.15
PCL805/85	1.35
PD500	3.75
PFL200	1.35
PL33	1.50
PL36	1.45
PL81	0.85
PL82	0.75
PL83	0.65
PL84	0.75
PL95	2.00
PL504	1.20
PL508	2.40
PL509/519	5.95
PY88	1.80
PY500A	2.40
U26	1.90
UCH81	0.90
UCL82	1.70
6J5GT	1.75
6SJ7	2.20
30FL12	1.60

TRANSISTORS + DIODES

Type	Price (£)
AC127	0.30
AC128	0.30
AC128K	0.34
AC132	0.55
AC141	0.26
AC141K	0.40
AC142	0.26
AC142K	0.48
AC151	0.45
AC152	0.45
AC176	0.28
AC176K	0.46
AC187	0.42
AC187K	0.48
AC188	0.44
AC188K	0.50
ACY40	0.88
AD142	1.10
AD143	1.10
AD149	0.96
AD161	0.42
AD162	0.42
AD161/AD162	0.98
AF106	0.48
AF114	2.10
AF115	2.10
AF116	2.10
AF117	2.10
AF118	0.85
AF121	0.62
AF124	0.48
AF125	0.48
AF126	0.48
AF127	0.48
AF139	0.68
AF178	0.68
AF239	0.68
AF279S	0.75
AL100	2.50
AL102	5.90
AL113	2.20
ASY80	1.75
AU110	1.40
AY102	4.32
BA102	0.34
BA110	0.67
BA121	0.40
BA129	0.38
BA148	0.16
BA154	0.08
BA155	0.10
BA156	0.08
BA157	0.28
BA164	0.14
BB104B	0.52
BB105B	0.30
BB105G	0.48
BB110B	0.42
BC107	0.10
A or B	0.12

Type	Price (£)
BC108	0.10
A,B or C	0.12
BC113	0.14
BC114	0.12
BC115	0.12
BC116	0.15
BC117	0.22
BC118	0.17
BC119	0.30
BC125	0.12
BC140	0.28
BC141	0.42
BC142	0.30
BC143	0.30
BC147	0.08
A or B	0.10
BC148	0.08
A or B	0.10
BC149	0.09
BC157	0.10
BC158	0.10
BC159	0.10
BC160	0.30
BC161	0.30
BC168B	0.12
BC169C	0.10
BC170	0.14
BC170B	0.12
BC171	0.10
BC171	0.10
A or B	0.08
BC172	0.08
A or B	0.12
BC177	0.20
BC178A	0.22
BC182	0.09
A,B or C	0.09
BC182L	0.09
A,B or C	0.09
BC183	0.09
A,B or C	0.10
BC183L	0.08
A,B or C	0.12
BC184L	0.10
A,B or C	0.10
BC207	0.15
BC208	0.16
BC212	0.09
A,B or C	0.10
BC212L	0.08
A,B or C	0.10
BC213	0.09
A or B	0.10
BC213L	0.10
A or B	0.10
BC237	0.11
BC238	0.12
BC239C	0.14
BC251	0.12
A,B or C	0.14
BC301	0.30

Type	Price (£)
BC302	0.32
BC303	0.32
BC307	0.10
BC308A	0.10
BC323	0.99
BC327	0.14
BC328	0.14
BC337	0.12
BC338	0.12
BC350	0.14
BC440	0.30
BC441	0.32
BC461	0.32
BC547	0.12
BC548	0.12
BC549	0.12
BC550	0.18
BC550C	0.18
BC557	0.12
BC558	0.12
BCX34	0.27
BCY70	0.15
BCY71	0.17
BCY72	0.18
BCZ10	1.68
BCZ11	1.45
BD124P	0.80
BD130Y	0.68
BD131	0.34
BD132	0.34
BD131/BD132	0.95
BD135	0.32
BD136	0.36
BD137	0.36
BD138	0.38
BD139	0.38
BD140	0.38
BD144	1.60
BD145	1.82
BD150A	0.51
BD159	0.65
BD160	1.65
BD165	0.45
BD175	0.60
BD182	1.00
BD183	1.10
BD184	1.20
BD201	0.72
BD202	0.87
BD204	0.80
BD222	0.80
BD225	0.86
BD232	0.45
BD233	0.60
BD234	0.62
BD235	0.63
BD236	0.63
BD237	0.65
BD238	0.56
BD241	0.60
BD243A	0.80

Type	Price (£)
BD244A	0.65
BD375	0.32
BD410	0.76
BD434	0.68
BD436	0.68
BD437	0.76
BD438	0.75
BD439	0.68
BD507	0.48
BD508	0.53
BD509	0.54
BD510	0.48
BD517	0.56
BD520	0.66
BD699	1.25
BD707	0.88
BDX18	2.35
BDX32	2.10
BF115	0.32
BF117	0.54
BF119	0.82
BF120	0.38
BF123	0.40
BF125	0.42
BF127	0.38
BF152	0.16
BF154	0.23
BF157	0.40
BF158	0.22
BF159	0.24
BF160	0.23
BF167	0.30
BF173	0.25
BF177	0.42
BF178	0.30
BF179	0.32
BF180	0.35
BF181	0.35
BF182	0.32
BF183	0.32
BF184	0.32
BF185	0.32
BF194	0.08
BF195	0.10
BF196	0.10
BF197	0.10
BF198	0.14
BF199	0.16
BF200	0.26
BF222	0.48
BF224	0.20
BF224J	0.16
BF240	0.20
BF241	0.20
BF244	0.26
BF244A	0.28
BF244C	0.24
BF245A	0.28
BF254	0.15
BF256	0.40
BF257	0.32

Type	Price (£)
BF258	0.30
BF259	0.32
BF262	0.30
BF263	0.30
BF270	0.30
BF271	0.26
BF273	0.18
BF274	0.32
BF323	0.92
BF336	0.26
BF337	0.26
BF338	0.26
BF355	0.42
BF363	0.82
BF367	0.24
BF371	0.27
BF422	0.38
BF450	0.38
BF457	0.33
BF458	0.36
BF459	0.44
BFR39	0.22
BFR40	0.22
BFR41	0.22
BFR51	0.30
BFR61	0.32
BFR62	0.28
BFR88	0.34
BFR90	1.72
BFT41	0.38
BFT43	0.38
BFW10	0.79
BFW44	0.76
BFX29	0.28
BFX30	0.30
BFX80	3.56
BFX84	0.24
BFX85	0.26
BFX86	0.26
BFX87	0.26
BFX89	0.65
BFY50	0.21
BFY51	0.21
BFY52	0.21
BFY57	0.40
BFY90	0.90
BFY90S	1.34
BR100	0.20
BR101	0.44
BR103	0.58
BRC4443	1.76
BRY39	0.38
BRY56	0.42
BRY61	0.86
BSS17	0.56
BSS27	0.92
BSX19	0.34
BSX20	0.34
BSX59	0.62
BSX76	0.29
BT100A/02	0.94

Type	Price (£)
BT101/300	1.15
BT101/500	1.25
BT102/300	1.35
BT102/500	1.65
BT106	1.50
BT108	1.30
BT109	1.18
BT116	1.25
BT119	3.62
BT120	3.60
BT121	3.02
BT138/600	1.30
BT151/500R	0.90
BT151/300R	1.15
BTY79/400R	2.80
BU100A	2.30
BU104	2.00
BU105	1.20
BU105/02	1.56
BU108	1.80
BU124	1.75
BU126	1.25
BU133	1.80
BU204	1.35
BU205	1.30
BU206	1.70
BU208	1.55
BU208A	1.63
BU208/02	2.05
BU326S	1.75
BU407	1.65
BU407D	1.80
BUX80	3.70
BUY20	1.75
BUY69A	2.60
BUY69B	1.98
BY101	0.48
BY118	1.10
BY122	0.68
BY126	0.12
BY127	0.10
BY133	0.16
BY135	0.25
BY164	0.44
BY179	0.66
BY182	0.87
BY184	0.40
BY187	0.72
BY189	4.75
BY198	0.44
BY199	0.47
BY206	0.24
BY207	0.24
BY210/400	0.25
BY210/600	0.26
BY210/800	0.30
BY223	1.20
BY227	0.26
BY229	0.30
BY238	0.68
BYX10	0.24

Type	Price (£)
BYX36/150	0.22
BYX36/600	0.28
BYX48/300	0.72
BYX49/300	0.47
BYX55/350	0.29
BYX55/600	0.33
BYX71/600	1.18
BYZ12	0.42
C106D	0.80
E1222	0.40
E5024	0.30
GET872	0.48
ITT44	0.04
ITT2002	0.11
ME0402	0.20
ME0404/2	0.24
MEU21	0.60
MJ400	1.25
MJ2955	0.90
MJ3000	1.98
MJE240	0.60
MJE340	0.54
MJE370	0.88
MJE520	0.48
MJE2955	0.99
MJE3055	0.70
MPSLO1	0.28
MRF475	2.50
MRF479	5.20
MRP477	10.00
OA47	0.10
OA90	0.08
OA91	0.09
OA95	0.18
OA200	0.06
OA202	0.15
OC25	2.10
OC26	1.70
OC28	1.50
OC29	2.47
OC35	1.75
OC36	1.75
OC42	0.72
OC42K	1.40
OC44	0.72
OC45	0.58
OC71	0.50
OC72	0.52
OC81	0.68
OC200	2.46
OC202	2.20
ORP12	0.85
R2008B	1.50
R2010B	1.52
SHG1.5	0.40
TAG1/100	1.40
TAG3/400	1.78
TIC44	0.40
TIC45	0.45
TIC46	0.48
TIC47	0.70

Type	Price (£)
TIC106A	0.70
TIP30A	0.46
TIP31C	0.54
TIP32	0.40
TIP32C	0.60
TIP33A	0.63
TIP34A	0.72
TIP41C	0.46
TIP42A	0.52
TIP47	0.60
TIP110	0.88
TIP2955	0.60
TIP3055	0.60
TIS43	0.32
TIS88	0.40
TIS90	0.25
TIS91	0.28
ZTX108	0.12
ZTX109	0.12
ZTX212	0.28
IN4001	0.05
IN4003	0.05
IN4004	0.06
IN4006	0.07
IN4007	0.07
IN4148	0.05
IN5400	0.12
IN5402	0.15
IN5405	0.16
IN5406	0.18
IN5408	0.20
IS920	0.08
2N697	0.55
2N706A	0.33
2N2904	0.28
2N2906	0.24
2N2926G	0.10
2N3053	0.22
2N3054	0.56
2N3055	0.45
2N3702	0.10
2N3704	0.10
2N3708	0.10
2N3772	1.90
2N3773	2.70
2N3904	0.16
2N3906	0.16
2N5294	0.48
2N6107	0.71
2N6126	0.68
2SB337	1.60
2SC495	0.65
2SC1172Y	2.90
2SC1173Y	0.82
2SC1302	1.40
2SC1226	0.84
2SC1279	0.50
2SC1306	0.92
2SC1307	1.40
2SC1413A	2.70
2SC1444	1.45

Type	Price (£)
2AC1449	0.63
2SC1507	0.63
2SC1678	1.06
2SC1758	0.68
2SC1909	1.20
2SC1923	0.30
2SC1945	2.88
2SC1953	0.74
2SC1957	0.76
2SC1969	2.88
2SC2028	0.73
2SC2029	2.10
2SC2078	1.05
2SC2091	0.73
2SC2098	2.90
2SC2122A	3.20
2SC2166	1.20
2SC2314	0.80
2SC2335	1.50
2SC2371	0.90
2SC2749	2.70
2SC2752	0.60
2SD234	0.64
2SD348	3.30
2SD986	0.62
2SJ50	5.20
2SK134	3.80
2SK135	4.60
3N126	1.90
3N211	2.52
3SK45	0.76
3SK88	0.66
3SK135	5.20

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0.25W Type 100R-4M7 V & H 10p ea. 10/90p 0.1W Type 100R-1M V & H 7p ea. 10/65p

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Metallised Paper

2n2F 600V AC 24p
10nF 1000V DC 22p
10nF 500V AC 80p
15nF 300V AC 30p
22nF 300V AC 32p
100nF 1000V DC 46p
470nF1000V DC 60p

HV Disc Ceramic (1)

1kV 1.5nF 18p
8kV 10, 47, 56, 82, 100, 120, 150, 180, 200, 220pF 30p
270, 300pF 39p

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400mW Plastic 3V–75V 8p each. 10/75p.
1.3W Plastic 3V–200V 15p each. 10/£1.40
1.5W Flange 4.7–47V £1.26 each
2.5W Plastic 7.5–75V 64p each
20W Stud 7.5–75V £1.35 each

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Type	(£)
AN240P	3.42
AN214Q	3.88
AN715Q	2.90
CA3065	1.75
CA4031P	2.88
CA4102	3.30
CA4250	3.50
CA4400	2.98
CA4422	3.07
LC7120	5.33
LC7130	5.26
LC7137	5.16
LM380N	1.65
LM1303N	2.52
HA1151P	3.12
MC1307P	1.85
MC1310P	1.85
MC1312P	2.25
MC1327P	1.25
MC1330P	0.83
MC1349P	1.85
MC1350P	1.20
MC1351P	2.50
MC1352P	1.50
MC1357P	2.88
MC1358P	1.30
MC1496L	1.15
ML231B	2.10
ML232B	2.10
ML237B	2.30
MRF475	2.50
MRF479	5.20
MRP477	10.00
NE555	0.50
C-mos 555	0.88
NE556	0.80
SAA1024	5.35
SAA1025	8.40
SAS560A	2.50
SAS560S	1.85
SAS570S	1.85
SAS580	2.85
SAS590	2.82
SC9503P	1.10
SL432A	4.00
SL901B	5.20
SL917B	7.25
SL1327Q	1.10
SN76003N	2.44
SN76013N	1.90
SN76023ND	2.90
SN76033N	2.45
SN76110N	1.12
SN76115N	2.00
SN76131N	1.65

Type	(£)
SN76226DN	1.80
SN76227N	1.10
SN76530P	1.40
SN76533N	1.60
SN76650N	1.05
SN76660N	0.75
SN76666N	0.80
STK015	6.50
TA7108P	3.20
TA7120P	2.20
TA7129AP	3.65
TA7130P	1.65
TA7172	1.80
TA7193	5.50
TA7172P	1.80
TA7176	2.50
TA7202P	4.18
TA7204P	1.86
TA7205AP	1.50
TA7208P	3.27
TA7210P	6.50
TA7222P	2.12
TA7223P	3.68
TA7227P	5.60
TA7310P	1.80
TA7609P	4.28
TA7611AP	2.88
TAA263	2.46
TAA310A	2.68
TAA550	0.50
TAA570	1.99
TAA611A12	3.50
TAA630S	3.90
TAA661B	1.70
TAA700	2.80
TAA840	3.38
TAD100	2.80
FM FILTER	1.20
TBA120 AS, S,SA,SB	1.30
Q,T,U,UQ	1.32
TBA120B	1.30
TBA231	1.45
TBA281	2.65
TBA395	1.20
TBA480Q	1.50
TBA400	2.30
TBA510	2.60
TBA510Q	2.60
TBA520/Q	1.60
TBA530/Q	1.30
TBA540/Q	1.40
TBA550/Q	1.52
TBA560C	1.70
TBA560CQ	1.60

Type	(£)
TBA570	1.50
TBA641BX1	4.50
TBA673	2.40
TBA700	2.85
TBA750	2.80
TBA800	1.60
TBA810P	1.10
TBA810S	1.20
TBA820	1.60
TBA890	3.88
TBA920/Q	3.90
TBA950/2A	3.05
TBA970	4.05
TBA990	1.88
TCA160C	3.90
TCA270S	4.00
TCA270SA	4.02
TCA800	3.10
TCA940	1.90
TDA440	3.80
TDA1002	1.90
TDA1003A	5.50
TDA1006A	2.40
TDA1035S	4.50
TDA1044	4.30
TDA1170S	3.00
TDA1190	3.50
TDA1200	2.98
TDA1270Q	3.70
TDA1327A	1.66
TDA1352A/B	1.56
TDA1412	1.20
TDA2002	2.80
TDA2020	4.60
TDA2030	2.78
TDA2140	5.90
TDA2521	4.10
TDA2523	3.50
TDA2530	2.70
TDA2540	3.80
TDA2541	3.80
TDA2560	3.50
TDA2571A	2.50
TDA2581	3.20
TDA2590	3.20
TDA2591	2.98
TDA2593	2.98
TDA2610	3.20
TDA2611A	1.94
TDA2640	2.90
TDA2680	3.40
TDA2690	3.50
TDA3950A/B	2.60
UPC554C	1.32
UPC557H	0.90
UPC566H	2.95
UPC575C2	3.20
UPC1018C	1.10
UPC1025H	2.90
UPC1032H	0.90
UPC1156H	4.20
UPC1158H	0.76
UPC1163H	0.98

Type	(£)
UPC1181H	1.60
UPC1185H2	3.75
UPC1212C	1.30
UPC1228H	0.54
UPC1230H	3.90
UPC1350C	4.25
UPC1367C	3.40
UPC1378H	4.40
UPC2002H	2.80

D CONNECTORS

	9 way	15 way	25 way
Male Solder	.75	1.00	1.50
Angle	1.40	2.00	2.40
Female Solder	1.00	1.45	1.85
Angle	1.50	2.00	2.40
Covers	.80	.80	.80

PLUGS & SOCKETS

Metal Co-ax Plug	0.18
Plastic Co-ax Plug	0.14
Metal Line Socket	0.50
Single Junc Socket	0.80
Plastic Phono	0.10
F.M. Plugs	0.20
PL259 Plugs	0.38
Reducer	0.15
Low loss splitter 1 in, 2 out	1.00

SOLDERING SECTION

XS25 Watt Iron complete with steel and plug attached	7.20
CS 18W, as above	7.00
Antex 15W iron	5.00
Antex 18W iron	5.00
Antex 25W iron	5.20
Antex elements	2.00
Antex bits	0.95
Antex stands	1.90
Soldersucker	4.50
Nozzles	0.65

TERMINAL BLOCKS

2 amp 12 way	0.19
5 amp 12 way	0.20
10 amp 12 way	0.40
15 amp 12 way	0.46
32 amp 12 way	0.90

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SLC5-SLC7 £4.50 each
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B.T. Approved. Secondary Socket £1.95
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Universal Ni-Cad charger, charges PP3, AA, C, D Price £6.00

Rechargeable Batteries
AA (HP7) £0.85 10/ 75p each
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Fifty Years of Uproar

It seems that some things never change. Since the dawn of TV, we've been plagued by an apparently endless series of standards battles. Back in 1935 in the UK it was a question of 240 or 405 lines, amongst other things. In order to come to a decision on this the government of the day in 1934 set up a Royal Commission under Lord Selsden to recommend which system to adopt. The Commission duly reported in April 1935 but felt itself unable to come to a definite conclusion, which was probably fair enough. Work on the two contending systems (Baird and Marconi-EMI) was still continuing apace and producing worthwhile improvements. Would it be fair or right to suddenly halt the race? Instead the Commission recommended that a public service should start as soon as possible (in order to avoid further delay) using both systems alternately week by week, which is what duly happened in November 1936. While the Marconi-EMI system would appear to have been the obvious choice now, with its much greater number of lines, it must at the time, with the small, primitive tubes and circuitry of the period, have been rather less than obvious what to do for the best. And of course the rivals didn't exactly help in the task of arriving at an objective decision. It's usually possible to pull the wool over people's eyes: with a completely new technology the scope for doing this is great indeed!

Much the same sort of confusion reigned on the other side of the Atlantic – and took even longer to resolve. The Federal Communications Commission was set up in June 1934 to deal with the increasing demands on broadcasting frequencies – up to that time anything above 30MHz was free to experimenters to do what they liked with. One of the first things the FCC did was to establish TV bands – two, 42-56MHz and 60-86MHz. RCA had been transmitting experimental all-electronic TV as early as 1933 – with 240 lines, moving to 343 in 1936. By 1936 the US Radio Manufacturers' Association had proposed 441 lines, though the first demonstration that this was practical was not given until 1937 – by Philco. The industry was not united however and the FCC was no more prepared than the Selsden Commission to come to a decision on its own. There thus followed a period of experimental services that continued until 1940, when the RMA set up the National Television Standards Committee (NTSC) to establish an agreed standard. To be fair to both Selsden and the FCC, they were not presented with easy choices and the consequences of making wrong decisions could have been serious.

The Americans didn't have quite so much difficulty when it came to a decision on colour, the next major step, since by that time the NTSC had been established. Contrast this with what happened in Europe a decade later! There was to be a right battle of the standards in Europe in the early sixties, between NTSC, PAL, SECAM and one or two other proposals. And none of the systems would stand still. They kept on evolving as Europe decided, if that's the right word, that a common standard was not to be. In retrospect one feels that there was probably rather an unnecessary amount of smoke and din as this battle raged. Both PAL and SECAM have turned out to be perfectly good systems. Would it have made much difference if the UK had adopted SECAM? Probably not. But of course there was commercial interest, not to mention national pride, present to make the matter of coming to a decision difficult.

If anything the pace of these standards confrontations seems to have increased in recent times. We've had teletext systems, VCR formats and TV stereo sound systems to keep the pot boiling. At least teletext wasn't a problem in the UK: the development work was done by the broadcasting authorities who got together at an early stage to agree upon a joint standard. Getting this accepted elsewhere has been a different matter however. As alternatives were proposed, the FCC soon gave up any attempt at making a recommendation, suggesting instead that broadcasters decide for themselves what to do. That hasn't exactly helped to get teletext started in N. America, since setmakers are reluctant to produce a multiplicity of decoders for different systems and public confidence is lacking.

The Japanese, having avoided broadcast standards battles by adopting NTSC after the war, have more recently had their own standards battle in the VCR field: This is strange in a way: the Ministry of International Trade and Industry usually manages to achieve some sort of industrial consensus. On this occasion however it failed to impose itself on the rivalry between Matsushita and Sony.

For the time being the stereo TV sound standards contest seems to be a bit of a non-event. Right now interest has moved to standards for satellite TV broadcasting – not so much in the UK, where after an initial skirmish between extended-PAL and MAC the latter system has been accepted, but in Europe where despite EBU backing for MAC there's no sign at present of any agreement. It's not necessary to have a common European standard of course, but it would simplify matters for everyone if one could be agreed upon.

Before too long we shall probably find ourselves in the middle of a battle about high-definition TV standards. The Japanese have put a lot of work into the NHK 1,125-line system, which has been tried out via satellite. From a UK point of view however this development will have to wait till more broadcasting bandwidth becomes available or we find a signal companding/expanding system that's cheap.

Why does the world of TV have to lose so much sweat over these endless debates? Couldn't some nice committees of "wise men" sort things out? If only things were that simple! In the end it's the public that wins or loses from all this warring. At least it keeps the authorities on their toes, probably to everyone's benefit.

Vintage TV: The Mighty RGDs

Chas E. Miller

The picturesque Shropshire town of Bridgnorth has many claims to fame: it has a most remarkable leaning tower – the remains of an old castle – that overlooks the headquarters of one of Britain's largest private steam railways; and its unusual split levels, called High Town and Low Town, are connected by one of the few funicular railways to be found away from seaside resorts. It has also at various times played host to two of the best known names in radio – curiously enough, they were once rivals in the high-quality market. These two are Decca and RGD. The former is still going strong, though now under the ownership of Tatung. RGD is all but forgotten however, though it survived for several years after the demise of the original firm in the form of badge-engineered sets from first Regentone then STC and ITT. RGD was nevertheless at one time well established at the top end of the quality market, along with HMV and Decca.

The Radiogramophone Development Company was founded in the 1930s to do exactly what its title suggested. By the end of the decade its products were justly famed, combining advanced radio and record-player sections with magnificent cabinet work. After the hiatus of the war years the theme was revived: its zenith was probably reached with a model introduced in 1948 costing almost £300 – at that time you could have bought a good van to deliver the radiogram for around £350! It was only natural that RGD should diversify into television, which was just beginning to hint at its eventual domination of home entertainment and still called for cabinets that were "pieces of furniture" rather than being functional. Typical then was the RGD Model B2351T, a large console set with a 12in. tube designed for use in the Sutton Coldfield channel 4 area. A matching record-player unit was available if required, also a built-in radio adaptor that gave a choice of four preset stations.

A good deal of thought had been given to ease of service, one result being that you could swing the front of the cabinet up and away for simple access to the c.r.t. and other components.

Basic Circuitry

A superhet circuit was employed for vision and sound reception, the total number of valves in the chassis for all purposes being 23. In addition a solitary Westector diode was used as a sound interference suppressor. The Westector was not a crystal diode but a miniature metal rectifier developed in the 30s by the Westinghouse Company. A power supply unit equipped with a large double-wound transformer supplied h.t. voltages of 250V, 260V, 330V and 380V for various purposes. The transformer's heater windings for the two h.t. rectifiers and the c.r.t. were tapped to give a choice of voltages so that alternative types could be used – that was a time when valves and tubes were in short supply. The e.h.t. was generated by an EL33 r.f. oscillator with an overwinding on the transformer feeding an EY51 rectifier. This circuit produced 7kV, and in the days before Aquadag tube coating became general high-voltage capacitors had to be used to smooth the e.h.t. These could hold a charge that called for respectful treatment!

The aerial input was transformer coupled to a straight 6F13 r.f. pentode operating as a common vision/sound signal amplifier and was then passed to a second 6F13 that did duty as a frequency changer – in conjunction with a 6L18 triode oscillator. Two 6F13 i.f. amplifiers were followed by a 6D1 diode demodulator.

The Unusual Bits

Now while most of the circuitry in the B2351T was reasonably straightforward and conventional, the video coupling and interference suppression arrangements were decidedly quirky. The arrangement is shown in Fig. 1. V11 (6F14) is the video amplifier, whose response is tailored by L3 and C19. The video load is split between R26 and R27, with the result that only half of the available video signal was fed via C22 to the grid of the c.r.t. The entire video signal was fed to the sync separator, via C23 and V15A. The idea of this odd arrangement was to ensure that an adequate level of sync signal was fed to the sync separator whatever the setting of the contrast control, which set the first i.f. amplifier's cathode bias.

V15A was biased to conduct on the sync tips, acting as a limiter and in effect as the sync separator, feeding the following 6F14 which RGD referred to as the sync separator but which would more accurately be called a sync pulse amplifier. V15B provided d.c. restoration, and since both sections of V15 conducted during the sync pulses they also acted as the video d.c. restorer, linked to the c.r.t.'s grid via R35.

Now to the ingenious vision interference limiter circuit which used the two diodes in V14 (6D2). The video signal was coupled via C25 to the anode of V14B which was biased so that it conducted when an interference spike above peak white appeared. As a result, it passed a pulse via C26 to the c.r.t.'s cathode to cancel the pulse at the c.r.t.'s grid. R63 provided a variable bias for V14B's anode while V14A produced a bias voltage dependent on signal level for V14B's cathode. This was done by switching V14A on during the line sync pulse period by means of a line-frequency pulse coupled via C37 – the sync pulse tip is a measure of the signal level at the anode of V11. All rather ingenious and akin to some of the a.g.c. techniques that were to come much later. If you didn't want this little lot to work you simply opened switch S2.

A small pulse tapped from the cathode of the field oscillator was fed to the c.r.t.'s cathode via C24 for field flyback suppression – an early example of a soon to become general practice.

The Rest of the Set

The sound i.f. signal was tapped from the cathode of the first i.f. amplifier and fed to a two-stage amplifier employing 6F15 vari-mu pentodes. Another 6D2 acted as detector and a.g.c. rectifier. An unusual feature of the sound channel was the use of a variable cathode bias resistor in the first sound i.f. stage as the volume control instead of a control acting at a.f. – an archaic system even

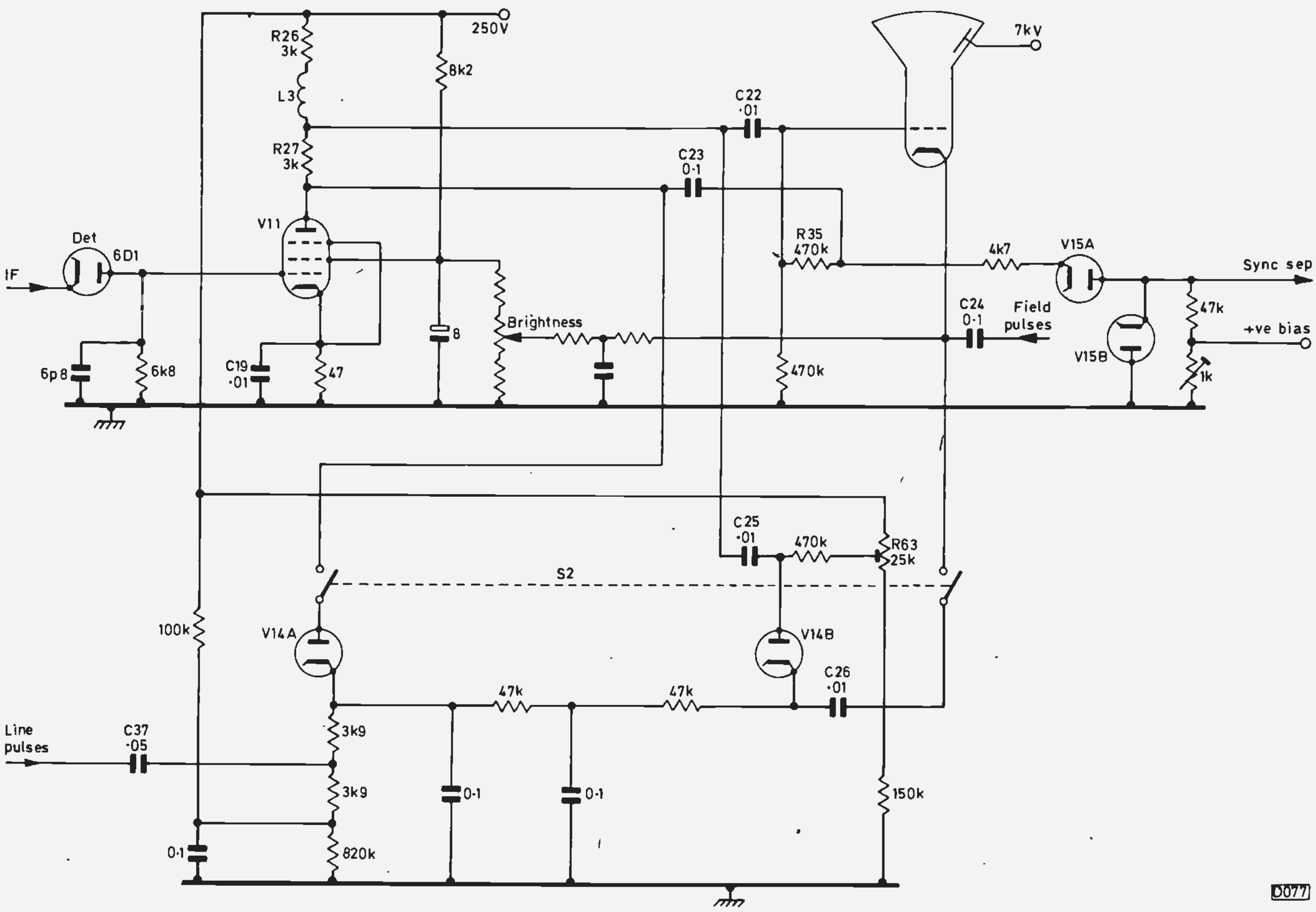


Fig. 1: The video and vision interference limiter circuitry used in the RGD B2351T.

then. The gain was reckoned to be adequate enough for it to be unnecessary to use an a.f. amplifier prior to the 6P25 high-slope audio output tetrode.

The timebases were straightforward but care was taken with the sync signal. The first 6F14 sync pulse separator/amplifier was followed by a 6F13 that amplified and shaped the field sync pulses. Both timebase generator stages used gas-discharge triodes (thyratrons) whose initial advantage of simplicity tended to be marred by erratic operation as they aged. The time-constant for a thyratron oscillator was set by an *RC* network between the anode and cathode, working in conjunction with a hold control that was connected to chassis.

The line and field output stages were very similar, owing much to contemporary a.f. designs, with simple two-winding output transformers. Considering that line output valves – an EL38 in this case – had had to be specially developed to withstand the high flyback voltage that appeared at the anode, it took a surprisingly long time for designers to cotton on to the idea of flyback derived e.h.t.! The circuitry in these output stages looks very sparse to the modern eye. The width and height controls consisted of variable cathode bias resistors while line linearity was controlled by means of a variable *RC* network connected across the scan coils.

The c.r.t. was electromagnetically focused, the coil and its variable shunt resistor being connected in series with the h.t. supply, on the negative side, so that the entire h.t. current flowed through them. Whether this made for better focus stability is open to question: possibly the large current flowing through the coil made it less sensitive to the small variations caused by changes in the operating conditions of individual valves.

The B2351T was capable of providing long and faithful service. I remember one that continued to soldier on after fifteen years use. Many engineers who had to deal with the older types of set will no doubt agree that a.c. only operation, where all the valves have low-voltage heaters, made for longevity. In addition, grid modulation of the c.r.t., with the cathode at or near the heater voltage, helped to prolong its useful life. In the vintage years c.r.t. heater-cathode shorts were fairly common, and where cathode modulation was employed the picture degradation could be serious enough to necessitate tube replacement. It was some time before low-capacitance heater transformers were introduced to alleviate the problem. In the intervening period it was not unknown for engineers to make up a small phase-inverting stage, built on the classic tobacco-tin chassis, to enable the drive to be transferred from the cathode to the grid. This sort of thing was justified since the cost of a tube in those days was much more in real terms than that of a modern colour c.r.t.

The 1700/1800

Grid modulation was one of several design features that were retained in the succeeding 1700/1800 series of models that were prefixed B, H or L to signify use in the Birmingham, Holm Moss or London areas. Changes in the receiver section included the use of a 12AT7 double-triode as mixer and local oscillator, with the sound signal tapped from the mixer's anode circuit. There was only one stage of sound i.f. amplification, but this time a stage of a.f. amplification was included between the detector and the output valve. A simple single-diode vision interference limiter circuit was used, but the video/sync coupling arrangements were the same as in the B2351T. A single sync separator/amplifier pentode was used but the timebases were otherwise much the same as before – though flyback e.h.t. this time put in an appearance. It was not obtained from an overwinding on the line output transformer however: instead, two EY51s were connected in a voltage-doubling circuit fed from the anode of the EL38 line output valve. This arrangement produced 6·5kV. The power supply was considerably simplified, with metal rectifiers powered directly from the mains used for h.t. rectification. A transformer was included, but was used for the heater supplies and mains adjustment only.

Demise of RGD

Regular readers of this column will know that I have little love for the live-chassis type of circuit, not least because a manufacturer's resort to this nasty economy so often presaged its demise. Regretfully, this proved to be the case with RGD. It was soon to be taken over by Regentone, and the 1953 and subsequent RGD models were fitted with Plessey chassis. Eventually Regentone itself succumbed and became part of STC. It was during this latter period that the RGD brand was briefly revived, with an advertising campaign that majored on Really Great Developments!

With hindsight, it's doubtful whether the original RGD firm could have survived much longer than it did, whatever the economies made. The approach that had made the firm famous – excellence of workmanship, especially with the cabinets – proved to be its undoing, as it was with many similar concerns. The public's enthusiasm for TV sets as pieces of furniture was rapidly waning in favour of less bulky mass-produced sets that nevertheless gave bigger and brighter pictures.

TVT Transistor Equivalents Books

Eugene Trundle

For those in the electronics field, particularly those in the maintenance and repair side of the business, a perennial problem is finding data and equivalents for the many types of transistors that have been used in equipment over the years. How do you tackle a twelve-year old Mitsontachi with a leaky 2SB41, or an obscure continental monster that's murdered its little BC219? What when you've blown up your entire stock of BU105s in a lambs to the slaughter session and wonder whether a BDX32 is a suitable sacrificial offering?

A specialist W. German publisher, ECA, regularly produces books of comparison tables. They are updated annually and the subject of this note is the current TVT 84/85 set. It consists of two pocket-sized volumes with baby wise-owls on their covers: there's an earnest and endearing preface that's a literal translation from the German. Volume 1 (A-Z, 317 pages) covers mainly European devices with AC-ASZ, BC-BUY and C-ZTX prefixes. Volume 2 (2N-∞, 487 pages) caters for American and Japanese types prefixed 2N-2SA, 2SB, 2SC, 2SD, 2SK and 3N on, ending with the five-digit 40000 series perpetrated by RCA. Between them the books list about 12,000 transistor types.

The coverage is comprehensive and I've seldom failed to find listed any transistor I've come across in domestic (and much other) equipment. For each type listed we get information on its type (ge/si), manufacturer(s), construction (npn/pnp/n-fet etc.), case style (TO3, TO18, SOT25 etc.) and lead-out identification. Also given are applications (general purpose, i.f., TV deflection etc.) and brief electrical details (voltage, current and dissipation ratings). Where relevant other parameters are given, such as gain, cut-off frequency or switching time. For virtually every type listed there's at least one equivalent given – sometimes up to nine – drawn from a wide range of manufacturers and species. Case styles and pinning diagrams are given for each of these. If a complementary device (to make a matched npn/pnp pair) is available for the listed transistor its type number is also specified.

I've been using this series of books for some years now and wouldn't be without them. The few transistors I've failed to find have generally been in very new equipment released since the current book was compiled. I've yet to find a misprint or error, though the criteria for transistor comparison must necessarily be broadly based and some of the suggestions for high-power switching transistors are not, I find, very good ones. For instance a BU208 is given as being a suitable substitute for a 2SC1942: o.k. on paper no doubt, but the BU208 will have a short and pyrogenic life in certain Japanese switch-mode power supply circuits! This is probably to do with the transit or recovery time of the devices.

The only serious criticism I have is that the books tend to fall apart after a certain amount of use. They're not really robust enough to stand up to regular workshop and field use – and abuse. Loose leaves are the first symptom, followed by partial disintegration.

In spite of this they represent very good value for money and should find a useful place on the workbench or design desk – and particularly in the roving toolbox. The set of two costs about £7·30 to the trade. They are available from HRS Electronics, SEME Electronics, Mastercare, PV Tubes etc., also by mail order from the Modern Book Co. (telephone 01 402 9177). For those interested, similar equivalents/data books on diodes and on thyristors etc. are also published by ECA – details can be obtained from the suppliers mentioned above.

The 1984/5 TVT transistor equivalents books.

Battle with a 9000

J. W. Cheshire

This Ferguson set (9000 chassis) was brought in with the complaint of a gradual reduction in width and some distortion at the sides, followed by complete loss of sound and picture.

The trip operated continuously at switch on so, bearing the reported symptoms in mind, I removed plug 14 to disconnect the scan coils. The sound returned along with a vertical white line down the screen. Probably a fault in the EW modulator circuit then. Checks in this area revealed that one of the EW modulator diodes, the MR814, was short-circuit, though no explanation for its death could be found. Anyway, a replacement diode restored a good picture and adjustment of the e.h.t., which was rather high, completed the job – so I thought.

Interlude with a Decca 30

The 9000 was to come back some weeks later, but in the meantime I had a small problem with a Decca 30 series colour set. Others might find it useful to know about this. These sets are rather old now but are quite capable of giving good results if a little time is spent on them. This particular one had been acquired recently by a young couple whose ears couldn't tolerate the intense line timebase whine. They asked whether it could be reduced to a more reasonable level. Now I've had this sort of trouble with several of these sets and find that it's often due to the disc capacitors associated with the line output transformer. Replacing these made no difference however, but slight movement of the line output transformer mounting changed the whine from intense to virtually undetectable. Slight bending of the retaining member and tightening the self tappers satisfied the customer.

Return of the 9000

When the 9000 came back the 2·5A mains fuse had blown, suggesting that the Syclops transistor VT701 (R2540) had died. It read zero resistance between its base, collector and emitter! Something nasty had happened here. Why hadn't the comprehensive trip coped with the failure? Perhaps the trip circuit had failed prior to the death of VT701, thus providing no protection?

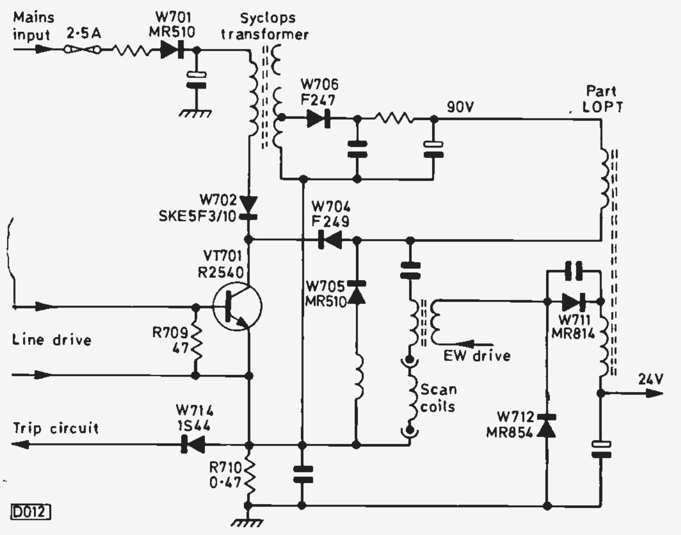


Fig. 1: The main elements of the Syclops circuit used in the Thorn 9000 chassis.

As a start I checked all the components around VT701 and its driver stage. I was getting nowhere fast in this area so I decided to try to find out why the trip hadn't worked. But the diodes that monitor various conditions all seemed to be in order (W714 which monitors the voltage at the emitter of VT701 often goes open-circuit but was fine in this case). Static checks were then made here, there and everywhere, but no joy.

So I replaced the prime suspects, the mains rectifier diode W701 and W702 which is in series with VT701 (see Fig. 1), fitted a new R2540 and a new fuse, connected a meter to the 90V line and switched on. Bang! The new R2540 and fuse had bitten the dust. Not even time to check voltages. Back to square one.

Recalling the previous incident with the EW modulator diode I began to think irrationally. The only thing that could have killed the Syclops transistor so quickly would have been a massive voltage. Now an internal arc inside the line output transformer could have explained the demise of both the MR814 and the R2540. Why hadn't the new diode died then? Because I'd previously fitted a fast-recovery diode with a much higher voltage rating, that's why. Knew I should have put in an MR814. Much cheaper than an R2540.

By this time another 9000 had appeared in the workshop. Needing a change, I decided to tackle it. Not much of a change in fact – the mains fuse had blown and VT701 was dead. At least it wasn't dead short this time. The cause was that the 90V supply rectifier W706 had gone short-circuit. In the process, VT701's base-emitter resistor R709 had gone open-circuit. Some Syclops faults are straightforward after all!

Life should have been a lot easier after that, with a working set available. Put the working Syclops/line output stage panel in the non-working set. Normal picture and sound. More than ever suspicious of the line output transformer – but haven't got a new one in stock. Decide to remove the transformer from the good panel and fit it in the suspect panel, then fit this panel in the working set. Surely this would work? Made static checks around VT701 again for good measure. Fit, switch on – good picture. So it was the line output transformer. Take a few voltage readings and find everything o.k. Debating as to which set to return first when – bang! Syclops transistor short-circuit once more. Not the line output transformer after all.

Spent ten minutes returning to the status quo, with the transformers restored to their original panels. Syclops transistors beginning to burn a hole in my pocket, and both panels suffering from surgery.

Now our voltage checks while the suspect panel was working had suggested that the current was not excessive. One obvious suspect was the isolating diode W704 (F249) in VT701's collector circuit. But I'd already checked it several times. Check again, again reads o.k. In desperation I heated the diode's body with the soldering iron. The leakage current shot up. How stupid!

After I'd replaced W704 along with the usual bits and pieces the set worked normally. I then gave it an eight hour soak test. It's not returned yet. Must make out an order for replenishment transistors. And make a mental note – never change line output transformers without good reason!

Video Servicing

Mike Phelan

This month we'll discuss some of the signal circuits used in a domestic colour video camera. To do so, we must first take a look at the various bits at the front of the vidicon tube, i.e. in front of the photoconductive target. See Fig. 1. Though we've shown these items separately they are actually integral with the tube and therefore irremoveable.

Optical Filters

The IR filter comes first. It attenuates light wavelengths beyond visible light – this is necessary as the vidicon is slightly sensitive to such rays and if steps to attenuate them weren't taken the colour rendering of an object would depend on its temperature! Despite the filter, most cameras will show whether an IR remote control transmitter is operating – quite a useful test.

The crystal filter is actually a low-pass optical filter. Without it interference patterns between fine detail in the image and the stripe filter would be generated, giving a similar effect to cross-colour on a TV set. The filter removes the high frequencies optically.

Mounted somewhere in this assembly is the OB (optical black), an opaque, L-shaped solid or plated mask that gives a reference black level at the end of each scanning line and field.

Colour Separation

Most domestic cameras with a vidicon tube use one of two systems for separating the colour: one is based on phase, the other on amplitude. The phase system is used on the simpler cameras at the lower end of the price range but can nevertheless give very good results. As the stripe filter format varies with the two systems we will discuss them separately, starting with the phase system used in the Sharp XC30, the Ferguson 3V17 and equivalents, and some National Panasonic models. See Fig. 2. The pitch of the stripes is typically 40·2 microns. You will appreciate from this that the height and linearity must be correct, as the filter has to be scanned in accordance with the precise stripe pattern.

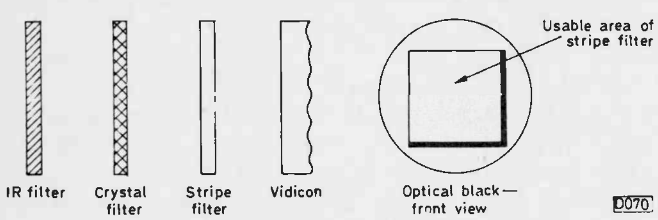


Fig. 1: Elements at the front of a colour vidicon tube.

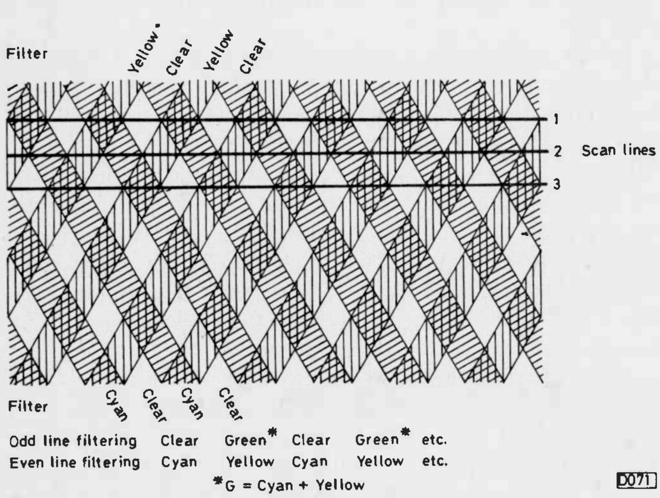


Fig. 2: Phase colour filter arrangement.

Phase System

The colour stripe filter works as follows. The yellow section passes cyan (B + G), the cyan section passes yellow (R + G), the clear section passes all light (R + B + G) while only G is passed where the yellow and cyan sections overlap (we'll call this G). As a result, a signal consisting of G information with a subcarrier containing R and B information is obtained – with, on a monochrome picture, a pattern that repeats itself on alternate lines. Because of the stripe angle, the actual signal phase is repeated every four lines, i.e. if you draw a vertical line down the filter from say a yellow diamond you will encounter another yellow diamond four scan lines lower down.

The carrier frequency can be calculated from:

$$f = \frac{\text{width of scanning line (mm)} \times 1{,}000}{\text{pitch of filter } (\mu\text{m}) \times \text{active line period } (\mu\text{sec})}.$$

To give the figures:

$$\frac{7{\cdot}45 \times 1{,}000}{40.2 \times 51.75} = 3{\cdot}58\text{MHz}.$$

Luminance Signal

To obtain a luminance signal, a low-pass filter follows the preamplifier. This gives us the G signal together with average values of R and B to feed to the luminance channel.

Colour Signal Processing

The composite signal is applied to the chroma processing circuit, see Fig. 3. The first section of the circuit, comprising ±90° shifts, a 64μsec delay line and two subtract circuits, produces R and B signals, still on a 3·58MHz carrier. This is followed by detection to produce R and B video signals, the addition of a −Y signal from the luminance channel to produce the two colour-dif-

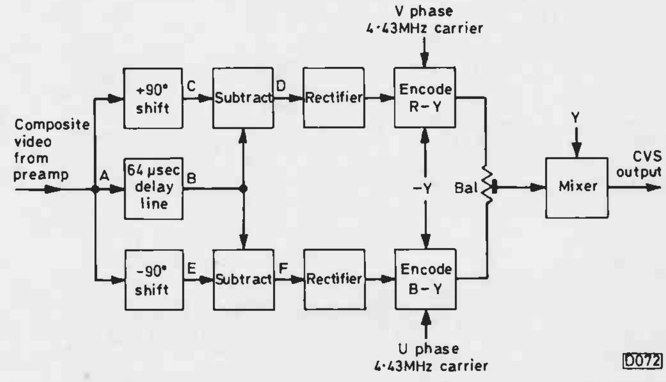


Fig. 3: Block diagram of the colour signal processing arrangement in a camera using phase colour separation.

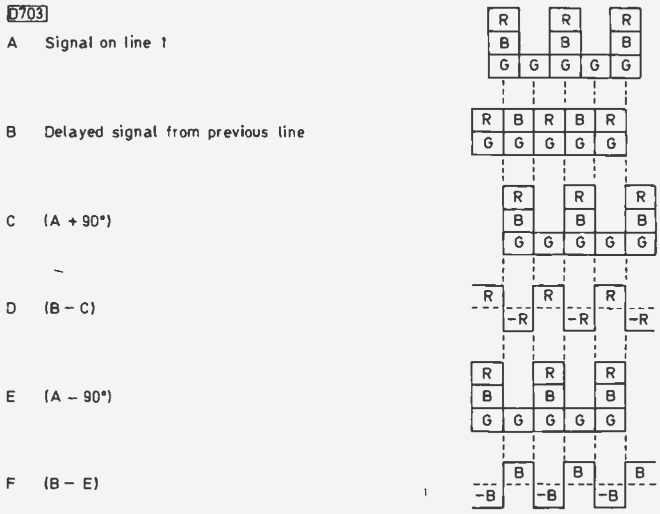


Fig. 4: How the phase colour separation system works.

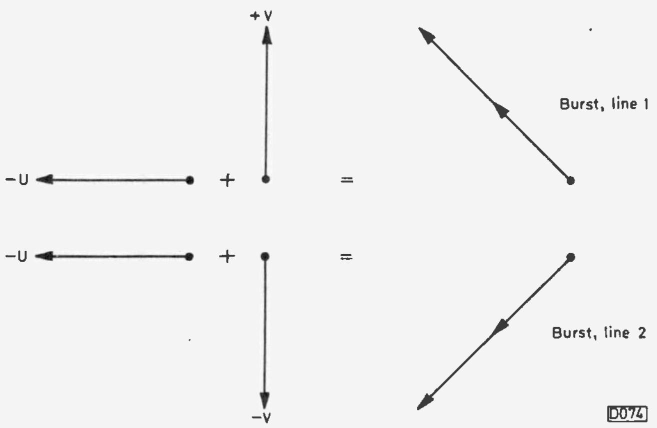


Fig. 5: Forming the burst signal.

ference signals R−Y and B −Y, then quadrature modulation on to a 4·43MHz carrier. When the result of these operations is added to the luminance signal we get a standard composite PAL output.

Fig. 4 shows how the R and B signals are produced. A is the signal on the line being scanned and B the signal from the previous line, present at the output from the delay line. The G component is constant (d.c.) irrespective of the phase shifts introduced and thus cancels out in the subtractive processes carried out in each channel. These subtractive processes also cancel out the unwanted R and B signals in each channel – due to the angle of the filter stripes the signals lead or lag by 90°. As a result we have at D and F the R and B signals on 3·58MHz carriers. Detection is usually carried out within an i.c., followed by filtering to remove the carriers. We thus get the two signals required for coding into PAL form.

The PAL Subcarriers

You will remember from our look at camera circuits last month that the sync and subcarrier generator (SSG) i.c. provides the two subcarriers required for V and U encoding, i.e. 4·43MHz subcarriers with the correct phase relationships, so all we need is a couple of balanced modulators to which the −Y signal is also fed (so that we get R−Y and B −Y chroma, not R and B).

– continued on page 199

Hints on the ITT CVC5-9 Series

Chris Avis

The ITT CVC5-CVC9 series of hybrid colour chassis continues to be popular – many of my customers are still happy with sets purchased new twelve years ago, and rumour has it that even the editor possesses one. An excellent three-part article on these chassis by none other than ET appeared in *Television* nine years ago (November 1975–January 1976). It's not my intention to trundle out the same details again but to provide some useful hints based upon my own experience of reconditioning these sets.

Power Supply

The mains filter capacitor C257 in the CVC5 may be cut adrift or missing due to a previous short-circuit and a so-called service engineer's short cut. Drill an additional small hole through the PCB and fit an RS type 114-115 (0·1μF, 250V a.c.) for greater reliability. Later chassis use a 1μF three-pin type: if yellow and 220V, replace immediately with the 250V grey/white type.

The CVC5's on/off switch is an integral part of the control assembly and cannot be replaced separately. Complete assemblies are at present available from Sendz Components for £2.

Check the mains transformer's mounting bolts, which are frequently loose. They can be responsible for an annoying 50Hz buzz when loose.

The h.t. reservoir/smoothing electrolytic can C271/3/5/6 is returned to chassis via a soldered lug on the line output stage screening cage. Dry or cracked soldering here causes loud arcing when the set is switched on – this can be devastating to the nervous owner. Resoldering will correct the condition but I also run a length of insulated wire down the board vertically from the top earthed foil area to the bottom, terminating at the earthy end of C302, breaking the insulation and soldering the wire to all earthed foil points en route, including C271 etc. This avoids various intermittent faults that can occur through poor chassis return connections on this board. By the way, this is also a useful dodge with the Bush A774 hybrid monochrome chassis.

Line Timebase

This may be old hat to many readers, but it's well worth resoldering all the connections on the line output transformer panel, including the transformer's mounting lugs. Erratic joints here can cause many strange, baffling faults, especially via winding L104-7 which distributes line-frequency pulses far and wide.

Old soldiers may never die but old solders do, particularly if the battle has been hot. The soldering to R424 (in parallel with the scan-correction capacitor – it damps the capacitor's inductance) is often such a casualty, causing board damage in extreme cases. If the resistor's mounting lugs are too charred or oxidised for reliable soldering, replace it with an 11W type (RS156-440 etc.) which can be accommodated at an angle – the long mounting wires, suitably bent, are useful for bridging damaged connection areas on the board.

If the original 0·47μF, 1kV boost capacitor (C310) is still fitted, replace it – the capacitor becomes increasingly prone to failure with old age (I can sympathize). Use a polypropylene replacement (e.g. RS114-626) for maximum reliability (at a price). A disc ceramic capacitor is more reliable than the original rod type in the fifth harmonic tuning position (C308).

Another geriatric symptom is hairline fractures in the PCB foil in the area around the line output stage valves (PY500A, PL509) – plus more old solders under the valve bases. Don't forget the line output valve's cathode resistor R423 (10Ω): poor connections here will cause contrast variations – or disappearance – as a result of the action of the beam limiter circuit.

Modifications for VCR use have appeared previously in *Television* (ET again, May 1982). In case you don't have the issue, here they are: change C288 to 820pF, C290 to 0·1μF and R395 to 47kΩ.

Focus problems are usually caused by the three resistors in the circuit – R429 and R431 (both 4·7MΩ) and R276 (2·2MΩ). In addition, the VDR rod itself can be responsible while C318 (210pF) which decouples the slider can be leaky.

Field Timebase

In my experience the field timebase is quite reliable apart from the usual PCL805 troubles and the field sync diode D46. If the latter is still an OA91, replace it with a more reliable 1N4002 etc. If the output pentode's cathode decoupler C247 has a black case . . . we can bypass further comment.

The height and/or linearity presets are often erratic: replacements can with advantage be mounted on the print side of the board for ease of adjustment and a cooler environment.

Many early bottom timebase boards were cracked in the area of the field hold control due to the unwise use of a control knob designed to protrude through a small hole in the back cover, but which didn't when the cover was refitted by an innocent engineer: the result was horizontal thrust on the field hold control and multiple fractures. Worth checking if intermittent line sync and field faults are present.

Mysterious Loss of Sync

If removal of and refitting the CVC7/8/9 chassis for tube replacement results in a mysterious loss of line and field sync, check that the extra metal support bracket at the bottom of the cabinet is located *between* the screened edges of the i.f./chroma panel and the timebase board and not on the inside edge of the latter where it can short against the TO5 case (collector) of the sync separator transistor T42.

The Decoder

Decoder faults received detailed coverage in ET's November 1975 article. Personally, I've found this area of the set to be pretty reliable. For absent or erratic colour, replace the chroma amplifier transistor T28 (suitable types BF597, BF299 etc.) before going farther into the decoder. Assuming that no twiddle-happy fingers have got there first, only two adjustments are normally required. First, using a colour bar signal move the colour control to minimum and balance the colour control bridge circuit by adjusting the trimmer C160 with a non-metallic tool for a neutral grey scale. Then put a squirt of Servisol on the chroma delay gain preset R214 and adjust this, with L68, for minimum Hanover blinds (use cyan for R214 and magenta for L68).

Ageing colour drive presets are now increasingly troublesome on all versions, sometimes making stable grey scale adjustment impossible even when the first anode presets are o.k. If they are touchy, remember the TUC principle – Terminate Unworthy Components: better still, remember "one out, all out" and change all three! The CVC5 uses standard 5kΩ (4.7kΩ) presets in the collector circuits of the RGB output transistors: later versions with a considerably modified demodulator/matrixing circuit have three miniature 2·2kΩ presets at the TDA1327A i.c.'s outputs.

The RGB output transistors are BD115 (BF337 etc.) types with their TO5 cases clamped to vertical heatsinks. Each pair of clamp screws passes through a strip of plastic intended to prevent the transistor's leads shorting to the sides of the heatsink holes. These strips will often be found to have disintegrated, with consequent loose clamping and poor heatsinking. If the plastic remains are excavated, the mounting screws can be tightened directly on to the heatsink, ensuring that the case of each transistor is positioned so that the base and emitter leads are central in the heatsink holes.

Front Controls

Two unreliable channel selector units were used in early models, causing tuning drift and erratic signals. Replacements for the seven-way round button unit are available from Sendz at £8. Conversion kits for the awful five-button-plus-thumbwheel units cost around £12, but I've successfully adapted many sets to use the cheaper GEC tapered button unit which will fit with a little modification.

Slider controls, when fitted, can be erratic but are sufficiently exposed for successful cleaning if care and thoroughness are exercised. A small ball of Duraglit wadding held in long tweezers can be negotiated along the carbon and metal tracks which can then be cleaned off with a similarly held wad of toilet tissue soaked in methylated spirit. A smear of silicone grease will protect the surfaces and aid smooth running of the sliders.

Previous clumsy servicing may have broken some of the slider assembly escutcheon mounting latches, leaving it secured by little more than the central knobs. The repair method depends on the extent of the damage. A combination of heat-welding with an iron and/or drilling and securing with small binder screws is usually sufficient, but ensure that the screws don't penetrate through the front of the control panel!

In Conclusion

Teletext, in-line gun tube and Digivision these chassis aren't, but they're good nevertheless – and long may they last!

ET adds: We still get a lot of complaints about 100Hz hum bars – it doesn't need much ripple on the 20V line to cause this effect. It's best to check the AD161 20V supply series regulator transistor T46 by substitution. If the trouble persists, check C263 (10μF) and the driver transistor T45 (BC170B). Short-circuit turns in the mains transformer can sometimes overrun the AD161: if the c.r.t. heater voltage is in excess of 6·8V r.m.s., this is likely. All this assumes that the reservoir capacitor C262 (500μF) and bridge rectifier are o.k.

Servicing the Panasonic TC2205

David Botto

Large numbers of these 22in. sets were sold. The A56-540X 110° picture tube gives excellent colour and monochrome pictures and the sound quality is good, with 10W audio output. Magic-line tuning is a feature of the set.

Access

To gain access for servicing, remove the back cover (four screws), take out two screws from the rear edge of the bottom chassis, unfold two plastic runners and the chassis will slide towards you.

The circuit boards are identified by letters which we'll refer to in this article. On the left, looking in from the rear, is the vertically mounted A panel which contains the tuner, sound and vision i.f. departments, the colour decoder and RGB output stages, the luminance and the magic-line circuits. By taking the lead clamps from the c.r.t. wires and turning the two little plastic clips at each side of the chassis top – don't try to pull them out – you can hinge panel A down, making it easy to work on.

To work on the underside of the bottom E timebase/power supply/audio amplifier panel, first undo the cable ties to the deflection coils, control drawer, etc. – make sure you note their exact positions. The panel can then be turned forwards through 90°, giving access to the print side. Two little knobs slot into the plastic runners, holding the panel securely.

PANEL E

The power supply circuit is shown in Fig. 1. It's of the self-oscillating chopper type with the chopper transformer T801 providing mains isolation. Connector CO2ZS/P links the 240V a.c. input to the little Z panel on which the mains fuse F801 (3.15AT), the on/off switch and the mains filter components are mounted. The output from this panel goes to the main E board via connectors CO1ZS/P and CO1ES/P. Once on the main panel the supply goes via the 4.7Ω surge-limiting resistor R802 on one side and the switch contacts of relay RY1001 on the other to the bridge rectifier D801-2 (two double diodes, type TVSMI1SR) whose reservoir capacitor is C808. The positive side of this d.c. supply is taken to the collector of the BU326A chopper transistor Q801 via the primary winding (P1/2) of the chopper transformer. The negative side of this supply is not taken to chassis: treat it with respect as you can get a nasty shock!

At switch on rectifier D803 (TVSRH1B) passes positive-going mains frequency pulses to the base of Q801, via C810/R805/R821/L804, to get the circuit started. Once the circuit starts to oscillate, feedback is via winding B1/2 on the transformer. Thyristor Q803 (TVSTF340MA) is used to switch the chopper transistor off at the end of each cycle. Rectifier diode D804 produces a negative bias voltage of about −0.2V for the gate of this thryristor. The key component is R814 (1Ω, 3W wirewound) which is connected in Q803's cathode circuit. When Q801 switches on, its emitter current flows through this resistor, and because of Q801's inductive load a sawtooth voltage is developed across R814. Once Q803's cathode is at −0.7V with respect to its gate Q803 fires, shorting the base and emitter of Q801 so that it's switched off. Q803 then turns off and when point B1 on the transformer swings positively Q801 switches on again.

Power is taken from the secondary winding S1-4 on the transformer, with rectifier diodes D852, D851 and D853 providing 195V, 160V and 25V d.c. supplies respectively.

Regulation is carried out by D809, Q802 and the associated circuitry which provides a second bias source for the gate of Q803. R809 (+B adjustment) is used to set the h.t. obtained from the power supply. The supply for this part of the circuit is obtained from winding F1-2 on the chopper transformer, with rectification by D810/C815. As the voltage developed across this winding varies, so the conduction of Q802 and the firing point for Q803 change.

Protection Circuit

The other thyristor in the circuit, Q804, provides overload protection. There are two ways in which it can be brought into conduction. If a fault in the power supply results in increased output voltages from the transformer, zener diode D814 will conduct, firing Q804 and thus shorting the base and emitter of Q801 so that it switches off. This protects Q801 and the circuits powered by the d.c. supplies obtained from the transformer. A heavy load or short across one of the d.c. lines on the other hand will reduce the output obtained from D810. As a result Q805 will switch off and D816 will conduct, switching Q804 on to stop the circuit. If you accidentally short one of the d.c. outputs obtained from the transformer you'll have to switch the set off and wait for about 45 seconds before switching on again.

Dealing with a Dead Set

What to do if the set is dead? First examine the mains fuse on board Z. It sometimes fails for no apparent reason. Provided it's not blackened, a replacement may well restore normal operation. Don't forget to disconnect the mains first, as F801 is live even with SW801 in the off position. Then soak test the set for at least one day.

If the receiver is trying to start up or is dead with the fuse o.k., you have to decide whether the power supply is faulty or there's an overload elsewhere. This is easy to do with the TC2205, but you'll need a variac or tapped input transformer and a digital multimeter.

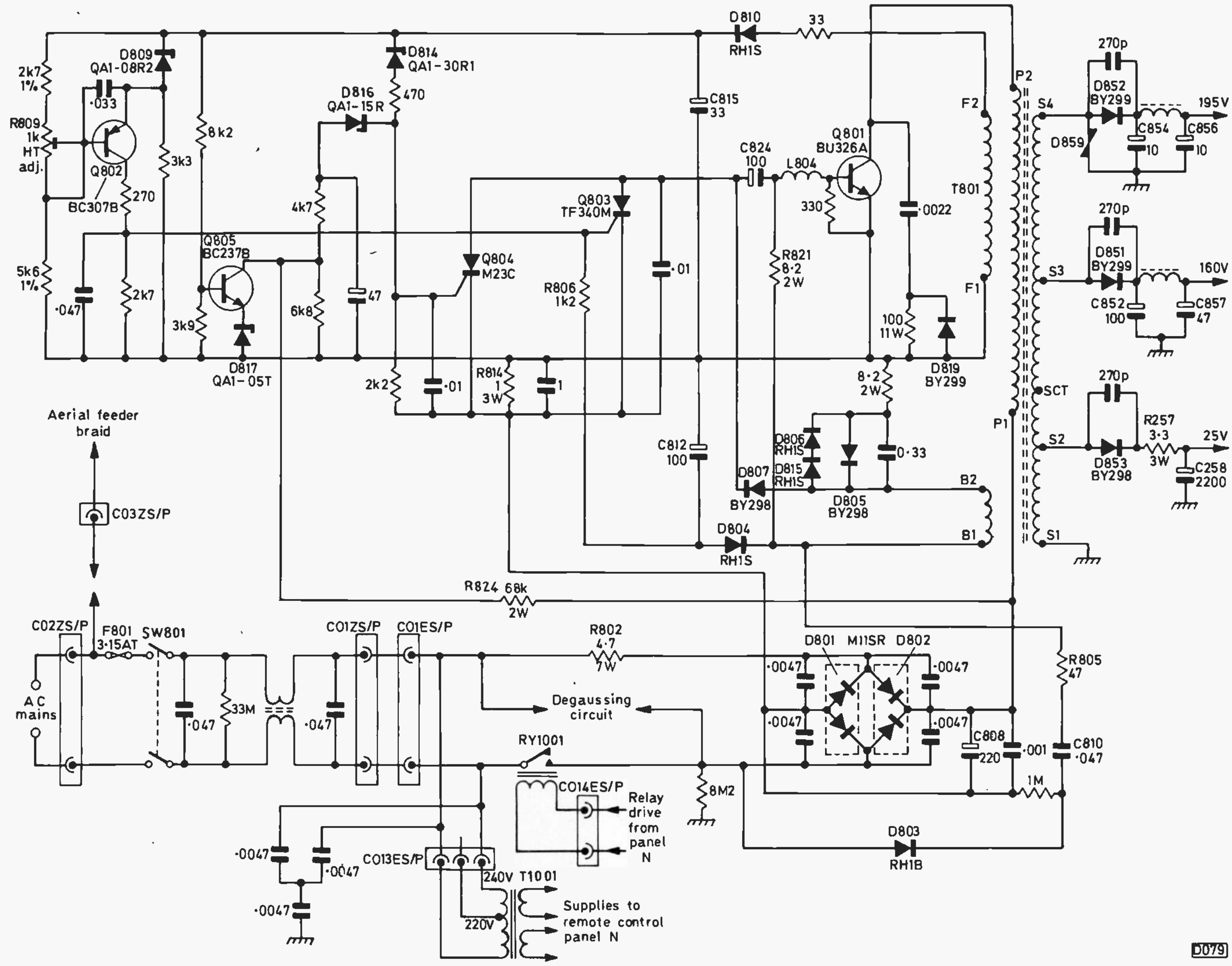


Fig. 1: The switch-mode power supply circuit used in the Panasonic Model TC2205 (chassis U2). It's not immediately apparent, but R824 is Q805's collector load resistor. Note that the circuit diagram in the manual shows R814 connected incorrectly (blob missing).

Connect the receiver to the a.c. mains supply via the variac/transformer, with the a.c. input set to 150-160V. Monitor the voltage at the cathode of D851. If it's low or zero, disconnect the mains supply then disconnect one end of the chunky 22Ω, 20W ceramic resistor R559 which is on top of the line output transformer. This disables the line output stage. Try again with the mains connected. If the voltage at the cathode of D581 is now at the normal level you've a line output stage fault. The 195V h.t. line can be isolated by removing connector CO5ES/P. The 25V line is protected by the special 3.3Ω fusible resistor R257 which will open if a fault is loading this supply.

If no outputs are obtained from the chopper transformer you've a power supply fault. Open-circuit the protection zener diodes D814 and D816. If the power supply now works normally, suspect transistors Q802 and Q805, both of which have been known to fail. Then check diodes D814, D816, D806, D815, D809 and D817. If you find one of these to be faulty don't leave it at that – check them all. The reliable way to do this is to use a component tester. C815 can leak, giving various weird effects. Finally check thyristors Q803/4.

The chopper transistor Q801 rarely fails. When it does, R802 usually goes as well, also D816. So check these before fitting a new BU326A.

The 195V supply reservoir capacitor C854 can cause two nasty faults – an unstable picture, or a bright raster with the sound o.k.

Before leaving the power supply it's as well to check all the electrolytics for signs of drying out or leakage. C856, C852, C857 and C258 have been known to cause various puzzling effects such as the sound stopping at one level no matter what you do!

The Line Timebase

The line generator resides in IC501 (TDA2591). The drive pulses emerge at pin 3 and are fed via choke L501, R514 and C517 to the base of the driver transistor Q501 (2SC2085) which is transformer coupled (T501) to the BU208A line output transistor Q551.

The line output transformer T551 is of the diode-split type. D552 (APB0515) and D553 (BY299) are the EW modulator diodes. Various d.c. supplies are obtained from T551. D554 (BY299) and C557 (2,200μF) provide a 24V supply for the field timebase and the EW drive circuit. D557 (TVSRC2) and C563 (820pF) provide an 800V supply for the tube's first anode presets. D556 (BY298) and C558 (470μF) provide an 18V supply which goes to the AN320 magic-line i.c. (IC901) and the 12V regulator transistor Q851 (2SC1847). T551 also powers the tube's heaters.

The line output transformer is very reliable but has been known to fail. Substitution is the only reliable test. The line output transistor Q551 can also fail, but doesn't do so often. It's best checked with a component tester.

Before condemning IC501 (we've never had one fail) check the 18V rectifier D556 (BY298), its surge limiting resistor R560 (1Ω, 0·5W), diode D856 (TVSRM1ZM) which is in series with the supply to this i.c. and, for corrosion or loss of capacitance, the electrolytic capacitors associated with the i.c. – C507 (4·7μF, 25V), C510 (100μF, 16V) and C516 (10μF, 16V).

If you've a line timebase fault that causes a dead set or one that tries to start then cuts out, tilt board E forward to examine the print side. Trace an imaginary line from the centre of the line output transformer 1·5-3in. towards the centre of the panel, checking carefully for print cracks. If all is well check D552. If it's faulty, fit the later type TVS2715M. Change capacitors C560 (0·33μF, 400V polyester) and C561 (1μF, 250V electrolytic) and measure the value of the special resistor R561 (180Ω, 2W, type ERQ2CJ181). These components are in the scan circuit. Also measure the value of R770 (4·7Ω, 2W type ERQ2CJ4R7) which is in series with the EW drive. After failure of D552 it's important to change the EW driver transistor Q753 (BD237) to avoid later problems.

Field Timebase Faults

Complete or partial field collapse is almost always due to IC401 (TDA1104SP). Replace it with the later type TDA1106. This i.c. can also blank out the picture, leaving the sound o.k. The voltage at pin 7 should be 1·4V: it goes via D303 (1N4148) and R319 (1·5kΩ) to pin 9 of IC601 in the decoder section on panel A. If the voltage at pin 7 of IC401 is 10V, replace this i.c. after first checking the spark gaps on the c.r.t. base. Then check the 24V supply surge limiting resistor R556 (2·2Ω, 0·5W fusible).

Voltage Adjustment

After working on board E be sure to check the 195V, 160V and 24V lines with a digital voltmeter, adjusting R809 as necessary.

PANEL A

Signals board A lives a quiet life and seldom requires attention. The bulk of the circuitry is contained in six i.c.s.

IF Strip

The vision i.f. department is in IC101 (TDA2540). The output from this i.c. can be checked by feeding the set with a colour bar signal and connecting a scope, via a 10:1 probe, to test point A7. If all's well the complete picture waveform should be seen.

Magic-line Tuning

A 39·5MHz reference signal from pins 8 and 9 of IC101 is taken via transformer T102, C133 (100pF) and R121 (220Ω) to pin 7 of the AN320 magic-line i.c. (IC901). The amplified signal is developed across coil L901. A line-frequency pulse is fed to pin 14 to synchronise a sawtooth generator within the i.c. The magic-line pulse appears at pin 6 and is fed via D902 and R332 to the TDA2530 matrixing/RGB preamplifier i.c. A green band that narrows as the receiver is tuned correctly appears on the screen when the AFC/ML switch is set to ML. R902 adjusts the minimum width of the line. Very occasionally IC901 fails. Little else seems to fail in the magic-line circuit.

The Decoder

The good design of the TC2205 makes colour faults easy to find. First examine the print near the pins of the decoder chips IC601 (TDA2560), IC602 (TDA2522) and IC301 (TDA2530) for dry-joints, then all the small electrolytics in the vicinity for corrosion. Next make some quick checks with an oscilloscope, connected via the 10:1 probe, and a colour bar input to the set.

The chroma signal is transformer coupled to pins 1 and 2 of IC601: pin 1 should show the familiar "cotton-reel" colour bars. The same waveform, amplified, should be present at pin 6 (test point A10). If the waveforms at pins 9, 10 and 15 are correct – they are clearly shown on the circuit in the manual – move on to IC602. This operates in conjunction with an 8·86MHz crystal. The reference oscillator signal should be present at pin 10 while the three colour-difference signals should be present at pins 1, 2 and 3. To override the colour-killer, short pin 16 to chassis, i.e. link test points A14/15. The final i.c. (IC301) does the matrixing and drives the 2SC1819 RGB output transistors (Q351-3). These i.c.s can occasionally fail.

Predominance of one colour can be caused by failure of one of the RGB output transistors. Strange colours and puzzling variation of colour shades can be caused by the BZX61C7V5 zener diode D351 which biases the emitters of the RGB output transistors. It has a habit of becoming intermittent before failing completely.

REMOTE CONTROL

Board N contains complex circuitry for channel selection and remote control. It's mostly within three i.c.s and is easy to service – when it does need attention, which is not often. Mains a.c. from connector CO13ES/P on panel E feeds the remote control mains transformer T1001 whose outputs are fed to board N via connector CO82. The transformer's two secondary windings feed separate rectifiers, D1004 which produces 24V for the relay and D1005 which, along with the two zener diodes D1006 (5V, type TVSQA105SV) and D1007 (12V, type TVSQA112RV), produces 5V and 12V supplies for the remote control circuitry. Relay RY1001 (on board E) operates when pin 16 of IC1001 (SN76730N) goes high. If it doesn't, check the relay driver transistor Q1005 (BC237B) first. The 5V and 12V supplies are both present when RY1001's switch contacts are open.

In the TC2205s we've handled only once has IC1051 (AN5010) failed, causing channel changing problems. A logic probe is useful, but the easiest way to service this board is to check all the transistors and diodes first – this is easy and quick to do – then inspect the print for dry-joints. Only then suspect the i.c.s.

We haven't had remote receiver (board GR) failure yet, nor a defective infra-red handset – except when the customer forgets to renew the batteries!

FINAL TOUCHES

Finally, do make sure you replace all the connecting cables and ties in their correct positions, and apply a thin coat of circuit varnish to any joints you've soldered.

Video Servicing

– continued from page 193

The only remaining thing to be done is to produce a burst centred on the – U axis with a ± 45° swing on alternate lines. This might seem to be a bit of a problem, but as Fig. 5 shows all that's necessary is to pass the unmodulated subcarriers through each encoder during the burst period. The modulators used for encoding are of the balanced type, as required for the PAL suppressed subcarrier system, i.e. with no R–Y and B–Y signals fed into the encoders no carrier comes out. This condition is set by the i.c.'s d.c. levels, which are sometimes adjustable by means of a carrier balance control. Thus if we upset the d.c. levels during the pack porch period we get a subcarrier output, which is exactly what's wanted. The burst flag output from pin 11 of the HD44007A SSG i.c. is used for this purpose.

As Fig. 5 shows, the U subcarrier is on the – U axis while the V subcarrier swings ±90° with respect to the U axis on alternate lines. Adding the two gives us the correct bursts.

Phase Shifting

Simple, isn't it? No? Well let's go back to Figs. 3 and 4. Each line contains the same green information, so if we subtract the outputs on successive lines we will be left with R and B only. Thus each line will consist of either alternate blocks of R and B or alternate blocks of R + B and no signal. The angle of the stripe filter advances the blocks half a block from line to line. Taking each pair of blocks as one cycle, the filter is introducing a 90° phase shift (a 90° phase shift equals a quarter of a cycle). The +90° shift circuit moves alternate lines half a block, lining up R + B with B and empty blocks with R: subtract one from t'other and the Bs cancel leaving us with + and – half cycles of R – at a frequency of 3·58MHz. The –90° shift circuit moves the alternate blocks the other way so that R + B lines up with R and the empty blocks with B: this time the Rs cancel, leaving B. With a picture containing colour information the three signal levels will vary of course, but the principle still holds.

Block Diagram for the 3V17

Fig. 6 shows in block diagram form the chroma processing arrangements used in the 3V17 camera. IC7 contains a buffer stage and the two phase shifters – the phase shift is adjustable by means of external trimmers. The phase shifted outputs go to the subtractor i.c.s IC9 and IC15 which also receive the output from the delay line after amplification by IC8. IC9 and IC15 are balanced modulators rather than amplifiers, their gains being variable in three ways. The shading inputs at pin 1 come from the SSG i.c. – we'll explain why next month, after looking at the alternative colour system. Pin 5 of each i.c. goes to a switched bank of resistors for daylight/artificial light control (there's no optical correction filter in the 3V17) and to a colour tint control potentiometer. These both vary the gain of the i.c.s – the former in two fixed increments, the latter differentially. Two presets R-bal and B-bal are provided: they are adjusted to ensure that no signal comes out when there's no colour input.

After amplification by IC10/16 and detection by IC11/17 (the filters are connected to pins 2, 3 and 4) the signals pass to IC12/18 for addition of the –Y signal and non-linear amplification (gamma correction) to compensate for the fact that the vidicon's sensitivity and the c.r.t.'s light output are neither linear – more on this when we get to the luminance signal. These i.c.s are also fed with the burst flag to sit on the signal, which is clamped to the sync level – the burst period then represents a chroma signal consisting of equal amplitude R and B components.

IC13/19 are balanced modulators fed with the respective subcarriers. The 4·43MHz outputs are then added, the encode-balance control providing a means of swinging the chroma and burst phase a little way either side of the mean axis. Finally IC14 is a straightforward amplifier whose output goes to IC4 to be mixed with the luminance.

Next month the alternative (step-energy level) chroma system and mysterious things like shading etc.

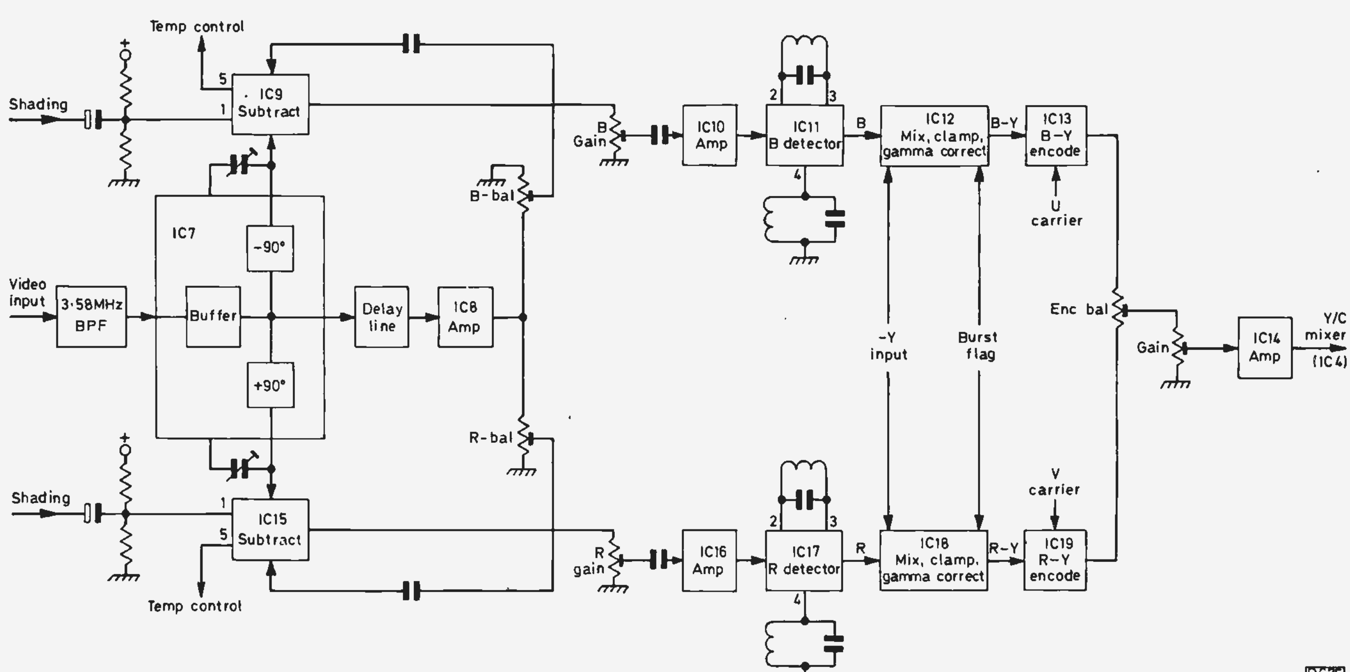


Fig. 6: Block diagram of the colour signal processing system used in the Ferguson 3V17 camera.

Low-noise 11GHz Converter

Hugh Cocks

Many transmissions in the 10·95-11·7GHz band are now receivable at relatively high signal levels from the ECS-1 satellite. The present article describes a simple low-noise downconverter: a later article will describe a low-noise amplifier to go with it – it's not as difficult to build as may at first be thought, provided you have some experience of r.f. construction techniques and are nimble with a soldering iron. The bandpass filter between the LNA and the LNC uses a high-precision waveguide system: arrangements have been made for the supply of this to readers as a ready-made unit since it has to be manufactured to exact tolerances, even down to the make of waveguide employed. The receiver section is very similar to that described by Nick Harrold in the October 1983-January 1984 issues of *Television.* The downconverter's i.f. output is adjustable to a certain extent. Fig. 1 shows the downconverter in block diagram form.

Oscillator/mixer Module

The local oscillator/mixer module is manufactured by Mitsubishi and is available off the shelf at a very reasonable price. It was originally designed to detect radar signals and is very small – see photo 1. The local oscillator consists of a gallium-arsenide FET with dielectric resonator while a Schottky diode is used as the mixer. See Fig. 2.

Dielectric resonators are relatively recent and form the heart of all modern LNC oscillators. The resonator is a little smaller than an Aspirin: it's made from a ceramic based material and is fixed on the board between the gate and drain connections of the FET. When placed in a cavity, a stable output with very low frequency drift – of the order of 2-5MHz over a very wide temperature range – is obtained. The frequency can be adjusted by means of a small disc that's a variable distance from the resonator, being mounted on the end of a screw thread. Adjusting the screw so that the disc moves closer to the resonator increases the oscillator frequency. The module used here can be tuned over a range of about 1GHz, from 10·4-11·4GHz, though individual units vary a little.

The module's input is in waveguide form (see photo 2): for some peculiar reason WG17 waveguide is used (US WR75 standard) with a WG16 (WR90) flange. The flange is made from heavy-gauge tinplate – a cheaper version is available with no flange. The module is thus easy to join to an aerial feedhorn or LNA/bandpass filter assembly with waveguide output.

Instead of using the conventional probe to pick up the signal in the waveguide and link it to the circuit, a wedge-shaped piece of metal that divides the waveguide in two is used. The rear end of the wedge is connected to the stripline on which the mixer diode is mounted (it also forms the d.c. return for the mixer's bias). The wedge tapers away at the flange end. As the wedge profile rises farther into the waveguide section the incoming r.f. is forced up the wedge. Since the divided waveguide is beyond the cut-off frequency at 11GHz the r.f. goes on to the stripline. The rear of the wedge is just visible in photo 1, connected to the stripline. The wedge and a tuning screw (fully closed) can be seen in photo 2.

The mixer diode requires an external bias. This can be used to advantage on weak signals, especially when an LNA is not used. The small tuning screw at the front of the assembly also helps with very weak signals.

Noise Figure

The unit's noise figure is 7·5-8dB, with a little spread for individual modules. Surprisingly good pictures can be had using a 1·8m dish and no LNA (see photo 3). Adding an LNA/bandpass filter assembly will reduce the noise figure to 2·5-3·5dB, giving excellent pictures with a 1·8m dish (see photo 4).

Modifications to the Module

The Mitsubishi module comes with a low-pass filter at the output, giving a roll-off above 600MHz. To remove this, take off the cover (secured by four bend-over pieces of metal, see photo 1) and cut the lead to the 2pF feedthrough capacitor. Next drill out the capacitor carefully, preferably with a hand drill. A stout piece of wire with plastic insulation can then be soldered to the output point and passed through the hole – soldering to the PCB is not easy as it's ceramic, causing quite bad heat loss at the iron bit. The bit should be grounded to the converter module as the Schottky diode is inclined to go short-circuit if there's a potential difference between these two items.

Two very thin pieces of track between the diode mixer and the output form a choke. Bridge the second, longer one with a piece of wire (resistor offcut). It's best to leave the short one, feeding the diode, in place. Both the diode and transistor are epoxy encapsulated. When soldering

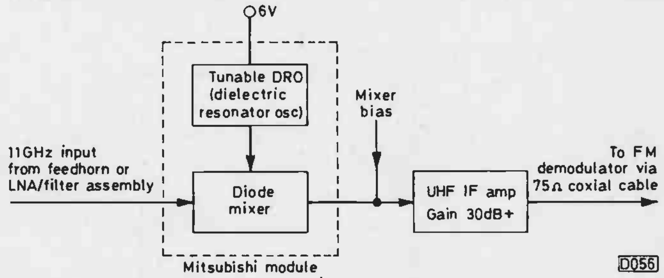


Fig. 1: Block diagram of the downconverter/u.h.f. i.f. amplifier system. The oscillator can be tuned over approximately 10·4-11·4GHz.

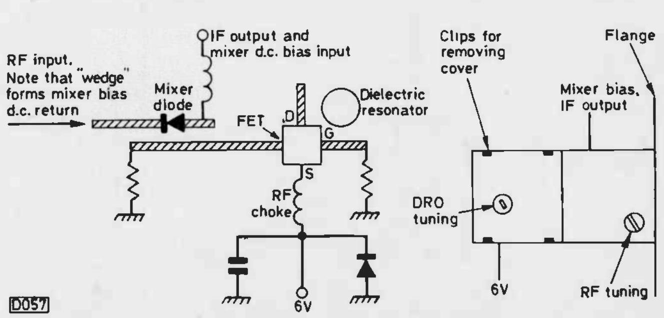
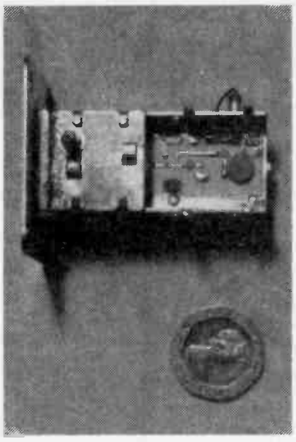


Fig. 2: Left, approximate circuit of the Mitsubishi FO-UP-11K oscillator/mixer module. Right, pin connections.



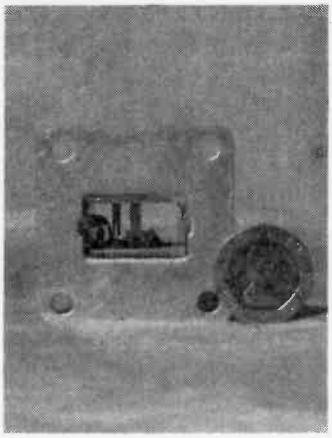


Photo 1 (left): Oscillator/mixer module with the cover removed. Note the resonator on the PCB.

Photo 2 (right): The module's input – the wedge and tuning screw can be seen.

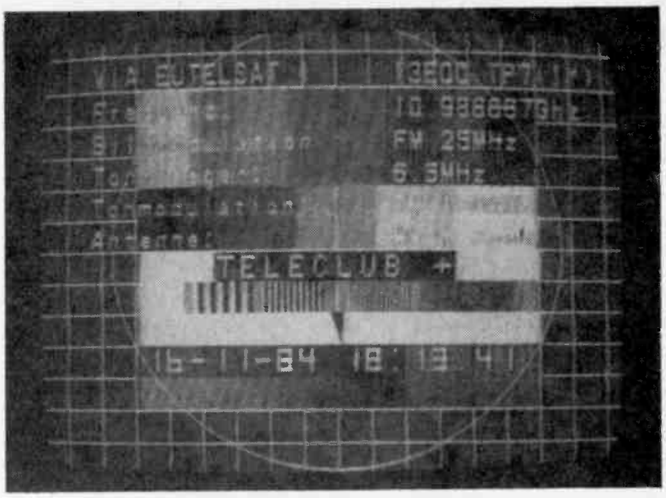


Photo 3: Teleclub signal received with no LNA using a 1·8m dish.

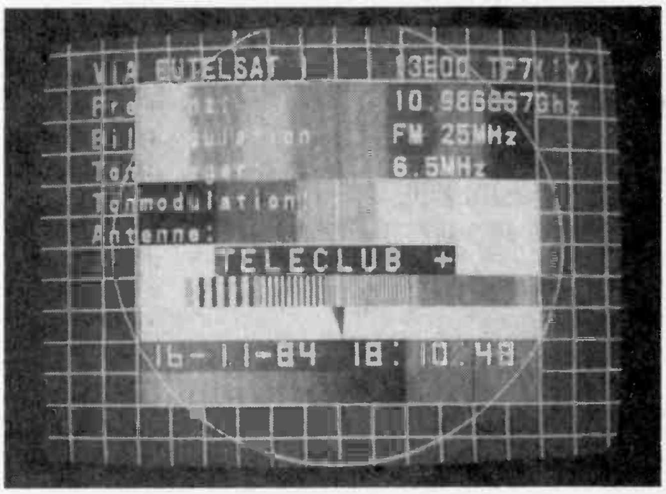


Photo 4: Same signal as shown in Fig. 3 but this time received with the addition of an LNA.

inside the unit be very careful not to short out the incoming stripline from the waveguide to the GaAsFET bias line – they are very close together and if they do short across it's difficult to remove the short with this type of board.

This completes the modifications to the module. Replace the lid. It's advisable at this point to unscrew the front tuning screw (not the oscillator screw) until it's right out: otherwise a notch in the response will be present somewhere in the middle of our frequency range.

UHF Amplifier

Due to the low level of the signal from the mixer diode it's essential to follow this with a high-gain amplifier mounted immediately after the mixer stage. The circuit used (see Fig. 3) is very similar to that described by Roger Bunny in the April 1984 issue, in this case with an emitter-follower output stage. Build the two stages in a small tinplate can mounted right at the module's output connection, using u.h.f. construction techniques. The amplifier's output can then be fed to a suitable wideband u.h.f. amplifier whose body is soldered to the rear of the first amplifier's can – a Labgear CM7066 is suitable or, to cut the size down, an OM335 or OM361 can be used. The gain should extend to above 1GHz. Solder the tinplate of the first can to the module with the i.f. pin coming through the floor. Don't use too much heat – the official recommendation is to keep the heating time down to a five minute period if possible, though I've never destroyed a module yet even when using very heavy duty soldering irons. It's essential for the first amplifier can to be right by the module otherwise local u.h.f. station breakthrough will be bad. You could make the first amplifier stage's base bias variable so that the system's noise figure can be optimised, though this doesn't in practice seem to help very much.

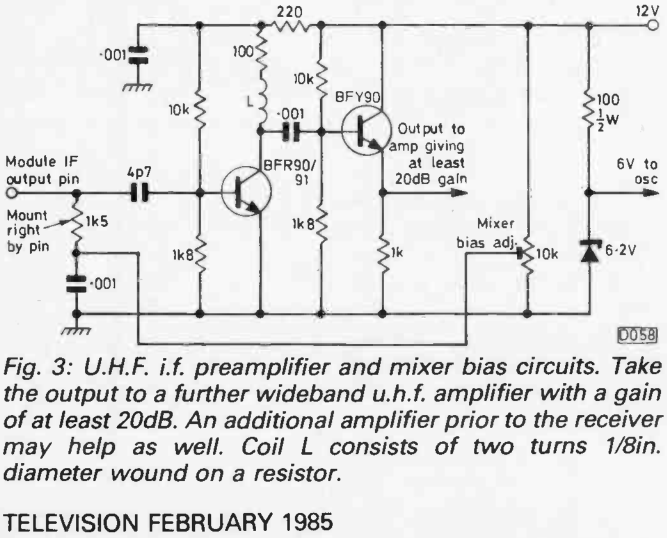
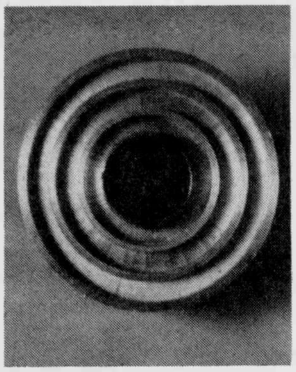


Fig. 3: U.H.F. i.f. preamplifier and mixer bias circuits. Take the output to a further wideband u.h.f. amplifier with a gain of at least 20dB. An additional amplifier prior to the receiver may help as well. Coil L consists of two turns 1/8in. diameter wound on a resistor.

The Schottky diode requires forward bias. A preset and series feed resistor are included for this purpose. The bias required varies from the low to the high end of the band: less is required at the top end while almost maximum is required at the lower end. It can also vary depending on the i.f. used. The preset can be located anywhere that's convenient after the series feed resistor and decoupling capacitor. If a u.h.f. amplifier bias preset is also used the two can be mounted together. Test the amplifier thoroughly before connecting it to the module. Applying a screwdriver to the input connection should nowadays give good local signal reception unless you live in a very screened location.

The module application note recommends the use of a 100Ω resistor to chassis at the i.f. output connection to facilitate matching. On all the units I've tried this merely reduces the signal levels considerably. The diode's output impedance is supposedly quite high, but a fair match into the first amplifier stage is obtained. Some optimisation



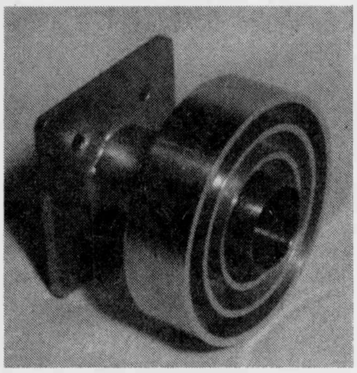


Photo 5 (left): Scalar feedhorn, showing front rings.

Photo 6 (right): Side view of the horn – the rings are adjustable with respect to the waveguide pipe.

could no doubt be obtained with the coupling.

The module requires a 6V supply which is easily obtained by means of a 100Ω, ½W resistor (minimum rating) and 6·2V zener diode connected across the 12V rail. The 6V consumption is quite high – around 50-60mA – and the GaAsFET chip may be quite warm in operation.

Testing the Module

To check that the oscillator is working, remove the mixer diode bias and power the oscillator, after checking that its d.c. consumption is 50-60mA or so. When a meter on a very low voltage range is connected to the output pin a reading of up to ±0·5V should be obtained, varying when one's hand is placed over the flange. This shows that the oscillator is working. Don't look down the waveguide when the unit is working as some of the oscillator signal comes out and can cause eye damage if you look for any length of time at a very close distance.

Connect the mixer bias and the u.h.f. amplifer to the output pin. You'll find that there's no additional noise when the module is powered and no LNA is used.

The oscillator is set at around 10·46GHz when the module leaves the factory. No problem should be had in checking this if a suitable signal generator is to hand – but more than likely it won't be! A 4GHz signal generator will give a good output at the third harmonic and should enable some checking to be done. If you've no gear at all, set the mixer bias at nearly maximum: you can be fairly confident that the unit will convert 11GHz to around 550-600MHz, which is the signal of interest for testing.

It's likely that the local u.h.f. transmissions will be at a very high level. Use good quality cable, as short in length as possible, with the u.h.f. amplifiers well screened. If group A signals are still intrusive, the i.f. output can be tuned to a quiet part of the band (see later).

Feedhorns

The standard "burglar alarm" horn will fit on the front of the module but is not particularly efficient for picking up signals from a dish. A scalar feedhorn (see Fig. 4) will give 1-2dB more. This consists of a series of rings mounted on a circular pipe: the position of the rings is adjustable and can be optimised once signals have been found. Ready made feedhorns can be purchased from the suppliers listed at the end of this article. These generally have a WG17/WR75 flange which matches the module's waveguide but not the flange holes. All you need to do is to drill out the holes in the module a little.

If you construct the scalar ring this is easiest to do using copper sheet, though it can be tedious to say the least! The pipe is easiest made from 22mm diameter copper tube. If you are worried about oscillator leakage from the waveguide, with the pipe exactly 0·64in. in diameter the incoming satellite signals will pass down it without attenuation but steep attenuation will occur below 10·7GHz. If you are tuned to the top end of the ECS-1 band however the oscillator will be at 10·9GHz to obtain an 800MHz i.f. output so there will still be radiation. Note that the 0·64in. pipe tolerance is very precise: some reaming out of smaller bore pipe may be necessary, in whcih case ensure that the inside finish is smooth – microwave signals hate rough insides and any sort of corrosion.

A scalar feedhorn will generally cope with a dish down to 0·33 f/d ratio (ratio of the focal point to the diameter). A lot of surplus "radar" dishes are around 0·25 f/d, which means that the focus point is right at the rim of the dish. It's very difficult for a scalar feedhorn to see the entire surface of this type of dish so it's better to employ a subreflector feed system. It'll be fine for finding signals however – it's just that your 1·8m dish will give signals akin to those obtained with a 1·5m dish!

The flange can be attached directly to the end of the pipe. You can experiment with circular to rectangular transitions, but for a basic system a circular pipe going straight on to a rectangular flange will work. The addition of some tuning screws in the horn near the flange may help a little, more so if there's mismatching into an LNA. The ideal diameter for the screws is 6BA – the nut can be glued to the pipe with epoxy. The easiest way to hold the screw in place while drying is to attach the screw to the nut, screw it into the pipe and tape the assembly over whilst checking that it's at 90° to the pipe.

Finding the Signals

We now come to the hardest part of all, initially locating the ECS-1 satellite with an unknown converter, an unknown dish which will have a beamwidth of around 1° and an i.f. possibly not known to within 100MHz! If possible use a dish of at least 1·8m, preferably of fibreglass or solid construction. The performance of petal dishes at around 11GHz is erratic, and the construction will usually result in a loss of at least 6dB.

The easiest signal to find initially is the Swiss Teleclub at approximately 10·99GHz with vertical polarisation (see photos 3-4). It's on test pattern all day until around 1815 GMT and after closedown at around 2330. The pattern conveniently lists the signal's characteristics. Vertical polarisation corresponds to the *narrow* side of the waveguide being vertical. The polarisation is not actually dead horizontal/vertical unless one is directly beneath the satellite: for the UK there will be an offset of 5-10°. You

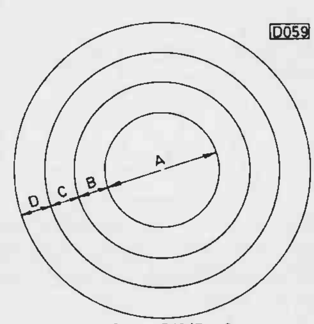


Fig. 4: Scalar feedhorn – construction of rings. The height of the rings is 8mm. Up to seven rings can be used – experiment for best results. Slide the assembly over the waveguide pipe and optimise reception for the individual dish.

won't need to worry about this for initial setting up. With a dish on a polar mount the polarisation can be set at exactly vertical/horizontal at due south and will keep to the correct offset on any satellite to the east or west as the dish is swung round.

The approximate co-ordinates for ECS-1 at 13° east over the equator are 30° elevation and 163° ETN (east of true north) for London, corresponding to a local hour angle of 14·5°E on a polar mount. An accurate inclinometer is highly recommended. Set the dish elevation (if on an azimuth/elevation mount), then swing the dish through the estimated azimuth position, varying the elevation setting by half a degree or so on each swing. With this method the satellite will be found sooner or later provided the dish and the electronics are both working normally.

Mount the converter feedhorn at the focus of the dish, allowing up to 5mm backward and forward movement for peaking the focus. In general the focus will occur 0·5-1cm inside the feedhorn. Take all the receiving equipment out to the dish and connect some form of signal strength indicator – due to the sharpness of the beamwidth and the fact that the adjustments are more critical than at 4GHz a signal strength meter is invaluable. Fig. 5 shows a simple circuit using a diode detector and an operational amplifier which can be used to drive a meter.

As the oscillator in the module is adjusted, the Teleclub signal will appear at around 550-600MHz. If this band is congested (local group A signals at high strength), screw the DRO plate *out* by approximately 1·5 turns. This will lower the oscillator signal by some 200MHz, giving an i.f. output at around 750-800MHz. If you use an f.m. receiver that's been used for Gorizont reception the picture should lock immediately, possibly with a slight energy dispersal flicker. The normal (as opposed to the Russian) energy dispersal standard is at half field rate with a narrow deviation. This should be removed by the d.c. clamping action in the TV set but may still be present if the signal is weak.

Once the signal has been found, peak the focus and dish alignment. Then screw the module's front tuning screw in (as mentioned earlier, this should be screwed fully out initially). The signal should disappear when the screw is approximately half way in, reappearing as the screw goes in farther. A small peak will be found just prior to the notch and this will give a worthwhile increase in signal strength. The exact position will vary for different frequencies of course. The mixer bias (and u.h.f. amplifer bias if fitted) should also be optimised for best results.

If you are feeding the LNC's output to a standard u.h.f. TV set and using slope detection, finding the signal initially will be more difficult. The images will look

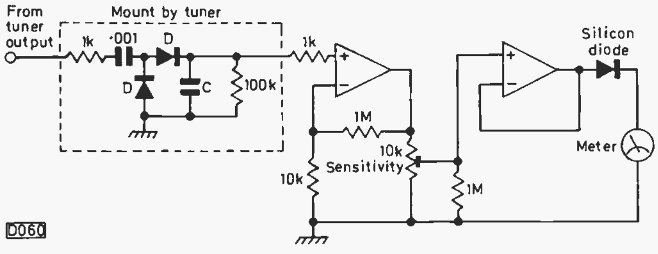


Fig. 5: Signal strength meter circuit. Diodes D type OA90 or similar. C is 0·001μF – if the readings vary a lot with the video content, increase the value of C to 0·1μF or more. The 10kΩ potentiometer adjusts the meter's sensitivity. Any type of operational amplifier will do.

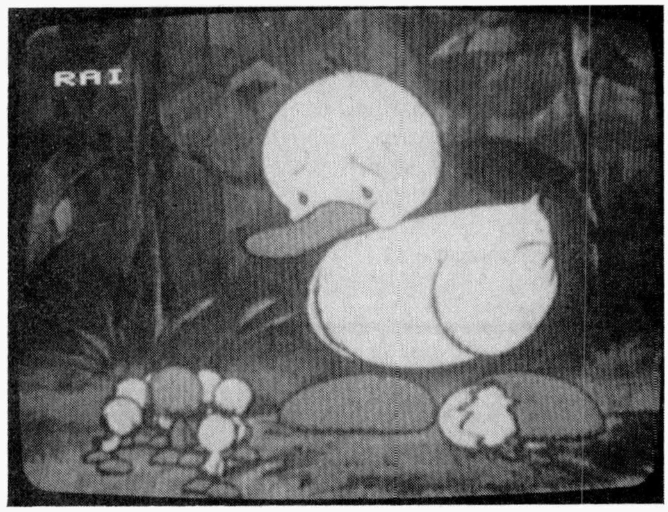


Photo 7: RAI-1 received via ECS-1.

weaker than they really are and will have the characteristic energy dispersal flicker.

It may take some time to find the satellite the first time (it took me two hours) due to the combination of unknown factors. It's worthwhile having an assistant to tune around while you are moving the dish – or vice versa.

If the polarisation is changed to horizontal, RAI-1 (Italy) should be found at around 11·005GHz, just above Teleclub and possibly a little weaker. At 11·175GHz Euro-TV (Holland) will be found, at present on test with colour bars. The Belgian Esselte service is at 11·15GHz with vertical polarisation. If the oscillator tuning (DRO) is set to give Teleclub at around 600MHz, Euro-TV should be present at around 770MHz, though some tweaking of the tuning screw for optimum results may be needed. TV5 (France) and Sky Channel are at the top of the band with horizontal polarisation, at 11·47GHz and 11·65GHz respectively. Screw the oscillator plate about two turns (possibly three turns) clockwise for the same i.f. as the lowband signals. PKS (Germany – to be renámed in 1985) is present at 11·51GHz and Music Box at 11·674GHz, both with vertical polarisation.

Results

With a 1·8m dish and a good feed, fair pictures will be seen on Teleclub, Euro-TV, TV5, PKS, Music Box and Sky Channel (the latter with Oak Orion coding). To get approaching noise-free signals a 3m dish is required. Using an LNA with bandpass filter will enable the dish size to be reduced to 1·5-1·8m for good to perfect pictures – a following article will describe this assembly. Building an LNA using stripline techniques is much easier now that GaAsFETs with a good noise figure are available, though the cost of the three GaAsFETs required is over £100. Supply delays often seem to happen, so if you intend to build the LNA we suggest you order the GaAsFETs now. The bandpass filter is ready-made in waveguide: it's not possible to adopt the DIY approach here due to the exact tolerances required. As mentioned earlier on, arrangements have been made to supply this item. The LNA case is built up from tinplate in a similar fashion to the downconverter modules and should not present any problems.

Suppliers

The GaAsFETs – two NE71083, one NE70083 – are available from Microwave Modules Ltd., Brookfield Drive, Aintree, Liverpool L9 7AN (telephone 051 523 4011).

LNA boards, assemblies etc, will be available from Hugh Cocks TV Services, Cripps Corner, Robertsbridge, Sussex TN32 5RY (telephone 0580 083 317).

Downconverter modules, type FO-UP-11K without flange or FO-UP-11KF with flange, are available from Aspen Electronics Ltd., 2 Kildare Close, Eastcote, Ruislip, Middx HA4 9UR (telephone 01 868 1188). Order a data sheet at the same time.

SP Antenna Systems, 3 Woolpack Corner, Biddenden, Ashford, Kent (telephone 0223 291 090) can supply feedhorns and 2m fibreglass dishes.

North East Satellite Systems, Cropton, Pickering, N. Yorks (telephone 075 15 598) can supply feedhorns and 1m/1·5m solid dishes.

STS Ltd., Baugh Farm, Church Lane, Downend, Bristol (telephone 0272 560 775) can supply feedhorns and dishes.

Workshop Decoder Alignment System

Denis G. Mott

Since the advent of colour television one of the greatest problems for service engineers has been the diagnosis of faults in the decoder. In colour TV receiver production there are problems with alignment and fault finding when an assembled decoder is defective. The following notes are applicable to both the repair and production of PAL decoders.

The earliest decoders used in the UK employed discrete component circuitry without an i.c. in sight. These had many presets and coils to twiddle. The next generation might have one or two i.c.s plus discrete component sections. This reduced the coil and preset count but there was still enough to provide the twiddler with his fun. The latest generation of single-chip decoders have few presets for the phantom twiddler. This latest generation generally produces only RGB outputs however and is not suited to the alignment procedure to be described.

Basic System

In our company decoders are assembled, aligned and repaired in a fully illuminated work area with each engineer testing, aligning and repairing up to seventy decoders a day. The boffins from the development laboratory, led by Rod Allison, came up with the following test/alignment method. It uses the Leader LCG399 colour pattern generator which can be set, by means of some internal switches, to give a colour-bar signal in which the lower half of the screen has bars that are 180° out of phase – the lowest few lines can be set for luminance only, to act as a reference. The system adopted is shown in block diagram form in Fig. 1.

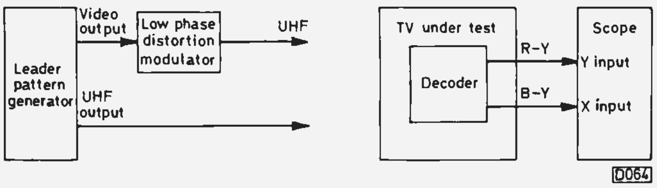


Fig. 1: Block diagram of the alignment system.

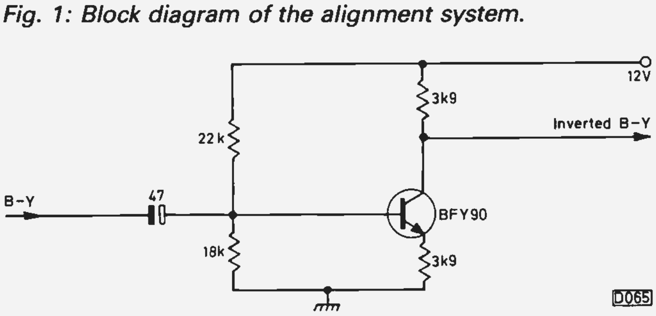


Fig. 2: Simple signal inverter circuit.

The pattern generator can be connected directly to the TV set being tested, via the generator's r.f. output socket. Where multi-output distribution is required however the 1mV of r.f. output is not enough for passive splitting, while if an active distribution system is used phase shift can occur, causing problems with decoder alignment. Instead, the video output from the generator is fed to a low phase distortion modulator with an r.f. output of 10mV, which is reduced by splitter attenuation to 1mV.

Signal Inverter Circuit

The display scope is connected to the decoder as follows, with the timebase switched off: R − Y to the Y input, B − Y to the X input. In some circumstances it may be necessary to invert the colour difference outputs from the decoder. A suitable circuit is shown in Fig. 2.

Alignment Procedure

Now to alignment. The following procedure is based on the Network Models NWC1401/NWC1402, whose decoder circuit is shown in Fig. 3. A very similar decoder is used in the Grundig GSC100/GSC200 chassis. The procedure should be applicable to any decoder using the TDA2510 and TDA2521/2 i.c. combination – and of course the basic operation of PAL decoders is similar in all sets.

(1) 6MHz sound trap. Unless the phantom twiddler has been at it this will never require setting. If it does require a tweak, disconnect the video input, connect a 6MHz input and adjust L2 for minimum signal with the scope connected to TP1.

(2) Reference oscillator frequency. Connect the video input to the decoder, feed in the special colour-bar signal, short TP2 and TP3 together and to chassis and adjust trimmer C23 for stationary colour bars – just as you would when setting up a line timebase with flywheel sync.

(3) Burst level. Connect the scope to TP2 and adjust the burst amplitude to 500mV with R30.

(4) Phasing adjustments. A graticle is used with the scope giving a vector display. Connections are as shown in Fig. 1. With a correctly adjusted decoder the display shown in Fig. 4 should be seen. If there's a fault condition or misalignment the display could look something like Fig. 5. Turn the colour control to maximum and concentrate on

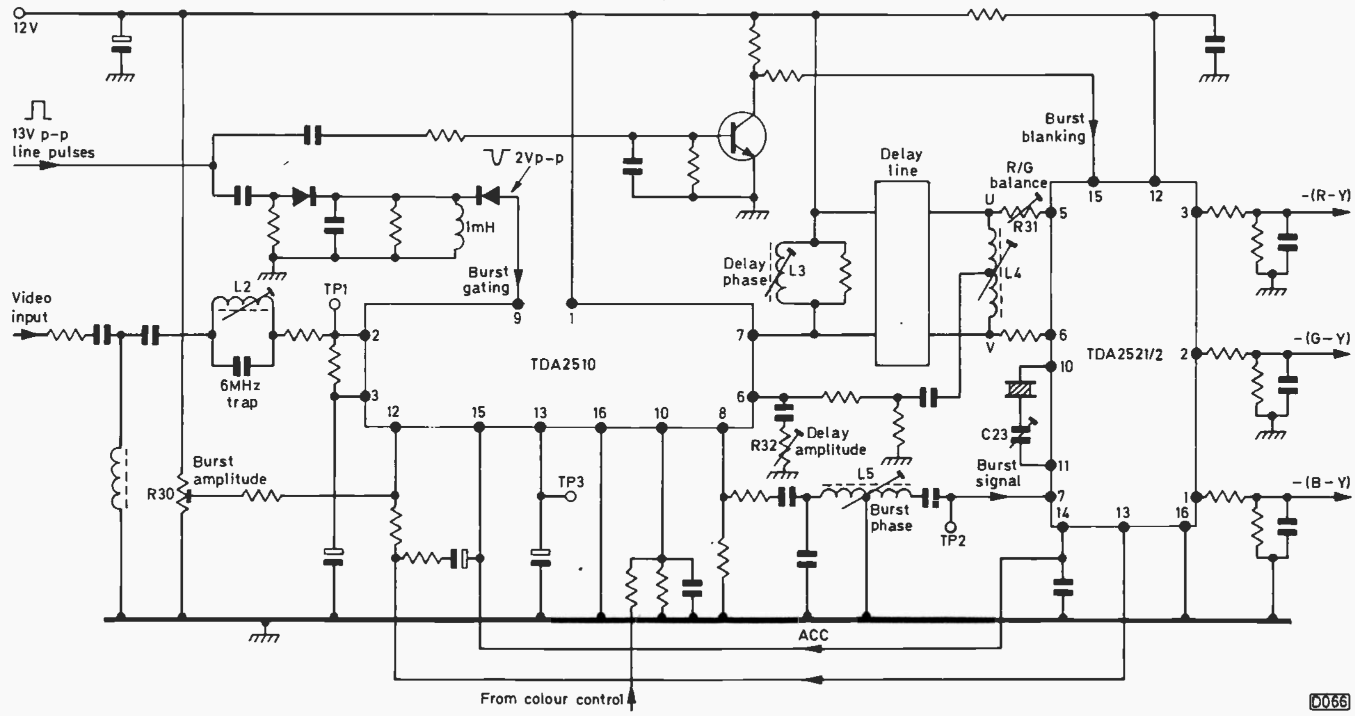


Fig. 3: The two-chip decoder used in Network Models NWC1401 and NWC1402 (simplified circuit).

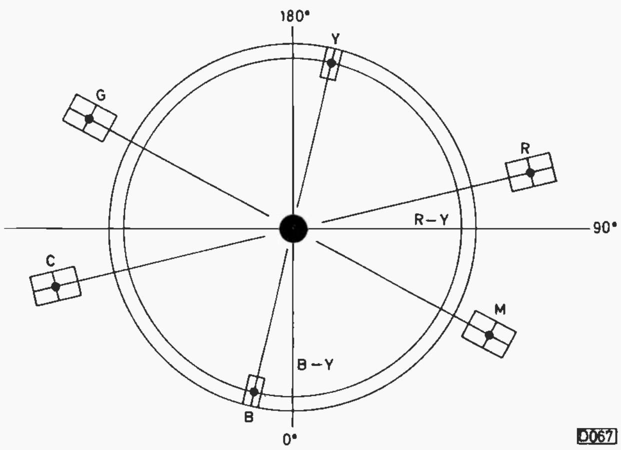


Fig. 4: Scope vector display obtained with a correctly adjusted decoder. The display arises from the fact that the scope's X and Y axes coincide with the B – Y and R – Y axes respectively: with a colour bar signal of the type used dots are obtained at the phase positions corresponding with the colours in the pattern.

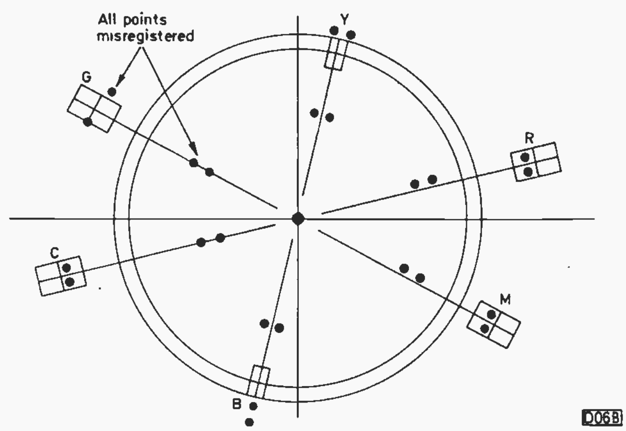


Fig. 5: Type of display obtained with a misaligned or faulty decoder.

the central area, adjusting R32 (delay amplitude) and L5 (burst phase) to reduce the area covered, as in Fig. 6.

Reduce the colour control setting to bring the outer dots into view. Adjust L3 (delay line phase) and L4 (matrixing coil) so that the outer dots register. Then give R32 and L5 a final tweak.

(5) R/B balance. Use the scope to monitor the R – Y and B – Y outputs as before, but set the timebase to approximately 20μsec/cm. Adjust R31 (R/B balance) for a ratio of R = 4cm, B = 5cm. This final adjustment should produce a TV display with reasonably colourless squares in the lower region – compare with the luminance only signal at the bottom.

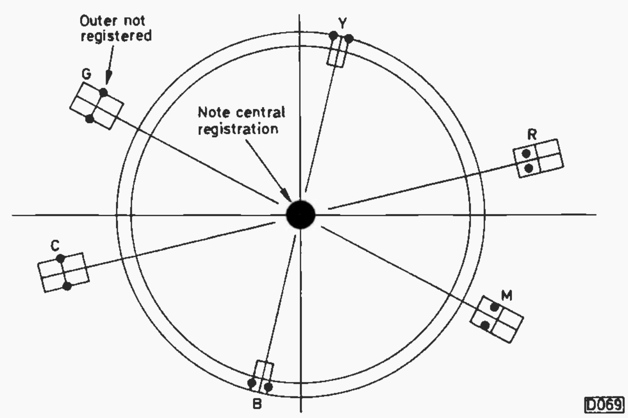


Fig. 6: Initial phasing adjustments.

In Conclusion

Try the system first with a known good decoder. This will enable you to find out what effects what in your decoder. The system was designed with the Leader LCG399 in mind, but there are probably other generators that give the same type of signal.

Finally, my thanks to R. Allison, J. Clarke and Network Industries Ltd.

Another Smash Hit

Les Lawry-Johns

After another long and weary day of mending TVs then watching TV in the evening we at last got to bed and dropped off into a deep sleep. We were awakened at one o'clock in the morning by a loud crash. I leapt out of bed and rushed down the stairs shouting at the top of my voice, informing the window smashers that they were born of unmarried parents. Such was the speed of my descent (naked as usual) that the smashers fled before taking a thing. I was hardly in a fit state to run out into the street so, after taking note of which window had been smashed, I ran back upstairs to pull my trousers on (having rung the police). There followed the usual clearing up operation, which was especially hard on Honey Bunch because she'd worked so well and long decorating the windows with Christmas decorations. They'd looked nice, very very nice.

We cleared up the mess and boarded the window (the small one this time), had a cup of tea and returned to bed, laying awake for a long time as we half expected another crash. I was plotting ways of laying a grid inside the windows connected to a 25kV e.h.t. supply. Something less I decided, in case I should hurt myself. Why anyone finds it worthwhile smashing the windows beats me: we always take the expensive bits out every night. They must do it for fun. So the grids will go up. I wonder whether that will stop them? Somehow I doubt it.

That Evening

We felt a bit depressed the following evening so we went next door to the Coach and Horses for a drink. Sylvia the landlady served us and she and HB chatted for a while about knitting patterns. Then HB went over to the fruit machine and lost some money while dreaming about making some. I sat at the bar and dreamed, waking with a start as I heard myself snoring. Just then Tony walked in. He's an avid reader of this magazine and has been for some years.

"You're slipping Les" he greeted me. I sat up straight and wiped the sleep from my eyes. "no you fool, not off your stool, I mean your articles are getting a bit dreary. You've lost your zest, your get up and go if you know what I mean."

I nodded miserably. "I know what you mean Tony. My get up went down and my go just went – some time ago. Sorry, very sorry."

Tony looked a bit mystified, then tried again. "No Les, we know you're getting on a bit and probably feel a bit jaded. But it used to be fun reading your adventure stories – how you won the Battle of Britain single handed, how you fought the Red Baron in the first war when he said your Camel was soppy, how you passed wind through the Great Wall of China. We never have any of that old tripe now. What's happened?"

"Well the editor didn't think he should print the last one about when we got lost up the Yukon and bumped into Eskimo Nell. He said it was too rude and I think he was right. I mean who wants to read what Dead Eye Dick had in his hand?" Tony gave a cough and turned away as Sylvia approached with the drinks. Sylvia doesn't like naughty songs and always looks daggers at me when I start to sing the Lobster Song. We all have to be on our best behaviour when Sylv's around. That's why Dave sends her upstairs sometimes, when the boys start telling each others' fortunes.

So we had a couple and called it a day, HB having scooped up all our change and bunged it back into the machine that kept telling her to leave the combinations to it to decide. But she wouldn't listen.

Next Day

Next day there was a long procession of idiots who each knew exactly what was wrong with their sets and didn't like it when I told them they were wrong. One chap said his fuse had gone. I spent some time proving that it was the line output transformer that was blowing the 800mA fuse in his G8, then he said he didn't want it done anyway. I helped him out with the set and he then turned and said he felt he should give me something for my trouble. So he pulled this orange out of his pocket and handed it to me. I gave it back saying I don't like oranges. Then he pulled this ten penny piece out. I told him to b...r off. Is it any wonder I get dispirited at times?

Look what happened when a chap brought in his ITT CVC9 (20in. version). He complained about the focusing and said he thought it was the tube. I chided him for thinking such a thing. "The smaller 20 and 22in. tubes in these sets last forever." I mean, just everyone knows that the resistors in the focus network change value and that if it isn't the one on the tube base it's one of the 4·7MΩ ones in series with the focus control. So I checked the 2·2MΩ resistor on the tube base panel and it was all right. I took off the line output stage cover and checked the two 4·7MΩ resistors. They were all right. So I changed the focus VDR itself and the decoupling capacitor for good measure. No change. I thought the resistors could be telling lies so I fitted some new ones. All to no avail and the voltage was spot on. I didn't believe the meter – it's played tricks before – so changed the tripler. The focus was as bad as ever and I had to conclude that the tube was indeed at fault.

"I thought you said the tubes last forever . . ."

A Lecture from Les

Having proved that I know nothing about ITT sets I'll now give you a bit of advice which you probably don't need.

Whenever you get a CVC32 or one of that ilk in for service for whatever reason, always check the small subpanel over the top of the scanning coils. Take it out (unclip it) and turn it over to check the contacts on the print side. You'll be glad you did (well I'm always glad that I do anyway). There's always one contact at least that's about to cause trouble. End of lecture.

Finale

We have a couple of large blocks of flats opposite the shop and I'm often asked to "pop over" to check a TV set or something. They never know the make or model number so if I do go I have to lug quite a load of stuff with me in order to be reasonably sure of doing the job. By the time I've walked over to the flats, gone up to say the seventh floor, then walked along the corridors I'll probably be feeling a bit puffed. You repair the set, replacing maybe a fuse and a transistor, then test it and line it up. Then you pack your kit bags as it were and prepare to leave. The lady has a pound note in her hand and is saying "I must pay you something". You don't want to offend, so you decline the reward and leave. As you go out of the door you hear her call out "if we get any other little jobs I'll give you a shout" . . .

Letters

DISCO-LIGHT EFFECT

Les Lawry-Johns mentioned a disco-light effect in the November issue. I've seen similar effects several times, due to loose shadowmasks in tubes. The mask seems to become partially detached within the c.r.t. and gets too hot. This leads to expansion with loss of purity etc. due to movement of the mask from its correct plane.

A tube with this fault will sometimes give a perfectly good display when the set is switched on from cold, going berserk as the shadowmask heats up. A similar effect can be produced by placing a shadowmask from a scrap tube against the face of a good working c.r.t. and moving it about. By keeping the mask still, the individual triad structure of the phosphor dots can be seen. To date I've seen this fault only in delta-gun tubes.

M.J. McHugh,
Hednesford, Staffs.

N1700 TIMER RECORDINGS

It doesn't seem to be too well known that to make an unattended recording of more than two hours on a Philips N1700 VCR all one has to do after setting the timer is to make sure that the time setting switch is not returned to the "lock" position. In any other position the recording will be started by the electronic clock and will continue to the end of the tape, being switched off by the stop foil. May I add that the speed reduction modification given in the April 1983 issue of *Television* works very well.

E.A. Evans,
Taunton, Somerset.

THE VIEW MASTER

I found Chas E. Miller's vintage TV article on the View Master (December) very nostalgic – I built one of these sets by way of a return to electronics after radio in the 20s followed by a period at University and then war work. Chas has clearly described one of the later models however – I believe there were several. The first appeared in approximately 1946, just after the war, when both Pye and Ekco had 9in. table model t.r.f. sets that sold for about £45. This first model – the one I built – was rather less sophisticated than the one described by Chas Miller. The e.h.t. (7kV) was obtained from a mains transformer instead of being flyback derived, there was electromagnetic focusing, and a full-wave rectifier was used for the h.t. supply. The set nevertheless gave superb results in the area covered by the Alexandra Palace transmitter.

At this time, and for two-three years, there was no question of being able to obtain a 12in. tube – unless you were friendly with someone "in the know". The 9in. size was the order of the day, without internal aluminising (ion burn was very common) and external Aquadag coating, so that high-voltage capacitors were required to smooth the 50Hz e.h.t. The first commercially available receiver with flyback e.h.t. was the Pye B18T, a 9in. table model released in July 1948. The valve e.h.t. rectifier was encapsulated with the line output transformer in bitumen.

Finally, *Wireless World* about this time designed and described a real DIY television set. In contrast with the View Master, everything that could be made by the constructor was described, even the scan yoke. There was flyback e.h.t. with a voltage tripler that employed metal rectifiers. It was originally a t.r.f. design, but a superhet version followed – very useful for frequency changing as the Birmingham transmitter had by then come into service.

J.B. Haley, Ph.D., C.Chem., F.R.S.C.,
Fleet, Hants.

AIRBORNE TV

In the December issue Roger Bunney mentioned airborne TV experiments carried out during the 1960s. A British book published in 1949, *The Television Guide* by Dr. W. Summer, gave details of American transmissions during the 1940s. The Stratovision project as it was called was undertaken by the Westinghouse Corporation, and the pictures of the aeroplane and the transmitter on board indicate that at least the experiment got off the ground. A map showed that virtually all the States could be covered by fourteen aircraft: a 1kW transmitter at 30,000 feet was said to have a service area radius of 400 miles across, giving the same signal as a 50kW ground-based transmitter.

Incidentally, recent discussion of pre-war television may have given the impression that the Americans used the 525-line standard from the start. This is not so: the pre-war system used 441 lines.

Finally a request. I'm assembling a collection of broadcast test card material and have already acquired more than a dozen different monoscope tubes and as many 35mm slides. I'd be pleased to hear from anyone who has items to dispose of.

Andrew Emmerson,
71 Falcutt Way,
Northampton NN2 8PH.

Editorial note: The effective starting date for regular TV services in the USA was July 1st, 1941 – with 525 lines. Previous services were allowed by the FCC on an experimental basis only. They used 441 lines, though RCA had used 240 and 343 lines for demonstration purposes in the early 1930s. An excellent and very detailed article on the early days of TV in the USA appeared in the March 1982 issue of *Radio-Electronics*.

Book Note

The second edition of the **Antenna Engineering Handbook,** edited by Richard C. Johnson and Henry Jasik, has been published by the McGraw-Hill Book Company at £76. This sumptuous book contains 1,408 pages and deals with just about every type of aerial, with the emphasis on design rather than installation etc. The material is of US origin, which means for example that in the section on TV receiving aerials the use of 300Ω twin feeder is assumed and US channels are specified.

ECONOMIC DEVICES, PO BOX 228, TELFORD TF2 8QP

16029	1.58	2SC1061	0.54	2SD898B	2.67	AN320	4.97	BC171	0.10	BD166	0.38	BF137	0.11	BLY49	2.00	BY203/20	0.18
16181	1.13	2SC1096	1.05	40408	0.45	AN322	4.38	BC172	0.09	BD168	0.66	BF152	0.28	BR100	0.20	BY206	0.17
16182	1.13	2SC1104	2.60	40594	1.39	AN331	2.99	BC172B	0.24	BD175	0.39	BF153	0.52	BR101	0.37	BY207	0.22
16334	0.88	2SC1106	4.12	40595	1.39	AN337	3.99	BC173	0.15	BD177	0.39	BF154	0.23	BR103	0.45	BY210-400	0.24
16335	0.72	2SC1114	5.61	40636	0.86	AN340P	1.06	BC174B	0.24	BD179	0.44	BF157	0.23	BR88B	0.58	BY210-600	0.27
16446	0.89	2SC1124	1.10	40871	1.39	AN355	3.36	BC177	0.18	BD181	0.90	BF158	0.16	BRC-M-300	1.58	BY210-800	0.30
16600	1.25	2SC1151A	4.29	40872	1.39	AN362	1.47	BC178	0.23	BD182	0.90	BF159	0.16	BRC116	0.60	BY223	0.85
16799	2.16	2SC1152	4.25	60857	1.10	AN5111	2.34	BC179	0.23	BD183	0.90	BF160	0.28	BRC1330	1.60	BY224-400	0.90
16801	0.86	2SC1157	4.12	74LS132	0.72	AN5132	3.99	BC182	0.08	BD184	1.10	BF167	0.34	BRC300	1.82	BY225-100	0.79
16802	1.03	2SC1162	0.95	74LS138	0.85	AN5250	3.33	BC182B	0.23	BD187	0.48	BF173	0.30	BRC4443	1.12	BY226	0.28
16803	4.81	2SC1172	1.92	74LS157	0.79	AN5435	2.80	BC182L	0.09	BD189	0.35	BF177	0.50	BRC4444	1.12	BY227	0.44
16905	1.35	2SC1195	2.83	74LS161AN	1.18	AN5610	6.75	BC182LB	0.12	BD190	0.59	BF178	0.36	BRC5296	0.70	BY228	0.54
17074	6.00	2SC1213	0.75	74LS196	1.25	AN5613	3.72	BC183	0.09	BD201	0.54	BF179	0.32	BRC6109	0.75	BY255	0.97
17127	3.91	2SC1226	1.32	74LS20	0.25	AN5620X	4.63	BC183L	0.09	BD202	0.54	BF180	0.32	BRC82	0.98	BY298	0.25
17376	1.43	2SC1306	0.85	74LS244	1.65	AN6320N	3.89	BC183LB	0.23	BD203	0.54	BF181	0.29	BRC83	0.98	BY299	0.25
1N4001	0.05	2SC1307	1.35	74LS30	0.29	AN6342	1.36	BC184	0.09	BD204	0.54	BF182	0.30	BRC84	0.98	BY476A	0.76
1N4002	0.05	2SC1316	3.40	74LS367	1.05	AN6344	4.68	BC184L	0.09	BD207	1.00	BF183	0.35	BRX44	0.54	BYW56	0.30
1N4003	0.05	2SC1364	0.49	74LS373	1.55	AN6363	10.20	BC184LB	0.23	BD208	1.00	BF184	0.39	BRX49	0.45	BYX10	0.26
1N4004	0.06	2SC1383	1.39	74LS47	1.05	AN6551	0.56	BC186	0.24	BD222	0.44	BF185	0.35	BRY39	0.50	BYX55-350	0.48
1N4005	0.07	2SC1398	0.51	74LS73	0.39	AN6552	0.52	BC187	0.18	BD225	0.44	BF194	0.15	BRY55	0.60	BYX55-600	0.25
1N4006	0.07	2SC1410	2.17	74LS74	0.39	AN7145	2.04	BC204	0.14	BD228	0.57	BF195	0.12	BRY56	0.38	BYX71-350	0.67
1N4007	0.07	2SC1413	3.68	74LS75	0.52	AN7150	2.22	BC207	0.12	BD229	0.63	BF196	0.15	BSR59	1.17	BYX71-600	0.85
1N4148	0.03	2SC1505	0.56	74LS86	0.49	AN7151	2.05	BC212	0.10	BD231	0.45	BF197	0.14	BSS38	0.30	BYX94	0.18
1N4448	0.12	2SC1578	6.67	74LS90	0.75	AN7156	2.05	BC212B	0.23	BD232	0.44	BF198	0.15	BSTBD1409	2.48	BYY56	1.09
1N5401	0.12	2SC1617	3.35	74LS92	0.75	AN7158	2.34	BC212L	0.09	BD234	0.38	BF199	0.15	BSTBD1405	4.37	BZV15-C12	0.72
1N5402	0.13	2SC1670	2.84	74LS93	0.75	AN7218	1.49	BC212LB	0.23	BD235	0.43	BF200	0.33	BSTCD146	2.25	BZV15-C12R	0.72
1N5403	0.14	2SC1678	1.25	74LS95B	0.85	AP58076	4.25	BC213	0.09	BD236	0.45	BF216	0.32	BSTC0233	2.25	BZV15-C24	0.72
1N5404	0.15	2SC1810	1.40	7805 TD-220	0.63	AS560S	1.43	BC213L	0.09	BD237	0.38	BF218	0.32	BSTC0246	4.51	BZV15-C24R	0.72
1N5408	0.18	2SC1815	0.41	7805 TO-3	1.05	AU106	1.96	BC213LB	0.23	BD238	0.29	BF222	0.50	BSTC1233	3.91	BZV15-C30R	0.72
1N914	0.05	2SC1829	2.01	7806	0.66	AU110	1.96	BC214	0.09	BD239	0.44	BF224	0.15	BSTC3146	0.71	BZX61 Range	0.16
1S44	0.06	2SC1875	4.77	7808	0.54	AU113	2.15	BC214L	0.12	BD240	0.36	BF237	0.59	BSTCC0143	2.79	BZX70-C11	0.54
1S5012A	0.73	2SC1891	3.35	7812 TD-3	0.54	AY102	2.62	BC214LB	0.23	BD240D	0.47	BF240	0.15	BSTC0643	3.06	BZX70-C12	0.54
1S921	0.09	2SC1929	2.25	7812 TD-220	1.05	AY105K	1.89	BC225	0.24	BD241	0.45	BF241	0.15	BSV57B	2.66	BZX70-C15	0.54
2582	1.94	2SC1942	5.70	7815	0.55	AY106	1.98	BC237	0.09	BD242	0.45	BF244	0.23	BSW68	0.38	BZX70-C30	0.54
2N1302	0.24	2SC1945	4.11	7818	0.55	BA102	0.30	BC238	0.09	BD243	0.44	BF245A	0.33	BSX19	0.30	BZX70-C47	0.54
2N1303	0.34	2SC1953	1.75	7824	0.55	BA1310 (IC)	1.72	BC238A	0.11	BD243A	0.50	BF255	0.18	BSX20	0.30	BZX79 Range	0.09
2N2218	0.38	2SC1957	0.86	AC107	0.66	BA1320 (IC)	1.22	BC239B	0.08	BD244	0.44	BF256	0.25	BSX21	0.45	BZY88 Range	0.09
2N2219A	0.29	2SC1959	0.36	AC117	0.39	BA1330 (IC)	1.82	BC251A	0.15	BD244A	0.77	BF256LC	0.38	BSY52	0.45	BZY93-C12	0.99
2N2222	0.34	2SC1962	1.75	AC123K	0.39	BA145	0.17	BC252	0.12	BD245C	0.68	BF257	0.30	BSY79	0.46	BZY93-C18	0.99
2N2646	0.75	2SC1969	2.92	AC128	0.28	BA154	0.08	BC258	0.22	BD246C	0.74	BF258	0.29	BT100A	1.46	BZY93-C24	0.99
2N2904	0.32	2SC2027	2.67	AC138	0.08	BA155-01	0.12	BC261A	0.20	BD253	0.95	BF259	0.30	BT106	1.20	BZY93-C24R	0.99
2N2905	0.39	2SC2028	1.91	AC141	0.26	BA156	0.12	BC262	0.20	BD278A	0.60	BF262	0.51	BT108	1.31	BZY93-C30	0.99
2N2906	0.34	2SC2029	1.49	AC142K	0.39	BA157	0.17	BC287	0.45	BD317	1.96	BF263	0.51	BT109	1.31	BZY93-C47	0.99
2N3053	0.24	2SC2057	1.07	AC151	0.25	BA159	0.12	BC294	0.45	BD318	2.08	BF264	0.33	BT112	2.25	BZY93-C68	0.99
2N3054	0.90	2SC2073	1.40	AC153	0.30	BA182	0.17	BC301	0.36	BD375	0.38	BF271	0.30	BT113	2.25	BZY93-C7V5	0.99
2N3055	0.55	2SC2078	1.25	AC153K	0.36	BA222 (IC)	1.26	BC302	0.30	BD377	0.23	BF273	0.18	BT116	1.52	ZTK33	0.39
2N3055H	0.77	2SC2091	0.59	AC176	0.17	BA284/2	0.15	BC303	0.34	BD379	0.69	BF274	0.18	BT119	1.60	ZX18	2.47
2N3442	1.05	2SC2122A	4.65	AC176K	0.40	BA301 (IC)	0.92	BC307	0.09	BD380	0.69	BF324	0.16	BT120	1.60	C106D	0.46
2N3702	0.12	2SC2141	1.69	AC179	0.25	BA302	0.90	BC307A	0.14	BD410	0.44	BF336	0.27	BT121	2.25	C1129	0.52
2N3703	0.12	2SC2166	1.35	AC183	0.65	BA311 (IC)	1.06	BC308	0.12	BD412	5.70	BF337	0.36	BT122	2.25	CA1310E	2.45
2N3704	0.12	2SC2216	0.62	AC186	0.30	BA312 (IC)	0.98	BC308A	0.09	BD418	0.76	BF338	0.36	BT123	1.80	CA3044	3.18
2N3705	0.12	2SC2233	2.20	AC186K	0.50	BA313 (IC)	1.28	BC309	0.15	BD433	0.33	BF355	0.36	BT125	2.25	CA3046	2.23
2N3706	0.12	2SC2271	3.64	AC187	0.35	BA316	0.07	BC317A	0.11	BD434	0.39	BF362	0.54	BT126	2.25	CA3060	1.50
2N3707	0.14	2SC2278	1.03	AC187-01	0.40	BA317	0.07	BC323	0.92	BD435	0.42	BF363	0.54	BT128	2.25	CA3065	1.17
2N3711	0.14	2SC2335-KIT	7.61	AC187K	0.39	BA318	0.08	BC327	0.15	BD436	0.42	BF371	0.45	BT128P	2.79	CA3089	3.35
2N3771	1.85	2SC2526	1.70	AC188	0.33	BA328 (IC)	0.80	BC328	0.10	BD437	0.41	BF391	0.36	BT129	2.25	CA3089E	1.30
2N3772	1.55	2SC2551	0.95	AC188-01	0.40	BA333 (IC)	1.24	BC337	0.08	BD438	0.44	BF393	0.90	BT151-800R	1.47	CA3090	1.25
2N3773	1.65	2SC2570	1.80	AC188K	0.39	BA401 (IC)	0.58	BC338	0.10	BD441	1.29	BF417	1.20	BT151 500R	1.25	CA3094	2.00
2N3819	0.28	2SC2570A	0.95	AC193K	0.59	BA511 (IC)	1.98	BC360	0.30	BD442	0.56	BF418	1.70	BTT6018	2.20	CA3131EN	2.83
2N3823	1.06	2SC264A	4.38	AC194K	0.59	BA521 (IC)	1.81	BC368	0.23	BD507	0.54	BF422	0.26	BTT6218	2.20	CA3132EN	2.83
2N3904	0.56	2SC2671	1.99	AD140	0.96	BA532 (IC)	1.88	BC440	0.99	BD508	0.54	BF423	0.26	BTT8024	4.02	CAH76023N	6.00
2N3908	0.56	2SC2728	0.95	AD142	0.96	BA536 (IC)	2.72	BC441	0.40	BD509	1.29	BF435	0.49	BTT8124	4.44	CBF16848N-07	1.41
2N4101	1.10	2SC372	1.27	AD143	0.96	BA6304A (IC)	2.65	BC454	0.32	BD510	0.45	BF450	0.30	BTT8214	5.44	CD4001	0.24
2N4240	3.00	2SC373	1.05	AD145	1.45	BA843 (IC)	3.60	BC455	0.32	BD518	1.36	BF451	0.26	BTT8224	2.70	CD4002	0.24
2N4443	1.35	2SC383	1.20	AD149	0.81	BAV10	0.10	BC460	0.38	BD519	1.36	BF457	0.37	BU105	1.66	CD4008	0.96
2N4444	1.12	2SC388	0.45	AD161	0.30	BAV18	0.10	BC461	0.42	BD529	0.38	BF458	0.35	BU106	2.25	CD4011	0.23
2N4914	0.65	2SC41	1.99	AD162	0.30	BAV19	0.10	BC462	0.27	BD530	0.60	BF459	0.35	BU108	1.90	CD4012	0.24
2N5064	0.64	2C458	0.55	AD262	0.95	BAV20	0.10	BC463	0.58	BD533	0.60	BF460	0.54	BU109S	1.90	CD4013	0.37
2N5293	0.45	2SC495	0.83	AF114	2.24	BAV21	0.17	BC464	0.58	BD534	0.36	BF469	0.27	BU110	2.52	CD4016	0.37
2N5294	0.45	2SC508	3.36	AF115	0.79	BAX12	0.10	BC465	0.58	BD535	0.44	BF470	0.28	BU111Y	3.78	CD4017	0.74
2N5296	0.40	2SC515A	1.28	AF116	0.79	BAX13	0.10	BC477	0.25	BD536	0.55	BF471	0.28	BU124	1.25	CD4020	0.92
2N5297	0.45	2SC537	0.49	AF117	0.75	BAX16	0.10	BC478	0.29	BD537	0.60	BF472	0.28	BU126	1.11	CD4021	0.24
2N5298	0.55	2SC558	3.35	AF118	0.75	BB105B	0.22	BC479	0.29	BD538	0.60	BF479	0.55	BU134S	4.15	CD4023	0.25
2N5490	1.35	2SC605L	1.05	AF121	0.50	BB119	0.15	BC532	0.25	BD544B	0.75	BF480	0.54	BU204	1.29	CD4025	0.54
2N5496	0.45	2SC620	1.32	AF124	0.36	BC107	0.13	BC546	0.15	BD580	1.06	BF495	0.58	BU205	0.98	CD4028	0.76
2N6107	0.53	2SC643A	1.40	AF125	0.36	BC107B	0.14	BC547	0.09	BD590	1.06	BF506	0.39	BU206	1.20	CD4047	0.96
2N6109	1.43	2SC673	1.11	AF126	0.36	BC108	0.12	BC548	0.09	BD598	1.13	BF509	0.37	BU207	1.50	CD4049	0.52
2N6122	1.60	2SC681	4.00	AF127	0.36	BC108A	0.12	BC549	0.09	BD645	3.62	BF523	0.18	BU208	0.98	CD4050	0.50
2N6130	0.65	2SC684	1.50	AF139	0.48	BC108B	0.15	BC550	0.36	BD677	0.55	BF594	0.24	BU208/02	0.98	CD4052	0.68
2N6133	0.57	2SC685A	2.62	AF178	0.75	BC109	0.11	BC556	0.12	BD680	0.69	BF595	0.24	BU208A	0.98	CD4053	0.72
2N6178	0.66	2SC693	0.89	AF179	0.50	BC109B	0.13	BC557	0.09	BD681	1.34	BF596	0.16	BU208D	1.43	CD4069	0.23
2N6180	0.66	2SC710	0.62	AF180	0.50	BC113	0.12	BC558	0.09	BD695	2.09	BF597	0.24	BU209	1.60	CD4081	0.26
2N696	0.39	2SC717	1.92	AF181	0.48	BC114	0.17	BC559	0.09	BD696	2.24	BF617	0.95	BU226	2.08	CD4093	0.72
2N698	0.39	2SC734	1.30	AF182	0.50	BC115	0.14	BC560C	0.10	BD697	3.27	BF618	0.95	BU312	2.16	CD4511	1.00
2N707	0.39	2SC735	1.05	AF186	0.48	BC116	0.20	BC635	0.18	BD698	1.68	BF694	0.20	BU326	0.75	CD4517	1.06
2SA1027	1.15	2SC782	2.24	AF239	0.48	BC116A	0.53	BC636	0.18	BD699	3.17	BF757	0.59	BU326A	1.40	CP5521	16.20
2SA1076	1.78	2SC790	1.15	AF279	0.80	BC117	0.18	BC637	0.18	BD700	3.36	BF758	0.59	BU326S	2.25	CV-12E	2.49
2SA329	0.36	2SC806	10.26	AL100	3.66	BC118	0.18	BC638	0.18	BD702	2.94	BF759	0.30	BU406	1.35	CX034	10.75
2SA351	1.06	2SC814	1.26	AL102	1.75	BC119	0.30	BC639	0.18	BD707	0.55	BF760	0.59	BU407	0.74	CX095D	2.85
2SA489	1.06	2SC828	0.25	AL103	2.43	BC125	0.18	BC640	0.18	BD709	0.72	BF762	0.30	BU407D	1.29	CX104	8.49
2SA490	1.51	2SC867A	2.49	AL113	1.80	BC126	0.18	BC879	0.28	BD710	0.72	BF870	0.27	BU412	4.80	CX108	6.92
2SA493	0.95	2SC926A	1.29	AN208	3.22	BC132	0.12	BC880	0.28	BD807	0.60	BF871	0.84	BU426	1.95	CX109	6.92
2SA628	1.03	2SC930	0.49	AN210	2.07	BC135	0.12	BCX32	0.33	BD809	0.60	BF900	0.68	BU426A	1.67	CX121	10.75
2SA637	1.32	2SC935	3.75	AN214	2.05	BC136	0.15	BCX33	0.24	BD810	0.60	BF907	1.62	BU427	2.67	CX130	4.90
2SA673	1.11	2SC936	1.58	AN214Q	2.05	BC137	0.16	BCX34	0.36	BD879	0.64	BF959	0.38	BU500	1.61	CX131	10.75
2SA683	1.46	2SC937	3.25	AN231	5.56	BC138	0.30	BCX37	0.60	BD880	0.65	BF970	0.55	BU508A	1.33	CX134	10.75
2SA684	1.33	2SC940	4.25	AN234	5.02	BC139	0.32	BCY70	0.27	BD895	1.98	BFR39	0.36	BU526	1.65	CX136	10.75
2SA748	0.68	2SD1138	0.78	AN235	4.84	BC140	0.33	BCY71	0.19	BD899	2.25	BFR52	0.45	BU608D	1.42	CX137	10.75
2SA818	1.65	2SD198	3.51	AN236	3.02	BC141	0.28	BCY72	0.18	BD901	0.55	BFR62	0.36	BU806	1.29	CX139	10.75
2SA835	2.27	2SD234	0.42	AN238	4.98	BC142	0.30	BD115	0.29	BDV64B	1.14	BFR79	0.29	BU806D	1.35	CX157	4.40
2SA940	1.64	2SD235	0.54	AN239	3.95	BC143	0.28	BD116	0.63	BDV65B	1.14	BFR81	0.45	BU807	1.40	CX158	3.44
2SA951	1.23	2SD257	2.67	AN240P	1.88	BC147	0.10	BD124	1.19	BDX32	1.50	BFR86	0.98	BU826A	2.79	CX170	6.92
2SA966-Y	0.54	2SD291	2.67	AN241	1.55	BC147A	0.42	BD124P+KIT	0.62	BDX53	0.80	BFR89	0.39	BUV46	1.13	CX177	5.99
2SB325	3.51	2SD292	2.35	AN245	2.54	BC148	0.11	BD131	0.38	BDX53A	3.68	BFT41	0.27	BUV84	1.12	CX506	8.48
2SB337	1.65	2SD313	2.59	AN247P	2.62	BC148B	0.11	BD132	0.38	BDX54B	2.37	BFT42	0.39	BUN81A	3.15	CX507	6.92
2SB375	3.51	2SD315	2.67	AN252	2.33	BC148C	0.11	BD133	0.48	BDX62A	1.92	BFT43	0.39	BUN84	1.56	CX758	6.92
2SB400	0.36	2SD325D	1.36	AN253	2.70	BC149	0.10	BD135	0.32	BDX63A	1.95	BFT84	0.36	BUX84	1.47	D1693	2.35
2SB407	2.94	2SD350	7.03	AN262	1.58	BC149B	0.11	BD136	0.32	BDX64A	2.37	BFW10	0.79	BY126	0.11	DEC1	1.52
2SB411	3.00	2SD350A	2.08	AN272	5.36	BC153	0.12	BD137	0.32	BDX65A	2.37	BFX29	0.30	BY127	0.11	DEC2	1.52
2SB511	1.48	2SD353	3.25	AN281	5.52	BC154	0.12	BD138	0.41	BDX76	0.53	BFX30	0.59	BY133	0.11	E1222	0.36
2SB54	1.26	2SD389	2.19	AN295	5.01	BC157	0.14	BD139	0.27	BDY20	1.10	BFX84	0.33	BY164	0.50	E5024	0.25
2SB56	1.26	2SD401	1.57	AN301	3.30	BC158	0.09	BD140	0.33	BDY62/01	4.20	BFX85	0.25	BY176	1.38	E5386	0.22
2SB618A	1.40	2SD551	2.20	AN302	3.62	BC159	0.14	BD144	1.30	BDY81	1.07	BFX87	0.50	BY179	1.42	E5529	0.22
2SB681	2.44	2SD588A	1.25	AN303	3.25	BC160	0.36	BD150	1.08	BF115	0.36	BFX88	0.30	BY182	0.95	E8021	1.17
2SB695	1.70	2SD621	8.88	AN305	8.07	BC161	0.36	BD157	0.60	BF117	0.36	BFX89	0.36	BY184	0.42	E9003	0.41
2SB75	0.94	2SD657	2.54	AN313	3.10	BC167	0.32	BD159	0.48	BF118	0.60	BFY50	0.24	BY187	0.70	E9005	0.45
2SB861	0.68	2SD731	1.72	AN315	2.12	BC168	0.32	BD160	1.45	BF121	0.22	BFY51	0.24	BY189	1.20	ER1400	10.12
2SC1034	5.61	2SD811	3.86	AN316	5.58	BC169C	0.14	BD163	0.64	BF123	0.11	BFY52	0.24	BY198	2.38	ESN310BP	3.86
2SC1050	3.66	2SD869	2.40	AN318	4.75	BC170	0.14	BD165	0.56	BF127	0.11	BFY90	0.96	BY201/2	1.36	ESM432C	4.18

IF YOU DON'T SEE IT LISTED ASK FOR QUOTE. GIVE MAKE MODEL LOCATION. REMEMBER TO ADD 0.60p POST & HANDLING. ADD 15% VAT TO TOTAL

Tuning in the Philips TRD IV

Michael Pitt

In the good old days when all that was needed to tune in a colour set was a little patience and short finger nails life was nice and easy. Just twiddle until something appeared on the screen. Not so now! Philips have revolutionised the idea of tuning your shiny new one-eyed monster to give any amount of TV channels. The TRD IV remote control system is, as the Americans would say, a whole new ball game. It was first introduced with the K35 chassis and has since been used with various versions of the KT4 and K40 chassis. Tuning one of these sets in is probably more awesome than any field fault you care to mention. Quite apart from initial tuning, our firm has quite a few K35s out in the field and the customers will occasionally have a bash at tuning. The result is that one of our field engineers has to make a call. It's true to say that they'd rather spend the afternoon at the dentist.

The first thing that's necessary in the world of Philips is an understanding of inane symbols. Philips seem to need these in order to have a series of blips and squiggles that will fit into their neatly hidden control flaps. Fig. 1 provides a guide. There now follows a beginner's guide to tuning.

Method A

Let's start at the beginning. Switch the receiver on and, using what Philips call search method A, press the button marked c/p. The red LED display will show 01. Press the same button again and the display will change to 21, 69 or any number in between. Press the button marked with the symbol for open memory and the display will start to flash.

What have we achieved so far? We've chosen programme number one, we've switched over to the channel scale 21-69, we've opened the memory and we now want to lock the BBC-1 channel to the memory's programme one position.

Press the search tuning button and a vertical yellow bar should appear on the left-hand side of the screen and slowly edge its way across to the right-hand side. As it travels, so the tuning moves up the band, from channel 21 to channel 69. In our case the local channels are 40 BBC-2, 43 ITV, 46 BBC-1 and 50 Channel 4 (Sutton Coldfield). So the first local channel we come to is 40. At this point the set will lock to this channel as programme one, the yellow line will disappear and the sound will be heard for the first time (the sound is muted until an aerial-supplied signal is received).

But we wanted to lock BBC-1 as programme one. Instead we've got BBC-2 as this programme. No problem! Simply press search tuning again and the display will move up to the next local channel, 43 in our case. Press it a third time and it will move up to the next channel, our BBC-1 channel 46. When you get there, push the store button (the one with the diamond symbol) and the memory will close, with BBC-1 locked as programme number one. The display will cease to flash.

To check that this is so, press the c/p button once to see that the programme is number one, displayed as 01, and press again to see 46 displayed.

With method A the selected programme number appears first and the channel that's locked to it afterwards. Method B reverses this – the channel selected must appear first, then the programme number.

Method B

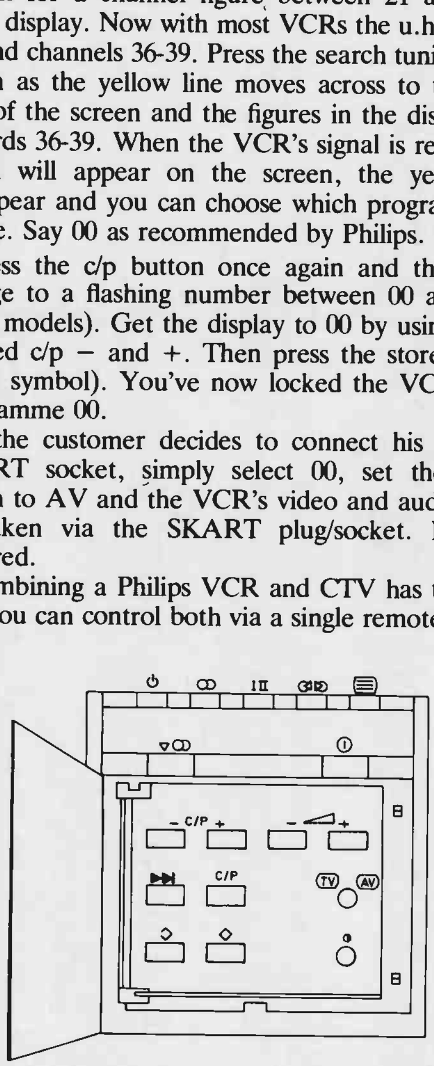
Method B, the "alternative method, direct channel selection", is no harder to follow. Let's assume this time that you're called to tune in the customer's VCR – we are assuming that the input to the set is at u.h.f.

Switch on the VCR's test signal, then turn your attention back to the TV set's control panel. Press the c/p button for a channel figure between 21 and 69 on the LED display. Now with most VCRs the u.h.f. output is at around channels 36-39. Press the search tuning button and watch as the yellow line moves across to the right-hand side of the screen and the figures in the display move up towards 36-39. When the VCR's signal is reached the test signal will appear on the screen, the yellow line will disappear and you can choose which programme number to use. Say 00 as recommended by Philips.

Press the c/p button once again and the display will change to a flashing number between 00 and 89 (49 on some models). Get the display to 00 by using the buttons marked c/p − and +. Then press the store button (diamond symbol). You've now locked the VCR's output as programme 00.

If the customer decides to connect his VCR via the SKART socket, simply select 00, set the changeover switch to AV and the VCR's video and audio signals will be taken via the SKART plug/socket. No tuning is required.

Combining a Philips VCR and CTV has the advantage that you can control both via a single remote control unit.



C/P	Channel/programme	⊂⊃	Stereo reception
▶▶I	Search tuning	I II	Second language reception
◇	Memory open	⊲ ⊳	Spatial sound
◇	Store	☰	Teletext
▽ ⊂⊃	Stereo/mono	◑	Contrast
ⓘ	Mains on/off	– ◁ +	Volume up/down
(TV) (AV)	Aerial/SKART signal input	– C/P +	Channel/programme up/down
⏻	Standby/message received		

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Fig. 1: Philips' on-set controls with the TRD IV remote control system – and what the symbols mean.

Most of the later Philips slim-line handsets have the necessary buttons for play, record, fast wind in either direction and of course VCR channel change.

One of the sets we handle is the 22CS3850. This is not just your average 22in. CTV. Apart from the automatic tuning covered above it has teletext, a 48-button handset, a stereo sound decoder, four loudspeakers, spatial (extended) sound effect, second language reception, a jack socket for private listening with the main speakers on or off and a whole range of audio plugs/sockets at the rear. All in all quite a set – or more a way of life!

Harold Peters adds: One of the problems we've had with the TRD IV system is initial tuner drift – the tuning system seems to need a bit of time to "burn in". The symptoms you get are confusing – "picking" all over the screen on certain channels only, i.e. it looks more as if there's a timebase fault present than tuning drift. To cure, open the memory, go from programme to channel then back to programme again and press store. What happens is that in the channel position the local oscillator is controlled by frequency synthesis, counting down from a crystal, while in the programme position the tuner is controlled by a voltage stored in the memory. As the tuning "burns in", the voltage required for a given channel varies slightly. Note that in the programme mode there's no full stop in the display: in the channel mode a full stop appears behind the channel number.

VCR Clinic

Reports from Derek Snelling, Paul Hardy, Philip Blundell, Eng. Tech., Mike Phelan and Steve Beeching, T. Eng.

Hitachis

A couple of general points about Hitachi VCRs. First the wires to the plugs and sockets on all Japanese produced Hitachi machines. These use resistor colour coding, i.e. pin one is the brown wire, pin 2 the red wire, etc. The exception is the use of pink instead of green for pin 5. This system makes identification of the various plug pins much easier. Secondly the more recent service manuals. Dotted around the various circuits are power supply lines that end abruptly with a circle in which the voltage is shown: if the red circle is not coloured in the centre this indicates that the voltage is coming in at this point; if it's solid red it's a voltage source.

Front-loading Hitachi machines react to fault conditions in the following ways:

(1) If front loading is not completed within ten seconds the cassette is ejected.

(2) If front unloading or unthreading is not completed within ten seconds the machine switches off.

(3) If threading is not completed within ten seconds the machine goes into the stop mode.

The current Hitachi range is as follows:

VT33: A front-loading machine that's similar to the VT11 but with only one microcomputer i.c. instead of two in the system control section and an extra i.c. in the servo section for visual search. It has instant record timing and a one-programme, 14-day timer. The VT11's handset will work with this machine.

VT35: A two-speed version of the VT33 with skew correction for picture search in the long-play mode. There's no indication at the front as to whether the machine is in the standard or long-play mode. On record there's a push button on the front for speed selection: on playback it's automatic. There's infra-red remote control, auto tuning for the TV channels and a five-programme, 14-day timer. The display dims automatically when the operate button is switched off.

VT57: A five-head version of the VT35. The extra head is used for super-fine still.

VT88: A hi-fi stereo machine which records stereo sound on both the hi-fi and conventional sound tracks with automatic or variable level controls affecting both systems. Dolby is fitted but operates on only the conventional sound track. The machine can be used as a sound only recorder, in which case it switches to a slower speed (equivalent to long play) to give up to eight hours of hi-fi sound. Unlike the Panasonic machine described in the January issue, it doesn't appear to have a hold circuit. Drop-outs of less than 1/25th of a second are ignored; with a drop out of 1/25-2 seconds the sound is muted; with a longer drop-out the machine switches to conventional sound. There's auto tuning.

VT7: This is a two-speed portable machine that slots into a tuner/mains unit to make a VCR with a conventional appearance. There's infra-red remote control, an instant record timer, reverse play at standard speed, and slow and still in the standard play mode only. No skew correction is incorporated, so long-play search is in monochrome with skew distortion. The auto tuning handles up to eighty channels and an LCD display continues for up to an hour after switch-off using the charge held in two 1μF capacitors. The r.f. converter is switchable for PAL G or I, a point to watch out for if the customer complains of no sound. As a battery saving feature, if the machine is left on battery in the stop mode the machine automatically switches off after five minutes. Finally the date in the form of three pairs of numbers can be recorded on the tape. **D.S.**

Mitsubishi HS306

One of the current range of models we handle is the Mitsubishi HS306, a mid-range front-loading machine with an acceptable though not outstanding picture. Two common faults have already put in an appearance, and we've had one or two other fault experiences.

The first common fault is squeaking/noise during play. Its cause is the head earthing spring: a spot of MS (conductive) grease on the end cures the fault. This simple job is made to last twenty minutes however by difficulty in gaining access to the head. The top must first be removed (four screws), next the front (one screw, eight clips), then the front control panel which is connected to the main panel by ribbon cable (three screws), after this the main panel (seven screws) and finally the head cover (four screws). This dismantling is also necessary when the head needs cleaning, though it's just possible to do a bit of cleaning from the side if the cleaning stick is long enough. Incidentally, two slots near the rear of the machine hold the main panel vertically for servicing.

The second common fault is that the cassette door sticks open. Along the front edge of the main board there's a metal bar on which the capstan drive i.c. is mounted. Part of the mounting consists of a piece of adhesive cloth tape. This comes unstuck, hangs down and the cassette door then sticks to it. The cure is simply to cut away the surplus tape.

Two of these machines have had low-gain pictures, both on the TV channels and in the E-E mode, due to faulty aerial signal amplifiers.

One-off faults have included no fast forward or rewind due to the spring coming off the fast forward/rewind arm, and no channel changing due to a dry-jointed transistor on the control panel. Both these faults were on UK-assembled stock machines. The failure rate with our machines is already approaching twenty per cent: small, silly faults perhaps, but they require a service call and twenty minutes work. A recent example was a dead machine due to blown mains fuses. As with everything else on this machine the top, front, front panel and main panel have to be removed, plus in the case of the fuses a small, clear plastic cover that seems to defy all attempts to take it off. **D.S.**

VCR Fronts

A word on fronts. Most of them nowadays have buttons consisting of a square or oblong piece of plastic with one or two small plastic "hinges", i.e. thin pieces of plastic $^1/_{16}$-$^1/_8$in. wide, along one edge. These are not very strong and are easily damaged by heavy-handed customers. We've had five machines recently with a broken off button – two Mitsubishi HS700s, two Toshiba V31Bs and a Toshiba V33B. An indication perhaps that manufacturers have reduced the amount of plastic too much? **D.S.**

Sanyo VTC9300

The customer complained of intermittent timed recordings: in fact the fault turned out to be the pinch roller solenoid dropping out. In the fault condition the voltage at the collector of Q810 (see Fig. 1) disappeared. It was also missing at the cathode of D814, though there was 12V at its anode. The cause of this trouble is usually either the regulator or Q810, also sometimes Q816/7/D817. On this occasion however it seemed that D814, which provides the holding current for the coil, was responsible. To prove the point the collector of Q810 was shorted to chassis with the machine working normally: the voltage at the anode of D814 dropped to about 9V, so a short was not responsible. Replacing D814 cleared the fault – it was apparently going open-circuit intermittently. **P.H.**

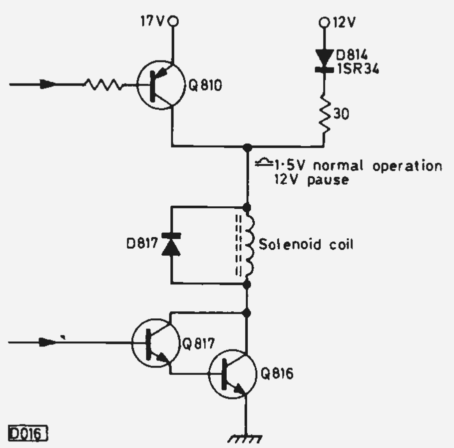


Fig. 1: Pinch roller solenoid circuit, Sanyo VTC9300.

Sharp VC7300

Ever seen a ghosting picture that isn't due to an aerial fault? This machine had two test cards side-by-side recorded on the cassette though it recorded and played back normally when I first tried it. After a couple of hours on E-to-E the tuning drifted, and when it was retuned the ghosted picture appeared. A few minutes spent with the freezer proved that filter SF1501 on the tuner/i.f. panel was the cause of the problem.

These filters are used in many of the circuits in Sharp VCRs and can be responsible for such faults as poor a.f.c. and intermittent colour on playback. **P.B**

Sharp XC30 Camera

It's not very often you come across a camera fault that's not due to a broken cable. This was one of the few! It was producing sync and burst but no video at all. Following the flow-chart in the manual I first checked for video at TP3. Nothing doing. Then to the collector of Q102 where the vidicon's target voltage was low at 18V. The voltages at the base of the vidicon were normal, so I disconnected the wire from the target pin to the preamplifier. This restored the target voltage to normal. There was a short from the target connector to the screening shield – a quick bend soon put that right. Phew! – I thought I'd a faulty vidicon for a few minutes. **P.B.**

Ferguson 3V23/JVC HR7700

The problem with this VCR was no tape transport, with the reel motor trying to run the whole machine on its own. In a case like this it's simplest to replace all ten motor drive and power supply switching transistors. The cost won't be much more than that of the parts and it'll save large-scale failure when you come to power up the machine. **S.B.**

Grundig 2 × 4 Super

If the chopper circuit in the power supply fails, check C401 which couples the drive from the TDA4600 i.c. to the base of the BU208A chopper transistor – it may be open-circuit. In one of these machines the cause of failure to rewind and tape damage was the turntable having become unglued from the supply motor spindle. **S.B.**

Amstrad 7000, Sanyo VTC9300

A couple of points arising from the December VCR clinic. First the Amstrad 7000 (Orion) shares the same reel subdeck as the Sharp VC381 and VC9300 – and the same idler pulley problem. Secondly, a further problem that's beginning to show up on the Sanyo VTC9300 is intermittent loss of the playback f.m. due to the set luminance record current preset having a noisy track. **M.P.**

Panasonic WV3000 Camera

The power and low-light LEDs were on and the monitor screen was blank. The camera's 9V supply was present but the vidicon was without h.t. or e.h.t. The high-voltage section is driven by Q123 (see Fig. 2) whose collector

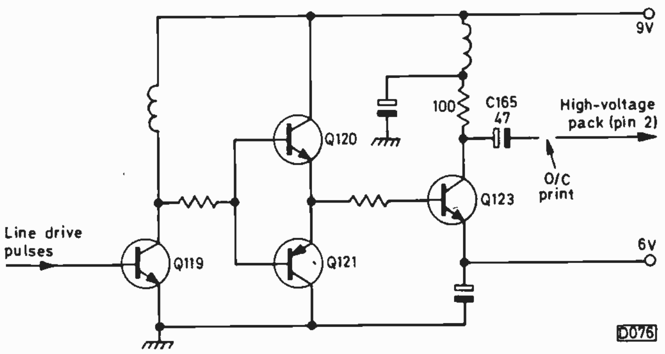


Fig. 2: High-voltage pack drive circuit, Panasonic video camera type WV3000.

waveform was o.k. There was no drive at pin 2 of the high-voltage pack however, due to open-circuit print between C165 and pin 2. **M.P.**

JVC HRD110

On all these machines and most of its forbears to date it's been possible to set the programmable timer once the machine has been powered. On this particular machine however we discovered – by accident – that the timer could be set only when a cassette had been inserted. There were no other problems and everything else worked fine. Andy has persuaded me to leave it alone. Odd. **S.B.**

Toshiba V9600

A tape got tangled in this machine, jamming the threading motor assembly which stalled and blew the motor drive transistors to Kingdom come. I didn't want to risk losing too many transistors so I replaced the motor assembly and transistors, switched on – and promptly wiped out some more. After much searching I found that I'd got two plugs reversed. The motor drive connection was plugged into the syscon input and the plug that should have been there (cassette compartment down detector switch) was across the motor drive output. This shorted the output, to the dismay of the transistors. The cause of the original problem, the slack tape that jammed everything up, was a dead spot on the reel motor which occasionally refused to run. Only eight months old too! **S.B.**

Murphy MVR7007/Sanyo VTC5300

For intermittent stopping in record or play, check that the tape counter is free. Its drive spindle is attached to the rotation detector, and if it sticks the machine cuts out. **S.B.**

Panasonic NV850

This hint from a friend concerns the Panasonic NV850. The r.f. signal is muted during playback. If you want it, short the base of Q707 to chassis. **S.B.**

JVC HRD110

While a new machine was being tested we found that the station indicator lights remained on the selected channel when the VCR was at off. Transistor Q5 on the timer panel was leaky. **S.B.**

Ferguson 3V29/JVC HR7200

This machine came to us in Saba livery. It entered pause when record was selected. The cause was the main microcomputer i.c. It's not an unusual fault – something to watch out for. **S.B.**

Teletopics

CABLE UPDATE

The Information Technology Advisory Panel, whose 1982 report encouraged the government to back the idea of cabling the UK, has decided to carry out a further study with a view to finding out what went wrong. Work on the study started in January and its conclusions will be sent to the Home Office and the Department of Trade and Industry.

Robert Maxwell's plan to buy BET's Rediffusion cable interests became entangled in legal problems because his holding company Pergamon is registered in Liechtenstein rather than the UK. A way round the difficulty was found – and BET knocked £2m off the price. The networks are mainly up-graded four-channel ones and are expected to be pushed by Mr. Maxwell's publishing interests – the Mirror newspaper group.

Windsor Television, which was planning to install one of the more sophisticated cable systems, including specialised business and industrial communications services and a local telephone service in competition with British Telecom, has decided to postpone further capital investment for six months. The franchise area had been extended to include Staines, Ashford and Heathrow Airport and cabling costs would call for some £35 million. The company hopes that it will be clearer by the summer whether such an investment would be justified. Its shareholders include GEC and Currys.

DBS LATEST

The report prepared for the participants – the BBC, the ITV companies and the five non-broadcasting companies – in the proposed UK DBS system, outlining a "business plan", has been approved and sent to the Satellite Broadcasting Board for forwarding to the Home Secretary. It's main concern is the cost of the satellite system which was to have been provided by Unisat, a consortium of British Aerospace, GEC-Marconi and British Telecom, under the earlier proposals for an initial BBC-only DBS service – the cost has virtually doubled since 1982. The report comes to the conclusion that a DBS service would not be economically viable at the satellite system cost suggested by Unisat – £80 million a year for three satellites. Alternative quotes from abroad have been about half that from Unisat and the report recommends putting the provision of the satellite system out to international tender. One quote was received from a UK firm, Britsat, for the supply of an RCA system providing five channels with a twelve year life.

The DBS project is at present based on an assumed ten year life, but the report feels that this would need to be extended to around fifteen years to take into account the high initial investment required and a slow audience build up – some three million subscribers are foreseen by the project's sixth year, with the cost of a receiving installation falling to well below £300. At present the future of the project appears to depend on whether the cost of the transmitting hardware can be brought down: if it does go ahead the start of the service is likely to be put back a couple of years.

A further complication relates to the transmitting standard to be adopted. C-MAC had originally been suggested but it's now lkely that a compromise between proposals put forward by France and the UK will be adopted in the interests of establishing a European standard. Until this has been sorted out the design of receiving i.c.s cannot be finalised and go forward for testing and evaluation.

The contract between the European Telecommunications Satellite Organisation (EUTELSAT) and the European Broadcasting Union came into effect on November 19th. Under the terms of the agreement, which will last for ten years, EUTELSAT will provide two transponders on its satellites on an exclusive, full-time basis for the transmission of Eurovision TV signals between the member countries of the EBU.

A range of SAW bandpass filters for use in DBS receivers has been introduced by Oakbury Components: the i.f.s are 70, 134 and 610MHz.

Several firms in the USA have withdrawn from or curtailed their plans for DBS services on the grounds of unacceptable business risk.

EUROPEAN VCR MARKET

Figures have been agreed between the EEC and the Japanese Ministry of International Trade and Industry for the export of Japanese VCRs to Europe during 1985. This will be the final year of a three-year agreement that started in 1983. For 1984 a total European market of 6·35 million machines was assumed. In the event, it turned out to be about 4·5 million. The agreement was that it would be shared on the following basis: 3·95 million complete machines from Japan; 1·1 million kits from Japan for European assembly; 1·3 million European produced machines (Philips, Grundig). For 1985 a market of 5 million machines has been assumed, shared on the basis: 2·25 million complete machines from Japan; 1·7 million kits from Japan for European assembly; 1·4 million European produced machines.

Japanese exports of complete machines to Europe in 1984 were some 3·15 million rather than the 3·95 million envisaged, and the planned 1985 figure of 2·25 million represents a considerable fall in expectations compared to a year ago. Even so Philips has protested – on the basis that the European market in 1985 is likely to take around 4·5 million rather than 5 million machines, and that of these 1·5 million should be allocated to European production.

Despite the reduced European market, ITT has announced plans to produce VCRs in Europe in conjunction with the Italian state owned consumer electronics holding company REL. The plant will be in Rome and is expected to be complete by the end of this year. Initial capacity will be 100,000 machines a year.

Grundig report a loss of 286m DM in the year to March 31st 1984, on turnover down 9 per cent. This compares with a profit of 65m DM in 1982-3. The report for 1983-4 was delayed following disagreement between Grundig and Philips, who took control of Grundig on April 1st 1984, over the valuation of large stocks of unsold VCRs and TV sets. Grundig's V2000 machines were excellent but don't seem to have done it much good. It's ironical that the Japanese/EEC VCR agreement was originally designed to protect the V2000 system: in its final year it's being used to enable Philips and Grundig to get going with VHS production.

NEW VIDEO EQUIPMENT

A new version of the Sony Betamovie camcorder, Model BMC200PK, includes auto-focusing. The suggested price is around £1,000. The new Sony mid-range VCR, Model SLF30, replaces the C20 and C30. It's just 3·25in. high and has a recommended price of around £400. Panasonic's latest VCR, Model NV430B, is a mid-range machine with IR remote control and a suggested price of £544·50. Sharp have introduced a new "user-friendly" VCR, Model VC488HD, with hi-fi sound to sell at around £750. A time-lapse VCR of RCA manufacture, Model TC3700, has been announced by Norbain Imaging Ltd. It has ten different speeds and can record up to twenty days of time-lapse recordings on a single tape. It's intended for industrial/CCTV use.

VIEWDATA

Richard Hooper of Prestel had some forthright comments to make at the recent Videotex International Conference in Amsterdam. He argued that to start a viewdata system off as a service for the general public was misguided, defining it instead as a "low-cost, easy-to-use way of editing, storing and displaying information". He went on to comment that other countries around the world appear to be making exactly the same mistakes that Prestel made in the UK. Take the W. German Bildschirmtext system for example – and aren't the germans always supposed to be interested in technology for technology's sake? The Bundespost initially expected to have a million subscribers by the end of 1986 and regarded the service as a communications system for public use. So far there are only some 20,000 subscribers, mainly business users. The parallel with Prestel is uncanny. It will be interesting to see how the Japanese system, called Captain, takes off: the service started recently with an initial 5,000 installations, after a lengthy trial period.

NEW TV SETS/MONITORS

Panasonic have introduced a 20in. set, Model TXC21, fitted with a high-resolution FS type tube. Of particular interest is the higher than normal resolution and wideband RGB circuits to give clear characters and graphics. The full specification includes stereo sound and teletext. Suggested price is £611.

Two new Mitsubishi monitors, Models C6920 and C9918, offer delta-gun tubes and line scan rates of up to 1,000 and 2,000 lines respectively, with stable convergence and low raster distortion. Tubes with different phosphors can be fitted to order, including one with a red, green and white phosphor combination for character display use. The line rates extend to 28-35kHz with field rates of 40-70Hz. Details can be obtained from Mitsubishi Electric (UK) Ltd., Industrial Sales Division, Hertford Place, Maple Cross, Rickmansworth, Herts.

A 14in. colour set, Model C1-338F, has been added to the Samsung range. The first set to be released in the new Italian manufactured Philco range is a 22in. model with remote control, frequency-synthesis tuning, a wood cabinet, SKART socket and optional teletext. A 16in. colour set with stereo sound, remote control, a telescopic aerial, multiple input/output sockets and optional teletext has been added to the Saba range.

SERT's TWENTY YEARS

The Society of Electronic and Radio Technicians (SERT), which was established in 1965, is to hold its twentieth anniversary banquet at The Worshipful Companies of Glaziers and Scientific Instrument Makers Hall in London on February 12th, with His Royal Highness the Duke of Kent as Guest of Honour. Present membership of the Society is over 8,500, in the UK and many overseas countries. Radio and TV servicing engineers account for about 11·5 per cent of the membership.

MULLARD CRT CONTROL UNIT

Mullard have introduced a combined focus/first anode control unit for use with colour TV sets and monitors. Optimum accuracy is ensured by integrating the resistors on a shared cermet substrate. The easy to mount plastic case saves assembly time and cuts costs: mounting is quick and efficient – the unit is simply pressed on to a PCB designed to mate with it. Four snap-locks secure the assembly while pins mounted on the board penetrate pads of conductive rubber for electrical connection. The h.t. input and focus output are connected by pressing the cable into another conductive rubber pad. There's an option for connecting the A1 potentiometer via board-mounted pins or the same method as used for the h.t. input and focus output. Three versions are available for use with lo-bri, high-bri and super hi-bri tubes.

VCR RELIABILITY

Last month we mentioned a *Which?* report on VCR reliability based on European experience. The November issue of the US magazine *Radio-Electronics* reports on some reliability checks carried out in the USA. According to its report, the overall defect rate for one major manufacturer's machines sold over an eighteen month period was 4·7 per cent: there were service calls to 6·3 per cent of the machines but 25 per cent of these were due to user misuse. This seems rather better than European experience, but then rental plays a much larger part in Europe, especially the UK, and it's been proved in the past that rented equipment is more likely to produce service calls. The same company reported that service calls to its cameras were lower at 2·9 per cent over eighteen months: a camera has far fewer mechanical parts of course – it seems that belts were a major problem with VCRs.

Head life is quoted as 1,000-3,000 hours depending on tape quality and cleaning practices. It seems that audio enthusiasts, used to frequent audio head cleaning, are a bit of a problem since they regularly have a go at their VCR heads as well.

COMBINED VCR/MONITORS

Markplan (Old Colony House, South King Street, Manchester M2 6DQ) have introduced a self-contained VHS-format VCR/12in. colour monitor, called the Videoport, which is primarily intended for sales presentations. Price is £1,495. A version with tuner, camera and microphone inputs sells for £1,695. A 20in. version with lockable

The 20in. Markplan Videoport combined VCR/monitor – it's intended primarily for public demonstrations.

security flap is intended for demonstrations in hotels, shopping malls and exhibitions. Automatic tape repetition is a feature of this version – it's available as an optional extra with the small-screen models. Brabury have introduced a similar unit, the Compact Model MCM37A, which combines a 14in. colour monitor and Panasonic NV180 VCR. An alternative version, the Compact Executive, offers additional features such as video/audio recording, switch-selected underscan (reduced picture size) and use as a monitor for RGB or composite PAL inputs.

TV CONTROL CENTRE

Ross Electronics (49-53 Pancras Road, London NW1) have introduced a device called a TV control centre, with five coaxial sockets and one phono socket that can be interconnected by means of six slider switches, enabling a TV set to be connected to VCRs, TV games and home computers (at r.f.). The aim is to avoid plugging and unplugging multiple leads. A chart is supplied to show the positions of the six slide switches for various purposes. The price quoted is £32.

IN BRIEF

Dixons take-over bid for Currys has succeeded, after a two-month battle and last minute court action . . . Rationalisation at ITT has led to the close down of the last vestiges of set assembly at Basildon. Production is now concentrated at the W. German Bochum plant. Mike Foster and David Cavey, managing and commercial director respectively, have left . . . Toshiba and Westinghouse Electric are to set up a c.r.t. plant with an annual production capacity of 1·6 million units in the USA. Production will start next year to meet the expected growing demand for terminals in the US . . . Production of the Sinclair pocket TV set at Timex's Dundee plant is now running at 300-500 a day. Large-scale production started late last year (the set was announced towards the end of 1983) after problems with the tube and main i.c.

Service Briefs

The following notes are based on servicing information issued by ITT, Philips and Thorn EMI Ferguson during the past year.

ITT

CVC30 chassis: The use of a non-approved replacement line output transformer can result in higher than specified l.t. voltages. This can cause field foldover at the bottom of the raster. ITT point out that the transformer is a safety component which must be replaced with an approved type to comply with the electrical equipment safety regulations.

CVC40 chassis: Failure of the BU126/TE1233 chopper transistor T807 is usually due to failure of one or other of the following resistors on power supply control panel CMP40: R808 and R809, both 220kΩ, R829 30kΩ and R833 1·5MΩ. These items may go high-resistance only when warm. Their replacement is recommended whenever the chopper transistor has failed. R818 (62kΩ) should be replaced whenever T807 has gone short-circuit.

R808 and R809 can be responsible for tripping, sometimes intermittent, when high in value. Tripping can also be caused by the 1N4148 diodes D8 and D10 associated with the chopper driver transformer being leaky.

Philips

VCR VR2220: The third harmonic of the erase oscillator can interfere with the DTF signals, causing tracking difficulties, when the machine is used in the sound dubbing mode. To overcome the effect retune the oscillator coil L5004 from 60kHz to 62·5kHz following the procedure laid down in the manual.

VCRs VR2220/VR2324/VR2334: The cause of strong patterning during playback on a few of these machines has been traced to contact between the deck screening cover and the side of head amplifier can A420. Ensure that contact between the can and/or the earth tag at the top of the can does not occur when refitting the screen – if necessary fit a strip of tape to the side of the can.

VCR VR2324: Tracking difficulties/picture interference have in a few cases been traced to poor actuator slip-ring contact. If this fault arises, remove the bridge assembly and clean the slip-ring with a lint-free cloth and a fluid such as Fomblin Freon. If this fails to cure the problem check and if necessary adjust the head height (see manual for details).

VCR VR2334: The original DTF control i.c., type P8049H, is no longer available. The later replacement version incorporates a programme with continuous DTF control during changes between different playback modes. When fitting the later type, R3142 and R3144 in the actuator feedback loops must be changed from 1·2MΩ to 820kΩ: potentiometers R3141 and R3143 will require adjustment (see manual).

G11 chassis: The following summary lists faults that are encountered from time to time in the field timebase.
Intermittent bottom cramping: Check C2083 (15μF) in the feedback circuit for loss of capacitance or open-circuit.
Random line pairing in the top half of the raster: Check coupling capacitor C2072 (4·7μF) between pins 2 and 3 of the TDA2600 i.c. for being open-circuit.
A black triangle at the top left of the scan: This is caused by a high-resistance joint at the earthy end of resistors R2104/5 which are in series with the scan coils.
Random interference on the field scan: This is caused by dirty/tarnished TDA2600 holder contacts. Don't try to clean the contacts – replace the holder.
Failure of the TDA2600 i.c.: The field timebase i.c. may fail due to an h.t. surge or e.h.t. flashover. In addition, poor holder contacts can cause actual or apparent failure of the i.c. The holder should be replaced if there's any doubt about its condition. If an e.h.t. flashover is suspected, clean around the e.h.t. cap. H.T. surges are usually caused by the type of h.t. reservoir capacitor (C4029, 470μF) used in some sets and can also kill the BU208A line output transistor. If C4029 is a Pye CCL or ITT KV3253T, fit an STC type CT347 250 L07 BUS. Loose mains supply connections can also be responsible for h.t. surges. Check for a defective on/off switch, an intermittent fuse holder or poor mains plug/socket connections.

Violent picture pulsating on high contrast scenes, sometimes intermittent, has been traced to the h.t. decoupling capacitor C3129 in the line output stage.

K30/K35 chassis: Loss of EW correction is normally due to dry-joints on the EW amplifier output transistor T1490 (BD234). Alternatively the preceding transistor T1485 (BC548) may be leaky.

If the fault on a set fitted with the TRDIV remote control system is intermittent loss of sound and vision with the channel display showing E1, check for dry-joints on the line output transformer before tackling (if necessary) the remote control panel.

CTX-E chassis: Earlier versions used a mains bridge rectifier. For improved reliability a half-wave rectifier, type BY527, is used in later production.

A problem with sets using the VST remote control system is intermittent switching to standby. Check zener diode D6770 (BZX79-B5V1) on the VST panel for leakage – it must be a Philips/Mullard type. Change C2335 on the main panel from 0·01μF to 0·1μF.

KT4 chassis: An 0·0018μF ceramic capacitor has been added between the base and emitter of transistor T7129 (BC558) in the protection circuit to prevent h.t. hiccups when transient spikes are present on the mains supply.

A BZX79/C27 zener diode (D6106) and 2·7kΩ resistor (R3106) have been added in series between pin 4 of the TDA3650 field timebase i.c. (IC7110) and the junction of R3109 and pin 5 of socket L53 to suppress flyback lines when the set is used for VCR playback. The cathode of the zener diode goes to pin 4 of the i.c. The lines may be more noticeable in the still picture mode. If necessary add the components on the print side of the timebase panel, adjacent to IC7110.

KT4/K40 chassis: The following modifications are suggested for problems that may arise when sets fitted with these chassis are used with a VCR. For ragged verticals, increase the value of R3193 to 10kΩ. For picture jumping/unsteady field, add a 100kΩ resistor in parallel with C2206 (10μF). For loss of colour in the slow/still modes (VHS machines), change C2193 from 1μF to 4·7μF.

K12 and K12Z chassis: Intercarrier sound/audio preamplifier/tone control i.c. type TDA2790 used in these chassis is no longer available. Various component changes must be made in the peripheral circuitry when a TDA2791, which has superseded the TDA2790, is used for replacement purposes.

Thorn

TX9 chassis: Increase in the value of R165 (300kΩ) or R166 (0·68Ω) can be the cause of chopper transistor failure (PC1044 panel). It's important to use replacements from Thorn as both resistors have special characteristics.

Interference on sound due to 27MHz CB transmissions, amateur SSB operation in the 144MHz band or possibly PMR can be cured by adding a capacitor with very short leads from pin 8 of the TDA1035 sound i.c. to chassis. The value depends on the source of the interference: 0·001μF at 27MHz, 470pF at 144MHz and something between these values for PMR.

The value of the 12V rail decoupler C915 on the U725 remote control receiver panel (PC1548) has been increased from 0·1μF to 10μF to eliminate a striation effect due to line pulse ripple.

TX10 chassis: The following points all relate to sets fitted with the PC1560 main panel (plastic surround, TDA2578A sync i.c.). Line whistle can be caused by vibration of the ferrite beads on the leadouts of diode D743 in the BU508A line output transistor's base circuit. Secure the beads with a blob of adhesive. To avoid bent verticals at high contrast levels, an underboard link has been added between the earthy ends of C742 and C745. R756 has been changed from 4·7kΩ to 6·8kΩ to overcome severe line ragging/sync pulling when a set is used for VCR playback. The new resistor value alters the sync slicing characteristic. To prevent interference *to* 27MHz CB transmissions, C779 (0·1μF, 400V metal polyester) has been added between pins 9 and 4 of IC772 (field output). If it's necessary to add this capacitor, keep the leads as short as possible.

TX90 chassis: Failure of the line output transistor TR112 can be caused by high-voltage spikes. To eliminate the problem the efficiency diode D113 has been changed to an avalanche type. It's a specially selected version of the BYV95 coded OGF721, part no. 00V4-631.

Here's one for fault connoisseurs. What happens (except at low beam current) when the ferrite core falls out of the line driver transformer (T103)? Answer, loss of field lock and sound! The reason for this is that the loss of inductance in T103 shifts the line drive phase to the extent that the coincidence detector in the TDA4500 i.c. (IC102) drops out, muting the sound and disabling the field sync separator.

Since the posistor in the degaussing circuit takes some time to cool down, degaussing at switch on may not occur when a set that's warm is moved to a new position, leading to purity problems. This has led to some complaints. It should be pointed out that the impurity will be corrected whenever the set is switched on from cold.

The following items relate to the remote control version of the chassis (Model 37141, main panel PC1140, remote control receiver panel PC1139). To deal with tuner drift at the high end of the u.h.f. band, R102 and C101 on panel PC1140 have been changed to 2·7MΩ and 0·1μF respectively; on panel PC1139 C921 is deleted, C919 becomes 1μF, R930 is replaced with a wire link, R975-7 become 2·4kΩ, R910 15kΩ and R950 10kΩ. Under high ambient temperature conditions continuous channel stepping may occur when a TA127 battery converter is in use. To overcome this problem a diode, type PH425, circuit reference D913, has been added in place of link 925 on panel PC1139 between the junction of C906/R919 (anode) and the junction of R993/D904.

To overcome a few isolated cases where a set fitted with the TA127 converter but being operated from the mains has failed to switch to standby on command from the remote control transmitter a 1N4001 diode has been added in series with R6 on the converter, cathode to the junction of R7/R21 etc. When the board layout is revised the diode type will be PH425.

Cases where a set has switched on from standby without a command from the remote control transmitter have occurred. The production modification to avoid this is the addition of a 4·7μF non-polarised electrolytic across D124 on main panel PC1140. When the PC1139 remote control receiver panel is revised the capacitor will be mounted here as C929 with a value of 10μF (non-polarised).

Model MC01: A random dot pattern may be experienced when this set is used for off-air reception in conjunction with a TA127 battery converter. This can be eliminated by adding an 0·01μF capacitor to the underside of converter panel PC1129 between the 85V output and the earth print.

TX100 chassis: Under certain field fault conditions a black raster may be obtained due to the action of the sandcastle pulse circuit. As a check switch off, turn the brightness/contrast/colour controls to minimum, disconnect PL14 (field scan coils), switch on, allow to warm up, then slowly increase the brightness. If a white line appears, check the field timebase.

1790 chassis: An 8·2pF capacitor (C59) has been added between the emitter of the i.f. preamplifier transistor TR1 and the adjacent earth print to eliminate instability.

VCRs 3V35/36: Two different non-interchangeable types of reel idler assembly have been used. They can be identified by inspecting the idler pulley whose centre boss is white (early type) or black (later type). The correct part number must be specified when ordering replacements.

To prevent colour shift in the search mode, R488 has been replaced by a 1SS133 diode (cathode to IC405, pin 12).

3V24: Vision buzz on sound can usually be cured by readjusting the 6MHz sound offset coil in the u.h.f. modulator. To gain access to make the adjustment, extension lead set A (part no. 01X0-034-152) is required. Tune for minimum buzz/maximum sound.

High-power UHF Transmitters

Nigel Cawthorne, M.I.E.E., C.Eng.

High-power u.h.f. transmitters are a world of their own! Powers range from about 1kW up to 55kW peak sync, at 470-860MHz. Special techniques are required to generate such high powers at these frequencies, and because of the distortion introduced by the output amplifying device a great deal of "precorrection" is required, i.e. the input to the final amplifier is deliberately distorted to compensate for the output device's nonlinearity so that the correct output waveform is obtained. A block diagram for a typical u.h.f. TV transmitter is shown in Fig. 1. Note that power in broadcast and professional communications transmitters means power at the transmitter's output, not d.c. input power as often quoted for amateur transmitters.

Klystron Operation

In the UK, the output stages of most high-power u.h.f. TV transmitters employ either a four- or a five-cavity klystron. This type of tube employs the velocity-modulation principle and is tuned by adjusting the resonant cavities. The operating voltage required for a klystron is high – about 22kV for a 25kW klystron. In addition to the high levels of r.f. power, klystrons generate a lot of heat. Thus cooling is required – this can be achieved by a combination of steam vapour cooling (where water is brought to boiling point by the heat dissipated at the klystron's collector) plus air cooling for the cavities.

With some types of r.f. amplifier the efficiency is defined as the amount of r.f output power in watts as a percentage of the d.c. input power. Because of the nature of the video waveform, this is not a practical measure for a TV transmitting amplifier. As the mean level of the TV waveform varies with picture content, a TV transmitter's power is quoted as peak-sync power (with negative-going modulation, the sync pulse tip corresponds to maximum output power).

The efficiency of a klystron amplifier is quoted as its "beam conversion efficiency", which is a measure of the peak-sync power as a percentage of the amplifier's d.c. input. When klystron u.h.f. TV transmitters were first being installed in the UK in the early 1960s the efficiencies were often well below thirty per cent. In those days over 130kW was taken from the mains supply to generate a 40kW peak-sync signal. Increasing energy costs have encouraged klystron designers to strive for increased beam conversion efficiency in order to reduce the electricity bills.

Two klystron characteristic curves are shown in Fig. 2. In both the nonlinearity increases as the maximum output level (saturation) is approached. Early klystrons were operated with the sync tip near saturation level, where nonlinearity becomes severe, and the video part of the waveform on the linear part of the characteristic.

One method of increasing the klystron's efficiency is to alter the characteristic used for different parts of the signal waveform. This is known as pulsing the klystron. In this mode curve A (Fig. 2) applies during the sync period and curve B during the video part of the waveform. This alteration to the klystron's operation is achieved by applying a control voltage to one of its electrodes. Which electrode is used depends on the klystron's design – it can be the modulation anode, a grid or an annular control electrode. Since the video part of the waveform gets much closer to the klystron's saturation region in curve B the overall efficiency is increased but a greater degree of input waveform predistortion is required to achieve a linear output.

As a further improvement on this technique, the suggestion has been put forward to vary the characteristic continuously throughout the entire range of the input signal. This approach would require dynamic correction, i.e. the amount of predistortion applied would be different for each input level. The idea has not been tried in practice and the marginal improvement in overall efficiency might not compensate for the added complexity of the system.

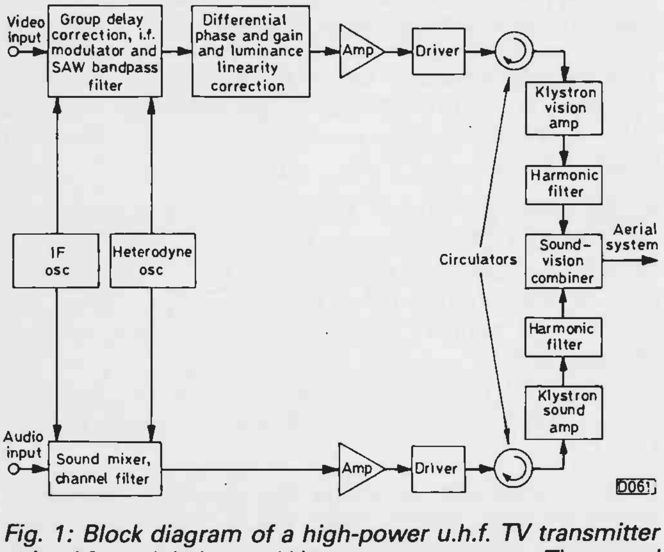


Fig. 1: Block diagram of a high-power u.h.f. TV transmitter using i.f. modulation and klystron output stages. The sound and vision channels are both shown: the outputs from the two klystrons are combined.

Transmitter Systems

With ever increasing energy costs the transmitter operator becomes more and more concerned with klystron efficiency. When considering the type of transmitter to install, the operator has to take into account not only the capital cost but also the "cost of ownership". This includes the cost of replacement output devices, maintenance staff and energy. In the long term, remembering that a broadcast transmitter will normally be in service for at least twenty years, the cost of ownership is likely to be the most significant factor in choosing between one type of transmitter and another.

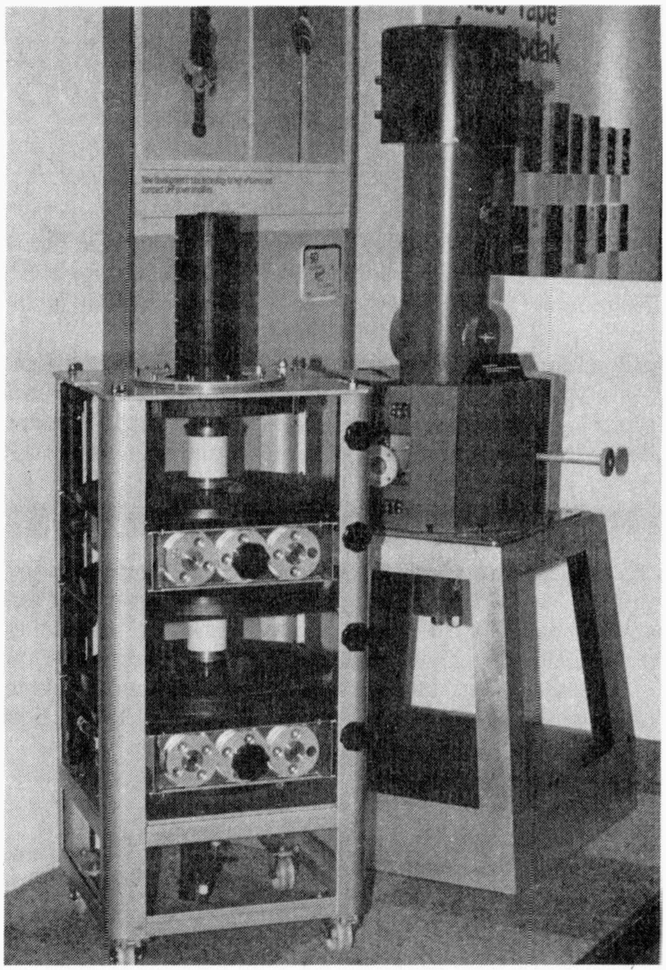
Some u.h.f. TV transmitters with output powers of up to 20kW employ rugged water-cooled tetrodes instead of klystrons. They are cheaper and don't require the complex cavity arrangements, but the operating life and gain are much less. With the present programme transmission times in the UK, a year's service is equivalent to about 7,000 operating hours. This is the typical life of a tetrode, which would thus require annual replacement. The IBA report that their klystrons have life times of up to 70,000 hours.

The drive required depends on the type of output device used. Klystrons have gains in excess of 40dB, which means that a 25kW amplifier requires a drive of only about 22W. This is relatively easy to obtain from a solid-state amplifier with today's technology, even at 860MHz. For a tetrode to provide an output of 20kW an input of about 700W is required. Even with current technology this sort of drive is still obtainable only from another valve. So a tetrode transmitter usually employs two tetrodes, one as the driver and the other as the output device.

Most of what has been said above applies to the vision signal only. The relationship between sound output power and vision peak sync output power varies from country to country. The vision-to-sound power ratio in the UK is 5:1, so that with a 25kW peak sync vision output the sound level will be 5kW.

The sound and vision signals in a high-power u.h.f. transmitter are usually amplified separately and then fed to a sound-vision combiner. If the sound and vision signals are handled by a common amplifier it has to operate in a very linear mode to avoid intermodulation products. As indicated above, this is inefficient in terms of energy conversion.

Co-siting the BBC and IBA transmitters usually means that the programmes for all four channels go from separate transmitters to a common aerial system. For this purpose the outputs from the sound-vision combiners are



High-power devices for u.h.f. TV transmitters: a four-cavity klystron on the left and a klystrode on the right. Klystrons are tuned by adjusting the cavities: two of the four cavities of the device on the left are shown in position. The klystrode is a new, experimental type of amplifying device that combines some of the features of a tetrode and a klystron output amplifier.

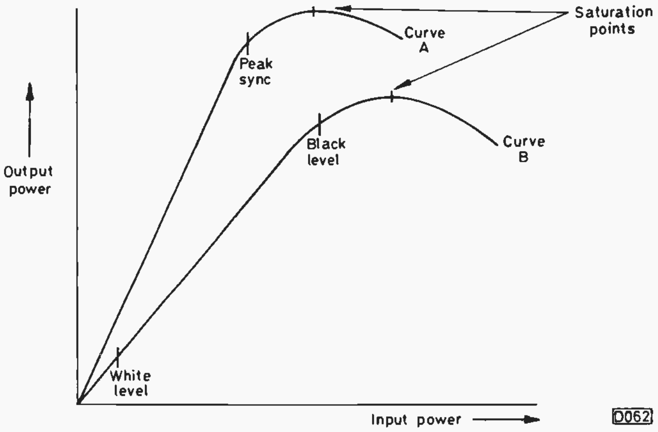


Fig. 2: Klystron power characteristic curves. Efficiency can be increased by pulsing the klystron so that its characteristic is altered for different parts of the input signal waveform.

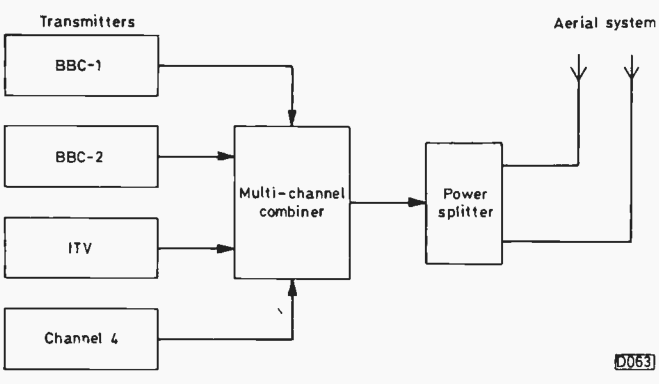


Fig. 3: Combining the outputs from four transmitters to drive the aerial system.

fed to a channel combiner (see Fig. 3). It's common practice to follow the combiner with a power splitter so that two separate coaxial cable runs feed the two halves of the aerial system.

The use of an aerial system that's split into two halves increases the station's inherent reliability – should failure of one of the feeders or one part of the aerial occur, the station will still remain in operation at reduced power.

The aerial's radiation pattern is set for optimum coverage. In the vertical plane the main lobe is usually declined by a degree or so to the horizon. Where there are viewers close to the mast a technique called null-fill is used – the signal might otherwise pass right over their heads.

The coverage of the UK's u.h.f. service is now well in excess of 99 per cent of the population. Nevertheless the designers of klystrons, tetrodes and transmitters continue to try to improve the efficiency of their products. Orders continue to come from overseas countries where u.h.f. networks are being extended, and also for replacement purposes in the UK where the original high-power u.h.f. transmitters are now nearing twenty years' service.

Future developments will probably include more efficient klystrons, higher power tetrodes and more advanced computer-controlled dynamic correction systems in which the output device's inherent nonlinearities are continuously corrected via computer-controlled feedback.

TV Fault Finding

Reports from Steve Beeching, T. Eng., Philip Blundell, Eng. Tech., Chris Avis, John Coombes, Paul Hardy and Mick Dutton

Grundig Gremlins

I don't usually write about TV sets in the magazine but as a result of modifying a lot of Grundig receivers for RGB TV/monitor use I've come across a few recurrent faults. First, small colour portables fitted with the CUC95 chassis: in the event of no power and the BU208A chopper transistor being short-circuit, check R646 (270kΩ) after replacing the BU208A – it's probably gone high in value. Secondly, for intermittent standby and generally silly things at switch on with the CUC120/CUC220 chassis, change the h.t. preset R647 in the power supply to a ceramic type. Some sets may produce a funny runway effect – a vertical path with black and white "things" rushing down the screen on each side. In this event change the TDA2595 sync/line oscillator i.c. (deflection panel 29504-007·25) which can lock the line oscillator out of phase when interrupted by spikes and channel changing. **S.B.**

Mitsubishi CT2627

The current range of sets seem to be prone to a sound fault – the sound goes louder or begins to oscillate intermittently. This is due to a poor screen connection on audio plug FF. **P.B.**

ITT CVC800 Chassis

If you come across a CMD800 decoder that produces *very* bad Hanover blinds, remember what Uncle Les once said – beware the blue tant! In this case C307 (10μF), the only tantalum capacitor on the panel. Don't think (as I did) that as it decouples the 12V supply to the TDA3560 it can't possibly cause the fault – it can. Check it by substitution: it will read o.k. on the meter. **P.B.**

Thorn 1500 Chassis

In my opinion the 1500 chassis was undoubtedly the best hybrid monochrome chassis ever produced. It still springs the occasional surprise, however, like these two cases recently encountered.

The first was said by the owner to have cut out and illuminated the wall behind it. It also lit up my bench quite well, with all the valve heaters glowing like November 5th. Heater supply rectifier W7 and boost diode V4 were quickly eliminated and the fault was eventually traced to the mains dropper – not open-circuit but short-circuit! When the dropper had originally been wound, the adjacent but isolated heater and surge limiter sections (R111, R116) had been almost bridged across by a whisker of resistance wire concealed under protective coating. Years of heating and cooling had eventually closed this unusual thermostat, placing the h.t. voltage across the heater chain. This undesirable link was removed by penknife surgery: fortunately the tube and valves lived to tell more Tales of the Unexpected.

The second 1500 had excessive contrast and sync crushing, even with the preset contrast control R34 at minimum. After the usual culprits in the video output stage had been eliminated I found that the bias voltage at the base of the video driver transistor VT8 (TP2) was over 9V instead of 5·8V. This voltage comes from the junction of R79 (317Ω) and R136 (62Ω) at the earthy end of the heater chain. R136 had increased in value to over 100Ω: two 120Ω, 1W resistors in parallel soon biased VT8 in favour of a good picture. **C.A.**

Rank T20 Chassis

For intermittent tripping, first check that the over-voltage trip preset 5RV1 is correctly adjusted. If this is all right, check the following items in the order given: the line driver transistor's emitter diode 5D1 (ITT2002) which could be open-circuit intermittently; 5R13 (330Ω) in the tripler circuit for being open-circuit; zener diode 5D2 (BZX79-B36) on the trip subpanel for being defective. If the set trips at switch on however check whether 7R11 (220Ω) in the snubber network across the chopper transistor on the power supply panel is open-circuit.

For lack of width, check 4R69 (82kΩ) in the width circuit then make sure that the EW loading coil 5L1 hasn't got shorted turns and if this is o.k. check the EW correction coupling capacitor 5C15 (1μF) for being open-circuit.

Intermittent loss of colour can be due to a decoder fault of course, but if the trouble persists after fitting a replacement panel check whether the line pulse is present at plug 3Z6 (pin 8). If the pulse is present at the socket side but not the plug check for a dry-joint or poor lead connection. A less obvious cause of this fault is 4C24 (0·01μF) in the line generator circuit – check it by substitution. **J.C.**

Thorn 3000 Chassis

You still come across these sets in regular use giving quite good results. One came my way recently. The chopper transistor was short-circuit and as I could find no shorts and the h.t. fuse F603 was intact I replaced the transistor, reset the cutout, disconnected the tripler, and removed W615 in the monostable oscillator circuit to ensure that the h.t. would come up to only about 40V. Thinking I'd done enough by way of protective measures I switched on. Pop – another short-circuit chopper transistor. The h.t. fuse was still intact, so an overload in the line output stage etc. was unlikely. Another chopper transistor was inserted but this time I left its collector disconnected from the 300V input. On switching on the chopper drive waveform was found to be all right, so it appeared that something went wrong as the 60V h.t. line came up. With W615 disconnected about the only thing I could think of was the dynamic trip. Sure enough the TIC46 thyristor and its associated 1S921 diode were both leaky. No other fault could be found and with replacement dynamic trip components fitted the set worked a treat. **P.H.**

Grundig C7400 (CUC70 Chassis)

The problem was no sound with snow on the picture. The channel display LED would light at switch on but would go out after a few seconds. We dismantled the chassis and considered how we were going to gain access to the tuning panel which stands vertically in the centre of the mother board. Our best bet seemed to be to start by checking the supply voltages on the mother board since these are readily accessible. The 15V supply was missing and on tracing back to the regulator (IC681) we found that it was dry-jointed. A touch of solder cured the problem. A point to note on these new Grundig sets is that it's important to quote the model number's prefix letter (C in this case) when ordering spares or service information as this indicates which chassis is fitted in the set. **M.D.**

Thorn 1615 Chassis

The customer's complaint was no picture and on examination we found that there was normal sound and a very dim line down the centre of the screen. The scan-correction capacitor C136 (0·15μF) turned out to be open-circuit. **M.D.**

Thorn TX10 Chassis

The volume or colour would suddenly alter or the set would go into standby when it had warmed up. Things would return to normal if the reset button was pressed. We thought this would be an easy one – change the focus control which can cause interference to the remote control system as a result of internal arcing. Not so however. The trouble was eventually traced to a dry-joint at pin one of the line output transformer. **M.D.**

Amstrad CTV2200

One of these sets came in dead as a result of a crack in the print around the mains filter transformer T501. The customer also complained that there was intermittent field roll. This was cured by adjusting VR805 – for 15V at TP22. The adjustment has to be done carefully if top foldover with teletext lines is to be avoided.

Dead set was the complaint on another of these receivers. When we switched on we heard the power supply and line timebase start up and shut down. We suspected an overload in one of the auxiliary circuits fed from the line output transformer and found that the 12V rectifier diode D806 (DFC10E) was short-circuit. **M.D.**

Grundig 8240

Absence of blue was the symptom and checks at the tube base showed that the trouble was in the RGB module. This chassis uses complementary-symmetry RGB output stages driven by a TBA530 chip (module 29301-046·01). The voltage at the base of the lower transistor in the blue output stage was very low while the other voltages in the stage were high. Moving back to the TBA530 we found that the blue feedback voltage at pin 9 was missing. Further checks led us to R1958 (470kΩ) which was open-circuit. **M.D.**

Hitachi CWP132 (NP6C Chassis)

The problem with this set was that the line speed would vary. In the fault condition there was a noise that sounded like internal arcing coming from the line output transformer but we found it impossible to take voltage measurements or make scope checks because everything is so interrelated. So we ordered and fitted a new line output transformer, all to no effect. After a lot of component changing and soak testing we came to the conclusion that the problem lay in the line oscillator stage. When the 2SA844 line oscillator transistor TR702 was replaced the fault had cleared, though the transistor measured perfectly out of circuit. **M.D.**

Fidelity CTV14S

The initial complaint was no results. On investigation we found that R828 (10Ω, 2W) in the h.t. line was open-circuit. A replacement overheated, indicating an overload in the line output stage, and on further investigation we found that the 25V supply rectifier D34 (RGP10B) was short-circuit.

Another of these sets would change channel when the remote control unit was used but on occasion failed to do so when the button on the front of the set was used. This was traced to poor soldering where the front panel switch pin is connected – the soldering looked perfect but was completely dry around the pin. **M.D.**

Decca 120-140 Series

The customer complained that the set would shut off after about five minutes or sometimes the sound level and picture width would alter. We found that in the fault condition the power supply was shutting down – also the remote control receiver was erratic, causing the sound level to alter. If the chassis was tipped or flexed anywhere the fault could be made to come and go: we eventually traced the problem to a break in the leg of C813 (0·01μF) which decouples pin 4 of the TDA4600 chip in the power supply. **M.D.**

Philips G8 Chassis

We thought we knew most of the problems on the G8 chassis, but this one caught us out. The fault was top field cramping – the set was fitted with the later type of timebase panel with BD131 field output transistors. The mid-point voltage was correct, but the bias preset was at nearly one end of its track instead of the usual mid-position. All the voltages were roughly correct so we worked back to the field oscillator stage. This uses a BRY56 silicon controlled switch and voltage checks are difficult here. Instead we made cold checks on the semiconductor devices. This showed that D4443 (OA47) was slightly leaky, and on replacing it we were rewarded with full field scan and the mid-point voltage setting up correctly with the control at its centre position.

Two days later we had a set with exactly the same symptom. Without thinking we replaced the OA47, but this time the fault remained. Looking at the circuit more closely we noted that the diode is forward biased by R4441, and on checking this we found that its value had increased from 27kΩ to 100kΩ. We changed this and left the new diode in for good measure. **M.D.**

Fidelity ZX3000 Chassis

The problem, intermittent field roll, was traced to the TDA8180 field/line processor i.c. being a poor fit in its holder. We've since had other faults, such as line jitter and intermittent no results, due to poor pin contact here. **M.D.**

Long-distance Television

Roger Bunney

November was a depressing month for both reception and weather. The high winds damaged a number of DXing installations while the rain damped any chances of enhanced tropospheric propagation, at least in our part of western Europe. Finnish readers on the other hand report a very good tropospheric opening with some quite spectacular results – see letters later. There was a slight lift over the UK on the 27th, and the prevailing high-pressure systems at the time of writing this (December 8th) suggest that a period of tropospheric reception lasting for several days lies ahead.

The mid-month Leonids meteor shower produced the expected increase in MS reception though the E layer ionisation wasn't very intense this time. Hopefully the December/January MS will be more lively! Sunspot activity has been almost non-existent though there was an increase towards the end of the month. Disturbances on the sun produced Auroral activity during the 13-17th: this was particularly intense in the north on the 16-17th, with reception of Scandinavian stations in Band I and TSS (USSR) chs. R1/2 on the 16th.

The brief SpE log is as follows:

8/11/84	DFF (E. Germany) ch. E4.
9-10/11/84	CST (Czechoslovakia) R1.
15/11/84	+PTT (Switzerland) E2.
17/11/84	YLE (Finland) E2.
18/11/84	Unidentified ch. R1/E2 signals.
20/11/84	RUV (Iceland) E4. There was a widespread opening from late afternoon through to 2100.
23/11/84	NRK (Norway) E2, 3.
24/11/84	SR (Sweden) E2, 3.
25/11/84	SR E2. Various ch. E3/4/R2 signals during the early evening.
26/11/84	SR E2.
28/11/84	RTVE (Spain) E2; unidentified ch. R1 signal.

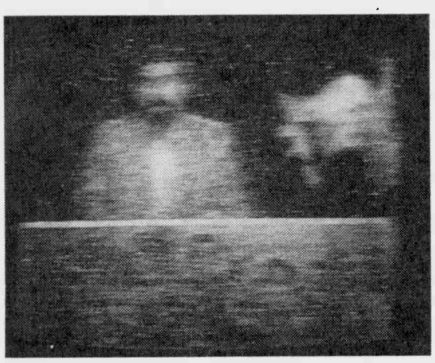
Thanks to Tony Privett (Basingstoke), Iain Menzies (Aberdeen), Hugh Cocks (E. Sussex), Roger Pates (Nottingham), Dave Shirley (Hastings) and Simon Hamer (Powys) for sending in reports during this rather bleak month.

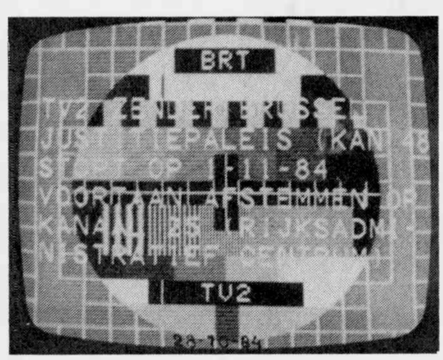
Mobile ATV

Allan Latham (G8CMQ) went mobile here in south Hampshire during the month, transmitting f.m. video at 10W on 1·286GHz from a car with an omni-array atop St. Boniface Down, Isle of Wight. P5 pictures were received in Southampton and P4 pictures in Brighton some 55 miles away.

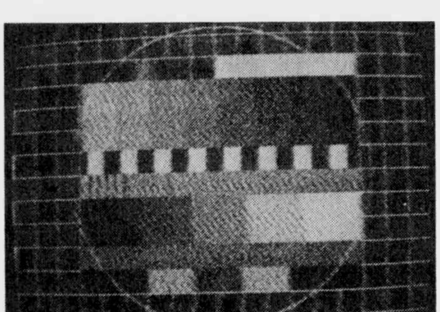
From our Correspondents . . .

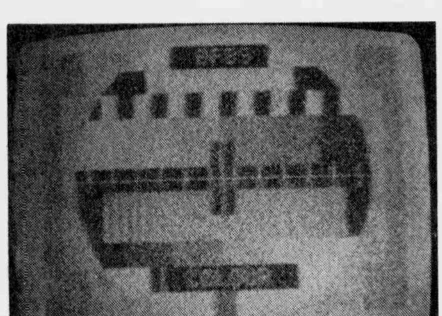
Ryn Muntjewerff (Holland) has received a QSL confirming his reception of SVF, the Faroe Islands TV Service. The QSL mentions that test transmission times are 0800-1200 local time on Mondays, Tuesdays, Fridays and Saturdays and that programme transmission times are 1900-2330 on Tuesdays, Fridays, Saturdays and Sundays.

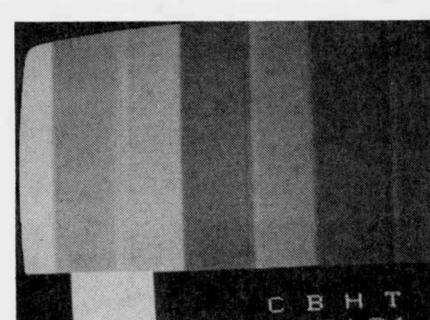




Left: Unidentified Arabic ch. E2 signal received by Petri Pöppönen in Lahti, Finland at 1256 GMT on July 21st last. Centre: BRT-TV (Belgium) ch. E48 closure notice with instruction to retune to ch. E25. Photo from Ryn Muntjewerff, Holland. Right: Another photo from Ryn Muntjewerff, this time the new American Forces TV logo used on ch. E70 in Holland.







Left: The NDR-1 (W. Germany) test pattern received by Seppo Pirhonen in Helsinki, Finland on November 12th last at 1355 GMT (ch. E50). Centre: An even more remarkable reception by Seppo Pirhonen, BFBS W. Germany ch. E51 on November 11th at 2330 GMT – the transmitter power is only 10W. Right: Satellite reception at 4GHz by Frank Lumen in Denver Colorado – the Canadian network programme feed via the Anik-B satellite.

The studio was operated by just three people until October 1984 – a further seven have now been taken on. Ryn's Dutch reception was the farthest to date. The transmitter network is at present as follows:

Station	*channel*	*e.r.p.*	*Station*	*channel*	*e.r.p.*
Husareyn	E6	10kW	Eysturhovd	E11	10W
Slaettafjall	E7	10W	Punthavn	E7	1W
Saksun	E8	1W	Hesturin	E9	100W
Eioiskollur	E8	10W	Nakkur	E10	1W
Stoolafjall	E10	200W	Hvalba	E10	1W
Brunaskaro	E11	10W			

Petri Pöppönen (Lahti, Finland) had an excellent summer with much Band I reception from the Middle East. Of several excellent quality photos showing announcers we've selected a less clear one in the hope that someone might be able to identify the source – reception was at 1256 GMT, July 21st on ch. E2. During June Petri logged an Arabic station with the identification EBT, suspected as being Dumyat, Egypt ch. E4 at 0.9kW e.r.p.

Seppo Pirhonen (Helsinki) reports that a strong tropospheric opening occurred on November 11-13th, with excellent quality signals from the USSR, Poland, Czechoslovakia and W. Germany. Of the W. German signals one is almost certainly BFBS Celle on ch. E51. The distance is over 900 miles – from a 10W transmitter!

Finally, a request for help. Gareth Foster requires the circuit of a 405-line "Radar Video and Sync Generator, Model L" – it's a single-channel (B1) type. Maybe someone has some information on this?

Interference

I had problems with a 49·71MHz cordless phone over one weekend during the month under review. The source was eventually traced and the operators made aware of the situation and the new Telecommunications Bill. Since then there's been no further trouble.

News Items

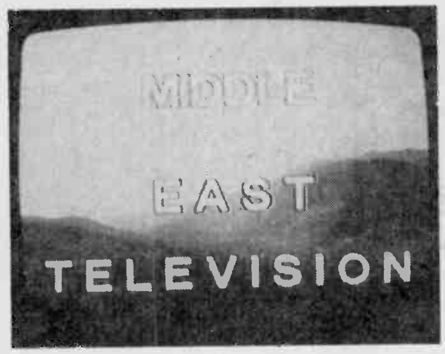
UK: It turns out that "Channel 36" was a firm called Waveview Holdings Ltd. who, following their successful pirate TV transmissions, have been granted a test and development certificate by the DTI. Waveview Holdings are developing a "suitcase size" transmitter for the export market, expected to cost considerably less than conventional transmitters. The firm can be contacted at 67 Westow Street, Upper Norwood, London SE19. No further pirate TV transmissions will be carried out by Waveview.

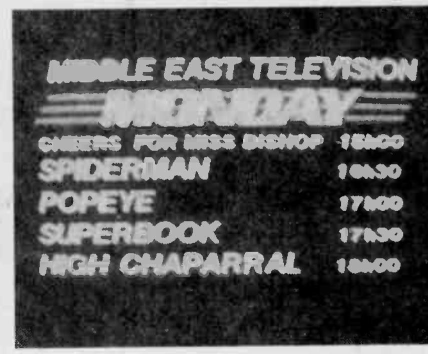
A further sixty licences for UK 50MHz amateurs were issued at the end of November.

The DTI is to license low-power wideband radio alarms in the 173·2-173·35MHz band. These will be in addition to the low-power telemetry and tele-control equipment that's likely to be decontrolled shortly.

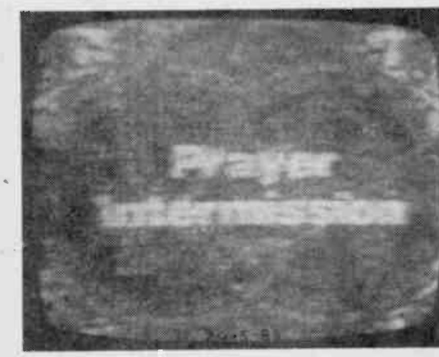
Norway: The Band I network is to be closed down progressively by the end of 1986. The authorities have granted 25 experimental 50MHz amateur licences for transmissions outside TV hours.

France: One technical magazine has published a design for a Canal Plus decoder and another plans to do so. Canal Plus obtained a court order preventing the sale of the first magazine though some copies were distributed. Interest in Canal Plus in continental Europe has been





Left: European satellite reception at 11·65GHz – the Sky Channel logo received by North East Satellite Systems on one of their own dish aerials, from ECS-1. Centre: Middle East Television ch. E12 identification received in Cyprus by Marios E. Colocassides. Right: Another Marios Colocassides photo, this time a Middle East Television programme guide.



Left: Pirate TV in South London – the Thameside TV tuning caption on ch. E28, received last October. Centre: Unidentified Arabic signal, possibly a Dubai news announcer, received by Ryn Muntjewerff on May 23rd last on ch. E2. An example of double-hop SpE reception. Right: Further exotic reception by Ryn Muntjewerff last May (24th). This time Aramco TV ch. E3 from Dhahran, Saudi Arabia.

widespread. The Canal Plus PM5544 pattern carries "TDF" at the top and "RESEAU 4" at the bottom.

Middle East: English language military communications on 40·86, 44·88, 44·94, 45, 45·12 and 46·9MHz are often heard during SpE openings. They appear to originate from UN forces in the Lebanon.

In brief: RTL (Luxembourg) has been seen in Holland on ch. E64 (unlisted) – tests suggest that the Dudelange E7 transmitter's e.r.p. is nearer 140kW . . . A high-power GDR (E. Germany) transmitter is now in operation on ch. E51 . . . The SBS-TV ch. 0 Sydney and Melbourne transmitters are due to close in 1986.

Meteor Showers 1985

Our thanks to the British Astronomical Association for the following 1985 meteor shower dates:

Lyrids	April 19-25th, peaking on the 22nd.
May Aquarids	April 24th-May 20th, peaking on the 5th.
Delta Aquarids	July 15th-August 20th, peaking on the 28-29th.
Perseids	July 23rd-August 20th, peaking on the 12th.
Giacobinids	October 7-10th, peaking on the 8th at 1300 GMT.
Orionids	October 16-26th, peaking on the 21st.
Taurids	October 20th-November 30th, peaking on the 1-5th.
Leonids	November 15-20th, peaking on the 17th.
Geminids	December 7-15th, peaking on the 13th.
Ursids	December 17-24th, peaking on the 22nd.

The Quadrantids shower occurred on January 1-6th. The Giacobini-Zinner comet will be present this year, the Earth passing inside its orbit on September 5th. This could well produce a significant shower.

Satellite TV Publications

Satellite TV News ceased publication during the last week of November, leaving something of a void for satellite TV enthusiasts. Those interested in the subject should find *Satellite Orbit International*, published monthly in the US at $4 a copy, of interest. For details write to Comm Tek Publishing company, PO Box 1048, Hailey, Idaho, USA 83333.

UHF Modulators

A convenient range of u.h.f. modulators is produced by Astec. I've been using one recently after constructing a distribution amplifier (one input, three outputs) to a BATC design for use with my video camera. One output goes to the 435MHz transmitter and another via the modulator to a TV set – providing a sort of poor man's viewfinder for the camera. The Astec modulators generally provide an output on ch. E36 – some models have sound facilities as well. A technical specification sheet can be obtained from Thame Components Ltd., Thame Park Road, Thame, Oxon OX9 3XD.

ATV Handbook

A revised and updated version of the *Amateur Television Handbook* has been published by the British Amateur Television Club. Earlier editions were very successful and soon sold out. The new edition has been completely revised and includes information on new i.c.s and 24cm f.m. ATV. This highly recommended publication is available for £2·40 including post from 14 Lilac Avenue, Leicester LE5 1FN.

Service Bureau

Requests for advice in dealing with servicing problems must be accompanied by a £1·50 postal order (made out to IPC Magazines Ltd.), the query coupon from page 227 and a stamped addressed envelope. We can deal with only one query at a time. We regret that we cannot supply service sheets nor answer queries over the telephone.

PHILIPS G11 CHASSIS

The fusible resistor R5406 in the supply to the sound output transistors keeps springing open and the heatsink for the transistors gets hot. The current doesn't seem to be excessive however and the voltages are all about right.

The fusible resistor could be over-reacting. Try cleaning the contacts and renewing the solder blob – use 60/40 standard solder. The output transistors can suddenly develop leakages when warm, flash over and reform, so replace them if the fusible resistor repair doesn't work. It should be possible to hold the heatsink with your fingers without getting scorched.

ITT CVC9 CHASSIS

When the contrast is turned up to get a reasonable picture the raster bulges outwards at the sides, causing bent verticals. Line pairing at the top of the screen also occurs. These symptoms are not present at low contrast. Turning up the brightness has a similar effect.

We have seen this combination of symptoms on several occasions and have traced the cause to the earthing of the c.r.t.'s graphite coating. Check the spring contacts and the continuity to the c.r.t. base panel and the chassis metal. If all this is satisfactory the tripler is suspect for internal discharge at high beam current. Before condemning it, check the associated components R426 (470Ω) and C309 (330pF).

HITACHI NP6C CHASSIS

The mains rectifier produces 340V which is present at the collector of the chopper transistor but there's no 110V output from the power supply. The circuitry seems rather complicated – can you suggest some simple checks?

The fault is becoming quite common on these sets. There's a start-up multivibrator that produces an initial burst of oscillation, until C910 has charged. By then the h.t. should be present and normal operation should start. The trouble spots are in the chopper control feedback network – resistor R937 (220Ω), the thick-film voltage divider module CP901 (HM9102) and the error detector transistor TR907 (2SC458). It's best to replace these, taking care over the soldering. Also desolder, flux, tin and resolder all the tags on the chopper transformer T902 and the line output transformer T703.

JVC HR7200EK

When the stop button is pressed at the end of a short recording, i.e. not a full reel, the tape unwinds from the head on to the left-hand spool as normal but the right-hand spool also unwinds for approximately ten seconds. This results in the loss of the final ten seconds of the initial recording when a subsequent recording is made. The problem occurs throughout the length of the tape, i.e. the tail end of the previous recording is always lost. We have to let the machine continue to run for ten-twelve seconds after the end of each item recorded.

This isn't a fault but is inherent in the design – the microcomputer i.c. is programmed to do this to ensure that when stop is selected with the tape threaded, near to or at the end of the tape, the leader splice is wound back so that it cannot contact the video head if play or record is selected. It also avoids tape looping.

THORN 8800 CHASSIS

This set was fitted with a regunned tube and then reconverged. The monochrome picture is perfect but when the colour control is turned up there's an effect like co-channel interference or bad interlacing. It's most noticeable on yellows and all colours down to magenta. The darker fields are clear.

The set's suffering from Hanover bars. If adjusting the delay amplitude potentiometer R167 and (carefully) coils L115 and L119 at the delay line input and output don't clear the effect, the delay line itself is suspect. Before replacing it, check the jointing and condition of the associated components.

PHILIPS G8 CHASSIS

After the set has been on for a time the convergence over the top half of the screen becomes incorrect. Adjusting the controls restores the convergence and produces a very good picture, but when the set is next switched on convergence is again lost as the set warms up.

The problem is due to dynamic convergence drift and will almost certainly be cured by replacing the clamp transistors T1910 and T1914.

ITT CVC25/3 CHASSIS

When the set is switched on several thin black lines appear on the upper half of the picture. These persist until eventually about half an inch at the top and bottom of the picture are lost. This condition continues for some time, though switching off and on produces a full picture – but with the black lines. Eventually the condition clears and the set gives a fault-free picture for a couple of hours. After that the problem returns.

There are several possibilities for this one. First, check the tuner a.g.c. smoothing capacitor C205 (220μF) by substitution. It's on the CMU30 tuner module. If necessary, go on to check the 12V supply: adjust R104 for 12V and check C71 (470μF) and C72 (10μF). Finally, examine the field timebase. Module CMF25 can be checked by substitution and the FT3055 output transistors by spraying with aerosol freezer.

THORN TX9 CHASSIS

The picture has shifted to the right, by about a quarter of the picture width. We suspect the TDA9503 sync separator/line oscillator chip. Any other suggestions before we order a replacement?

The usual cause of this trouble is change of value in one or other of R212 and R217 (both 220kΩ) in the flyback pulse feed to the phase detector in the i.c. Other items worth checking are R218/9 (both 10MΩ), R213 (82kΩ) and C172 (0·01μF) which could all affect the picture centring.

SANYO VTC5000

This machine will not complete, without cutting out, any of the following functions: rewind, fast forward, record or play. It will occasionally play or record a full cassette, but once a function cuts out it becomes increasingly more difficult to restart the machine. Usually it's necessary to put the set on standby for several hours before trying again. Rewind seems to aggravate the fault condition more than the other functions do. When the machine cuts out, the stop button must be manually pressed before the stop mode is actually entered.

A very common cause of this problem is failure of the reel motor. It's not expensive and is easy to fit if you have the right hex wrench (VJ0108). If replacing the motor fails to cure the fault you'll have to check the deck sensor inputs to the microcomputer i.c. in the syscon department.

GEC 2114

The l.t. rail, line hold control and line oscillator coil have all been set up correctly. Line hold is o.k. for about an hour, then starts to slip.

In our experience the most common problem in the line section of this little portable is dried-up and aged electrolytics. We suggest you replace C224 (1μF) and C226 (10μF) in the reactance stage and would be surprised if this did not cure the problem.

THORN 8500 CHASSIS

After about twenty minutes a narrow, broken band of colours jitters up and down about four inches from the left-hand side of the screen, accompanied by bands of very fine lines extending across the picture. The interference sometimes moves slowly down the screen and at other times upwards.

These symptoms suggest that some form of arcing or sparking is occurring within the set – it may be visible if the set is examined in darkness. The main areas of suspicion are the power supply panel (check for dry-joints, particularly on choke L701 and the electrolytics C704/6) and the high-voltage areas of the line output stage, around the e.h.t. rectifier and focus circuit. Also check that the tube's Aquadag coating is firmly bonded to chassis via the c.r.t. base panel.

SONY KV1810UB Mk II

When the set is first switched on there are momentary variations in both the height and width, with a popping noise on the sound. This happens every few seconds, but after about ten minutes stable conditions are achieved.

The fault seems to be h.t. flutter, which is often caused by a noisy thermistor (Th601, type TH4700) in the error sensing circuit. Replacing it and setting VR601 for 130V at L603 should clear the problem.

FERGUSON 3292

Prerecorded cassettes are played back in monochrome only, though colour is o.k. with the machine's own recordings. I've tried slight adjustment of the 4·43MHz VXO preset on playback and have also changed the AN236 and AN305 i.c.s.

It would seem that the machine is making non-standard recordings and that the fault is the same on record and playback. Check that the connections to one of the video heads are not reversed, and for the presence of the drum flip-flop pulses at TP222 (scope or meter plus diode probe, or alternatively 0·1μF to TP19 on the audio-servo PCB). If missing, trace the wiring back to the servo PCB. If the fault is still present the only course is to attempt to set up the oscillators in the colour circuitry as laid down in the manual, using a frequency counter. This will either cure or pinpoint the cause of the fault.

THORN 1590 CHASSIS

When the set is switched on the height begins to decrease slowly until after about five minutes there's complete field collapse. Switch off, try again half an hour later, and the same thing happens. The field output transistors have been replaced.

The first suspect is the field oscillator isolation diode W3 which can leak to give this symptom. If a replacement fails to cure the fault, suspect protection diode W4, driver transistors VT17/18 and the linearity amplifier transistor VT16 in that order. Note that problems with these semiconductor devices are often not shown up by making cold resistance checks.

SONY KV1340UB

The problem with this set is a very bright line, about a quarter of an inch wide, across the centre of the screen. The picture is otherwise good, with no distortion. The brightness control varies the intensity of the line along with the rest of the screen.

We suggest you disconnect R165 on board C to prove that nothing strange is happening in the field flyback blanking circuit. If the line remains it's likely that some form of crossover distortion is occurring in the field output stage, though this is very rare. Suspects would be the driver and output transistors Q509/510/901, the supply decoupler C525 (33μF) and the electrolytics in the field output stage – C545/6/7.

THORN 9600 CHASSIS

The chopper transistor keeps going short-circuit, blowing the mains fuse. This happens at switch on. The diodes that shape the chopper transistor's drive have been replaced, also the components in the snubber network and the overshoot clipping network. The rectifiers fed from the chopper transformer have been disconnected in turn, but the fault persists.

If the chopper transistor's drive is not square it will quickly succumb. We suggest you check R518 (1Ω) and R521 (100Ω) in the chopper transistor's base circuit and R514/5 (both 39kΩ) which bias the base of the driver transistor. Make sure that all the joints in the area are good. A variac is very useful when tackling a fault of this sort.

PHILIPS N1700

The machine runs for a short time on either record or playback then switches off. After resetting it the machine will run for a longer period then do the same thing. The picture and sound are otherwise perfect.

Check R101 (1·2Ω) in the power supply (bottom panel) – a replacement must be of this exact value. If the playback picture breaks up prior to the fault, check whether the drum or capstan stops rotating or slows down – the drum spindle bearing and both motors are suspect. Other possibilities are loss of either the drum or capstan servo pulses: if both pulses are present the collectors of TS109 and TS111 in the power supply should be at not more than 3-4V with the tape running.

TEST CASE

266

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.

Last autumn we had some very stormy weather in this locality. In its wake came the usual crop of equipment damaged by voltage spikes and static charges (up the mains and down the aerial lead respectively). In the main most older TV sets are reasonably immune to this sort of thing: mains filter capacitors and aerial isolator assemblies might be found carbonised, with the rest of the set intact and ready to go. The latest equipment seems to be much more vulnerable to storm damage, with i.c.s and transistors falling like skittles once the high voltage has found its way on to a printed panel.

A patient that escaped lightly was a Ferguson colour portable fitted with the TX90 chassis. It seemed that the surge had come up the a.c. power line since both fuses on the mains transformer had failed and a quick check on the four rectifier diodes D120-3 showed that D120 had welded itself up – it was a dead short. This item and the fuses were replaced and after a cursory glance at the picture (Saturday afternoon sports programme!) the little set was sent on its way. Our customer sent off a claim to his insurance company that same day.

The set came back on Monday with a note that said "wiggly picture, required ASAP". Now Monday morning is not our best time, so the set was put on the bench to warm up while we sorted out the job cards and brewed some coffee. An hour later we returned to the set whose picture was by now wiggling nicely – but only in the bottom left-hand corner! Each curve was accompanied by a pretty impurity pattern. Our first thought was that the degaussing thermistor might have suffered as well, but if this was the cause of the problem why was the effect confined to a corner at the bottom of the picture? Disabling the degaussing circuit proved that it had nothing to do with the fault.

With the back off we realised that the mains transformer T101 was mounted just behind the screen area affected. We also noticed a strong smell of hot varnish. It was almost too hot to touch! Plainly the transformer was overloaded in some way and was generating a sufficiently strong magnetic field to upset the c.r.t. beam landing. We had a known good TX90 in the workshop so we compared the d.c. resistances of the mains transformer primary windings. This failed to provide any clue and we came to the conclusion that the transformer in the faulty set had developed shorted turns. Since both sets had been dismantled we tried swapping the transformers over. Surprise, surprise! The good transformer in the faulty set soon began to heat up while the suspect transformer in the guinea-pig set behaved impeccably, running cool with no effect on beam landing.

The cause of the trouble was found without too much difficulty, and there's little doubt that the damage was done at the same time that D120 was destroyed by a mains surge or spike. As well as underlining our laxity in releasing the set without thoroughly examining the picture, this case highlights the effectiveness of a certain section of the Ferguson set's circuit design.

Watch this space next month for the solution!

ANSWER TO TEST CASE 265 – page 163 last month –

The problem with our Decca CS2230 (Bradford chassis) was simple enough – a short-circuit from the line output transformer's primary winding to chassis. As a result the boost diode was overheating and the h.t. fuse would then blow. The stock-fault cause of this trouble is a short-circuit boost reservoir capacitor (C436), but you'll remember that we'd checked this and also the fifth harmonic tuning capacitor C435.

With the meter connected between pin 12 of the line output transformer and the chassis metal we next disconnected, one at a time, all the wires to the primary winding. Continuity was still indicated on the meter, and it wasn't until we removed the fixing screws to release the transformer assembly that the meter's pointer dropped back – the transformer itself was internally shorted to the core and frame! Close examination then revealed a degree of rusting and corrosion on the metal U bolt that holds the ferrite core moulding together.

Even then we weren't completely out of the woods! By some ghastly mistake, the Weyrad transformer fitted as a replacement was of the type intended for use in small-screen models with 20kV e.h.t. It worked, but with lack of width, poor e.h.t. regulation and other troubles. It was some time – after replacing many peripheral components – before we realised what had happened. The stores man was promptly taken to task over this . . .

If you've got a faulty hybrid TV set please don't bring it to us – we can't afford to take it on except on a five-minute guarantee basis!

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TELEVISION FEBRUARY 1985

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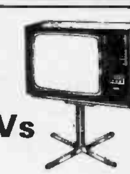

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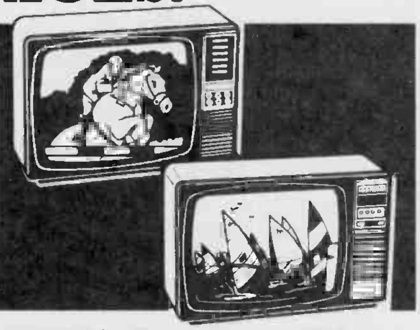

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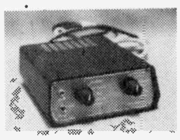

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GEC	£3.00	£5.00	£4.00	£2.00	£2.00	£2.00	£2.50
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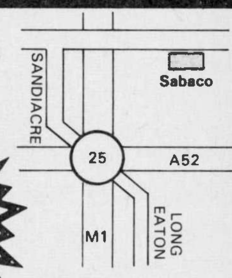

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GEC 20 AX Transductor £1.00

All diodes at 10p or less in this list 20 of one type £1.00

OA 47 8p
OA 90 8p

IN 60 5p
IN 541 5p
IN 914 3p
IN 2069a 10p
IN 2070 10p
IN 4001 3p
IN 4002 3p
IN 4003 4p
IN 4004 4p
IN 4005 4p
IN 4006 4p
IN 4007 5p
IN 4148×40 £1
IN 4448×40 £1
IN 4722 10p
IN 4751 10p
IN 5235 10p
IN 5254 10p
IN 5349 10p
IN 5392 10p
IN 5928B 10p

IAV 30 10p

IM 72Z55 10p

IR 106a 20p
IR 3051 10p

IS 164 10p
IS 921 10p
IS 3011a 10p
IS 3072a 10p
IS 5024a 50p
IS 5030 50p

ITT 921 10p
ITT 923 10p
ITT 1075 10p
ITT 2001 10p
ITT 2002 10p
ITT 4150 10p

Rank Panels
Z904 Line £10
Z905B Decoder £10
Z736 Tuner I.F. £10
A805 Conv. £2
T136A Scan Drive £10
Z780 Line O/P £10
Z968 £10

AA 113 10p
AA 119 8p
AA 144 10p

BA 102c 10p
BA 157 8p
BA 159 8p
BA 173 8p
BA 182 8p
BA 201 8p
BA 202 8p
BA 243 8p
BA 248 8p
BA 316 5p
BA 318 5p

BAV 10 10p
BAV 21 10p

BAW 21 10p

BB 103 10p
BB 105A×12 £1
BB 105B×12 £1
BB 105G×12 £1
BB 121a 10p

BRC 83c13 10p

BZX 46c22 15p
BZX 61 9-1 6p
BZX 61c110 6p
BZX 61c20 10p
BZX 61c30 10p
BZX 61c220 10p
BZX 70c6v2 8p
BZX 70c12 20p
BZX 70c33 8p
BZX 79c3v9, 4v7, 5v1, 5v6, 6v2, 6v8, 7v5, 11, 12, 30, 47 10p each
BZX 83c4v3, 5v6, 8v2, 12, 13, 24, 27, 33 10p each
BZX 84c6v8×10 30p
BZX 85c8v2 10p
BZX 88c0v7, 3v9, 4v3, 6v2, 8v2,12 10p each

1A/1600V 10p

2 amp bridge rec. wire end 15p

CV 8617 10p

Y 716 10p
Y 729 30p
Y 730 10p
Y 827: 6A/1KV 20p
Y 860 30p

G11 470M/250V SP £1 each

Min 12 volt Relays 75p

Y 933 5p
Y 969 50p
Y 997 30p
R 1038 40p
R 1039 40p
R 2009 80p
R 2010b £1
R 2029 50p
R 2210 60p
R 2257 60p
R 2265 50p
R 2305 50p
R 2306 50p
R 2322/2323 pair 80p
R 2323 15p
R 2396 50p
R 2461 80p
R 2030 50p
R 2443=BD124 40p
R2737 40p
R2738=TIP41 30p
R2775=TIP41c 40p
R3129=TIP47 40p
S 2008b 80p

BU 105/04 80p
BU 108 £1
BU 124 50p
BU 126 80p
BU 180a 65p
BU 204 70p
BU 205 £1
BU 206 £1
BU 207 £1
BU 208 80p
BU 208 on heat sink 70p
BU 208A £1.10
BU 208D 90p
BU 222 £1
BU 326 £1
BU 407 60p
BU 426V 60p
BU 500 £1.10
BU 508A £1.20
BU 526 75p
BU 807 £1
BUX 84 50p
BUW 84 30p
BUY 71 £1

TIC 106a 30p
TIC 116m 40p
TIC 116n/Y 1003 35p
TIC 126N 40p
TIC 206m 30p
TIC 225S 40p
TIC 226E 40p
TIC 226m 30p
TIC 236m 30p
TICV 106D
(T092 case 2A/400V) 10p
TIP 29 20p
TIP 30 35p
TIP 30A 35p
TIP 30B 40p
TIP 30C 45p
TIP 31 30p
TIP 32 25p
TIP 33B 50p
TIP 33C 70p
TIP 34A 50p
TIP 34B 60p
TIP 34C 70p
TIP 35B 50p
TIP 35C 70p
TIP 35D 80p
TIP 36 50p
TIP 36C 70p
TIP 41B 40p
TIP 41D 70p
TIP 42/BRC 6109 30p
TIP 48 40p
TIP 49 30p
TIP 57 30p
TIP 100 30p
TIP 102 30p
TIP 112 30p
TIP 115 50p
TIP 117 50p
TIP 120 35p
TIP 125 35p
TIP 130 30p
TIP 131 25p
TIP 136 30p
TIP 140 50p
TIP 147 50p
TIP 640 50p
TIP 2955 35p
T 6032 30p
T 6036 40p
T 6040 40p
T 6047 40p
T 6049 40p
T 6051 40p
T 6052 40p
T 9004 40p
T 9005 40p
ZTX 102c 10p
ZTX 107 10p
ZTX 108c 10p
ZTX 109k 5p
ZTX 213 5p
ZTX 341 10p
ZTX 342 10p
ZTX 384 10p
ZTX 451 10p
ZTX 550 10p
MJ 2253 60p
MJE 3040 60p
MJE 2209 10p
SP 8385 50p
SAB 3205 £1.00
SAB 4209 £1.00

SPECIAL OFFER CVC 21
Chassis complete £35
Computer Transformer
20v/2.25A; 20v/1.5A; 17/.5A; 19/.5A; 28/.05A £3

BD 517 30p
BD 519 30p
BD 534 30p
BD 544 30p
BD 595 30p
BD 610 30p
BD 646 30p
BD 676 30p
BD 678 30p
BD 681 30p

Voltage Regulators
+5V/UA78PO5SC 30p
−5V/LM79MO5CP 25p
−8V/79M08c 30p
+6V/78M06c 30p
+10v/78LA10 20p
LM 337 30p
LM 342/18 30p
LM 340T 5.0 50p
+12V/LM 340T12 50p
+15V/78M15 15p
+18V/MC78M18 20p
+24V/78M24 30p
MC 7724cp 40p
MC 7824 40p

TIS 90 10p
TIS 91 20p
TIS 92 20p
TIS 93 20p

U 19885 40p
U 3832 15p
U 3845 15p
MR 508 10p
MR 501 10p
MR 502 10p
BCW 71R 30p
BYF 1202 10p
BYF 1204 10p
BYF 3126 40p
BYF 3214 40p
BYX 10 6p
BYX 36/600 35p
BYX 38/300 25p
BYX49/600R 75p
BYX 55/350 10p
BYX 55/600 (Bead) 10p
BYX 71/350 20p
BYX 71/600 50p
BYX 72/300 20p
BYX 36/600 50p
BYV 95B 10p
BVY 95C 12p
BYZ 106 10p
BPW 41 15p
BYW 56 2A/1000v G11 8p
BZU 15/24 54p
BZY 93c75 50p
BZV 15/18 30p
BZV 15/30 30p
BZW 70c6v2 10p
BZX 79.3v 10p

Bush thyristor RCA 76122 £1
ITT computer bookset 2020 £2
G8 20 turn 100K pot 35p
Transformer 240v/20v-500Ma 75p
Viewdata torroidals £6
CVC 20 tube base £2
Tube Base Rank & G11 £1.20
Sankyo tape motor 75p

Swiss made 250rpm/240V motor very small 75p

Mono scan coil 110° small neck £1.50

Infra red led
LD57CA 15p
Mono scan coil £3
G 8 transductor £1.25
AT 4041/41 transductor £1
2K5 Lin pot with 40mm spindle 20p
1982 Hitachi Ae isolator 50p
Mullard FM decoder 1401 £1
Philips service pack, flat films, 57 condensers 56nf-2.2uf £2
VHF 3 Transistor rotary tuner DX-TV £1
15K-20 turn pots 20p
Thorn panel 6×100 pot + changeover switch (Irish) 50p
Battery converter TA 75 for colour TV. 12/24v Thorn 3787 £6
Thorn 3500 2A cut out 75p

Stereo GEC amp 20 watt + pre-amp with 4 pots + mains power unit with circuit £6

SPECIAL OFFER
Decca-TTT etc.
FEO4/1/250AC/4
Mains filters
(grey type) × 4
£1

BRIDGES
SKB 2/08 L5A 30p
KBL 005 30p
KBL 02 30p
KBP 04 30p
W02 15p
W004 15p
W005 20p
GEC remote panel. Main transformer 3/ic SAA 1025/SN 74141/TBA 231 £6
AT 2076/35 £7
AT 2076/55 GEC split diode transformer £10
AT 2048/11 LOPTI Mullard £2.50

PHILIPS DIY HOME SECURITY ALARMS KITS
Send for details. Prices **£54 to £112.**

10 Mixed TV & radio speakers £4

2× Hi-Fi Philips car tune up tweeter EN8320 £10

ITT CVC45 8 way resistor unit for v/cap £3

4700/10v × 10 50p
68/16 × 10 50p
150/16 × 10 50p
47/25 × 10 50p
220/25 × 10 50p
1/250 × 10 50p

G8 Speaker £1

8000/30v 50p
470/40v × 10 £1
22/100v × 10 £1
100/350v 70p
400/350v 70p
.47/500v 25p
1/600v 25p
.022/1kv 10p

VIEW DATA PANELS
NEW 19 I.C. £5

Philips GP422.4CH
(£40 cost) £6

Stereo Dynamic Cartridge

12 Volt Aerial Changer over Relays 144 Mc/s 45 watts 50p

GEC Hitachi
V/Cap tuner, after 1979 Series £8
6 Push Button Unit for GEC 2100 Series
Replacement for Touch Button Unit £12

8 SEG LED Display with driver I.C. LM1017 **50p**

20AX GEC Split Diode lead **£1.00**

GEC Dynamic 20AX Convergence C2233H-R223GH **£2.00**

Mullarad 12.5V/170 Mc/s 45 watt
BLW60 £5.00
BLW60C £5.00
Mullard Broadband R.F. power modules
VHF. BGY33 £15
UHF. BGY22E
£5 PT4236C
£5 PT8706C
£5 PT9783

Various Tools and Accessories

Philips £1.00
Philips Neon Lamps for TV sets 5p
Freeze £1.20
Foam Cleaner £1.20
Contact Cleaner £1.20
Push Button Mains 75p
Lorlin Full Remote Relay Switch fit most T/V sets, mains 4 tag, 2 tag 12 volt £1.00
Mains timer. 13 amp — up to 2 hours: easy to use, plugs into socket £3.00
Sellotape PVC Electric Insulation
25mm × 20M 50p 50mm × 20M 70p
ITT CVC £8.25 Chassis £40.00
Screen locking agent, large can £1.50
20 GEC Service Manuals & Rank £5.00
Red E.H.T. LAED and Anode Cap £1.00
10 × G11 Cap 470/250 £15.00
Soldering iron 6v/23w £2.50
TX 10 Focus Units £6.00
Weller solder iron 15 watt/25 watt £5.00
2 way baby alarm/intercom with long leads £5
Phillips universal battery tester/charger, fuse/bulb tester To Clear £4
Eisenmann NICAD CHARGER 5.5V/150 ma £2
12V Nicad pack. "AA" £2.50
Hitachi 7.2v/1.8A Nicad pack £6.00
Hitachi TP 007 Battery pack 7.2v/1.6A £7
Hitachi Silver Oxide Battery G13 UCC357 IEC SR44 1.5V 60p
70ML Silicone Sealer (clear) £1
100 Coax Plugs £10.00
De-solder pump + 2 nozzels £5.20
Plastic box for i.c.s with anti-static pad 6″×3″×½″ 75p
Can of handy oil 'mobil' 40p
Flat Red LED 12p
500gm 60/40 solder reel £7
Clearweld glue pack 30p
Dual v/u meter -20 – +10db £1
3 × C90 Cassettes 70p
K30 thermistor 232266298009 75p
GEC Mains Power Supply R.E.G. £3.00
1Kg reel of solder £8.00

75R/25 Watt 25p
18R/11 Watt 25p
120R/17 Watt 20p
Front End Music Center. VHF/MW/LW 13″×3½″ £3
Output Stage for music center £5
SONY 1400KV Chroma Panel £6
SONY 1400KV Tuner unit £3.50
SONY 1400KV Touch button unit £3.50
12 Volt Mains Trans 500M/A £1.00
18V or 12 Volt Mains Trans 500M/A 75p
Texas Viewdata Decoder VDP 12/80 Issue 3 with all IC's £10.00

Quantity Reductions
BY204/4 25 for £1.00
BY206 25 for £1.00
W005 bridge 20 for £2
KT3 touch button black 6 for £1
G11 touch button red 6 for £1
K30 full remote Dawer Ass with 3 I.C. £7.00
K30 VHF. UHF Dawer Ass £6.00
BY298 3 amp/fast/R 20 for £1.50
BD239 20 for £2.00
25 for £1.50
BU126 10 for £6.00
BU205 10 for £8.00
BU105 10 for £6.00
2SC2122A 10 for £8.00
BF458 10 for £1.00
BD136 10 for £1.25
BF224 20 for £1.40
OA90 40 for £1.00
BYX10 100 for £4.00
KT3 multicaps 10 for £7.50
50 Ceramic Condensers £1.50
Mixed Mounting Kit for Power Transistors 50p
300 Condensers £1.50
300 Resistors £1.50
150 Electrolytics £2.00
15 Bulbs 40p
Antistatic Discloth 5 for £1
100 Diodes £1.50

Plastic Boxes 50p
100 Fuses £2.00
100 W/W Res. £1.50
BF 199 20 for £1
10 × 20 Turn 100k pots. Rank £2
Thorn 9 volt power supply regulated £3.00
BF 470 20 for £2
20 Slider Knobs 70p
6 Mixed UHF Aerial Isolating Sockets, some with long leads. Fit ITT, GEC, Philips, Pye £1.00

Mixed Packs
TO66 12 Power Trans RCA 16182 NPN Replacement for BD124 and Mounting Kits £1.00
50 Mixed AC series Transistor £4.50
15 Panel mount rocker switch 250V/10A £1.50
25 Panel Mount Bulbs & Neons 10A £1.50
Mixed ribbon cables £1.00
25 LED red/yellow/green £1.50
20I/C Holders £1.20
20 Large LED Red £1.00
20 Small LED Red £1.00
10×20 Turn 100K Pots £1.00
100 Transistor £2.50
20 Convergence Pots 80p
100 Sticks £1.00
10 Thermistors 50p
20 Slider Pots £1.00
30 Presets 50p
15 VDR + thermistors, degaussing, HT, etc. £1.00
40 glass reed switch £1
10 press to make switch 70p
40 Pots £1.50
10 Gun Switches 50p
5 Tube Bases £1.00
1,000 Diodes, Condensers, Resistors on Bandolier £2.00
Lucky Dip 600 gram £1.00
Jungle Bag 5Kg £3.00
20 Knobs £1.00
40 Pots, ¼″+6mm spindles for audio/TV £3
20mm Fuse Holders
Chassis Mount 20 for £1
IN4001/6 100 mixed £2.50
EHT Diodes, small 20 for £1
20 Mixed Switches £1

SENDZ COMPONENTS
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SENDZ COMPONENTS

TO ORDER SEE BACK PAGE

Thorn Spares

9000 Frame panel £8
9000 Cyclops panel £1.50
8000/8500 timebase panel £8
8800 convergence panel £6
8500 convergence panel £6
4000 Chroma £20
4000 Power supply £3
1600 Mains lead, switch
3500 6 push button + cable form £1.50
T605 1vNPN T066 80v/6A 10p
9000 Sound output panel £1
3500 Focus unit £1.50
3500 Mains Trans £4
3500 2amp thermal cutout 75p
3500 IF panel £2
3500 Frame panel £3
3500 Line panel £3
3500 A1 Diode 20p
Export 3500 IF panel £2
IC board with set of SN74LS £1
4000 Tube base £4
3500 A1 pots 50p
Beam limiter panel £1.50
3500 Power panel with Y969 £1
3 Way regulated adaptor 240V 6V/ 7.5/9V/300mA £3.50
Rank/Toshiba preh unit 0354 £9.50
2 banks of 3 PB unit. Pye 731 £2
4 Push button unit preh £1.00
6 Push button VHF/UHF for v/cap. GEC-Decca type £7.00
7 Push button for CVC5 ITT £8.00
KT3 12 Push button unit £2.00
KT3 (Export) 12 P.B.u £2
6 Push button Unit Thorn £1.00
6 Push button Unit fits GEC & Decca etc. £6.00
6 Push button unit for GEC 2040 and ELC 1043/05 £6.00
Hearing aid unit £3
6 Push button unit PYE 713 £7.00
7 Button Unit GEC with Lamps £7

Mains Droppers

G8 2R2+68R £1.25
G8 47R 15 watt 75p
Pye 731 3+56+27R 50p
Pye 3R5/15R/45R 50p
Thorn 50/17/1K5 £1.00
120/20/20/48/117 £1.00
270/10/6 for Thorn 4000 50p
18/320/70/39 £1.10
Thorn 50-40R-1K5 50p
Ae Socket & Lead
GEC, ITT, Philips, Pye 25p
7×3¾ Thorn £1
Rank Toshiba Tube Bases 30p

Speakers

6×4 G11	25 ohm	70p
5½×2½	3 ohm	£1.00
5×3	80 ohm	70p
5×3	50 ohm	50p
5×3	35 ohm	70p
6×4	15 ohm	£1.00
7×3	70 ohm	£1.00
5×3	8 ohm	70p
7×3	16 ohm	£1.00
5" dia	16 ohm	£1.00
5" dia	8 ohm	£1.50
6½" dia	4 ohm	£1.50
6½" dia	3 ohm	£1.50
2¾" dia	8 ohm	75p
3" dia	8 ohm	75p
4½" sq.	15 ohm	75p
KT3 speaker	K30	75p
3" dia	15 ohm	60p

KT3-K30

OF-550	E.W.	10p
OF-513	correction	10p

Diodes

BY 127 10p
BY 133 10p
BY 134 10p
BY 164 50p
BY 176 25p
BY 179 40p
BY 184 25p
BY 187 10p
BY 190 40p
BY 196 30p
BY 198 10p
BY 204/4 8p
BY 206 8p
BY 208/800 8p
BY 210/400 5p
BY 210/800 10p
BY 223 60p
BY 224/600: 4.8A/600v bridge 50p
BY 226 15p
BY 227 15p
BY 228 20p
BY 229/400 30p
BY 237 5p
BY 254 10p
BY 255 30p
BY 298 10p
BY 299 10p
BY 406 8p
BY 527 20p
BY 407a 10p
International Rectifier EHT Diodes G770/HV34 6KV 3 for 8p
6A/600V Stud Diodes 20p
6A/1000V Stud Diodes 20p

BY 602 10p
F 247 10p
XK 3102 50p
XK 3123 50p
Hitachi 2A/1500V metal case wire end 20p

20.AX

GEC Degausing Panel 809 with PT37 £1.00

Line Transformers

2 J/Pots 3,500 1 off each type £3.00
G8 Symmetry Coil £2.00
G8 Trans. Philips £7.00
G11 Split Diode £12.00
CVC820 Split Diode ITT £10.00
Thorn B/W AD5308F + Stik + Lead £1.50
GEC 2040 £3.00
GEC 2110 £7.00
Mullard AT 2036 £1.50
Pye 169 Line Trans £3.00
Pye mono £3.00
Rank mono T704A £3.50
GRC 20 AX Split Diode Trans £7.00
CVC20 ITT £3.50
AT2080/15
CVC30 ITT
CVC32 Line Tran £4.75
CVC800 Line Trans £6.00
CVC40 Slip/Diode £12.00
GEC Portable G1OT2041 £3.00
GEC Portable G1OT2046 £3.00
EHT Split Diode Leads ITT £1.00
EHT Cable/Metre 20p
Ex panel "14" Fidelity portable £5

Triplers

8500 Triplers £6.50
11 TEZ Rank £3.00
G9 Philips £4.00
GEC 2110 £4.00
3500 Thorn £3.00
9000 Thorn £5
9500 Thorn £4.50
2040 GEC £3.50
GEC TVM25 Tripler £2.00
Universal Tripler £5.00
TVK 76/9 £3.00
G8 Philips (Mullard) with cap £6.00
CVC 825 ITT CVC 20/25/30/32 £3.50
Decca 80 100 £4.50
Grundig TVK 52 £2.50
11TBQ Pye 731 £3.00
11THY £4.00
D22 for Pye 18" colour portable £4.00
LP 1193/63 £4.00
BG 100/41 £3.25
BG 100/61 £3.25
KT3 BG200/43 £3.50
T/text ultrasonic rec'r panel £14.00
Video cassette lamps on lead. 12-14V. 50p or 3 for £1.00
20 for £5.00 200 for £25.00
GEC 8 touch unit assy complete with all I.C.'s + pots £4.00
G11 E.W. Transformer 50p
G11 E.W. coils £1.00
G11 Transient Suppressors 245V 10 for £1.00
G11 Scan Coils £5.00
G11 100K tuner pots 12 for £1
KT3 IF panel £6.00
KT3 line OSC transformer £1
KT3/K30 infra-red receiver head £3
K30 drawer unit with IC's (home) £10
K30 drawer unit with IC's (export) £10
KT3 AE Sockets 25p
KT3 receiver panel £8
KT3 line driver transformer 50p
Decca 80/100 IF panel £5
NPN PNP 80V 6 Amp TO66 O.P. Trans. pair 25p
5 button touch tuner BBC1/2 ITV1/2 video with ic SAS 560T/570T £7.00
Control panel 5 sliders + mains lead £1.50
G11 8 touch button unit replaces old 6 P.B.U. £24
Tube base + base unit for 820 Euro chassis £4.00
GEC Line O/P Trans. & Rec Stick for Portable £3.00
CVC 20/25/30/35/40 decoder panel £10
CVC 20/25/30/35/40 decoder panel (untested) £5
CVC 40/45 IF panel £5
40K Transducer 50p
PHILIPS NE511N £1.20
LM337M Reg. 30p
20 GEC Black Spark Gaps £1.00
G11 Line Driver Transformer 35p
KT3 Front Panel Control Assy. £2.50
BTW 30/50 50p

TELETEX DECODER

I.C. SAA 5051
I.C. SAA 5042
I.C. SAA 5030
I.C. SAA 5020 etc. £12.00
BTW 92/800R £3
25A473 PNP C/P 10p

6 Diode Universal Triplers £3.25
NEW PYE 725 line O/P panel with L.O.P.T. & Tripler £10.00
Thorn Mains Isolator unit for 70-80W. Ex-speaker £2
NEW GEC 20AX Power Supply Switch Mode £12.00
Complete new GEC portable chassis M1201H/M1501H with P.B.U./v.cap/LOPTI £10
Field + Jungle panel for GEC 3133/3135 £1.50
GEC 2110 line panel with transformer £7.00
GEC 2110 tuner unit + IF Panel £12.00
Pye/Chelsea Line op panel £12.00
Pye 713 IF panel and tuner £7.00
Pye 713 Chroma £10.00
Pye/Chelsea Timebase panel with LOPTI £10.00
Pye 731 Frame Panel £5.00
Pye 731 Convergence Panel £5.00
Pye 731 Chroma £10.00
Pye 731 IF panel + tuner £10.00
Pye 607/205 Line panel with transformer £10.00
Pye CDA/205 panel £6.00
GEC portable chassis + LOPTI 2114 New £4.00
Thorn 1613/1713 chassis 9.75
Hills 520 multimeter + case. 20,000W/volt, fuse diode protected + logic test facility. 10meg/1200 volt £19.50

NEW MULLARD TELETEX

Decoder Panel (VM6230) £15.00
Panel 6101 £15.00
Panel 6330 £15.00
G8 Tuner Unit + Panel £6.00
G8 Convergence Panel (late type) £12.00
G8 Power Supply £6.00
G8 6 Sloping PBU £8.00
G8 IF & Chroma £12.00
G8 Chroma £6.00
G11 IF Detector £3.00
G11 Selector gain module £3
Complete CVC 825 Chassis (both panels) £40.00
AEC V/Cap Resistor Unit UHF with IC SAS660 SAS670 £3.00
Z714 RANK IF Panels 6MHz 1 I.C. SL437F £3.00
Z909B RANK IF Panels Export 5.5MHz 2 I.C.'s
TBA1205B TCA2705Q £2.50
Z743 RANK IF Panel Export 5.5MHz 3 I.C.'s TBA750+SC9504P+SC9503P £1.50
Pye G11 Front panel with transducer, pots, tuner pots, 6 pb switch+lead £5.00
GEC V/cap VHF/UHF tuner and IF+ sound O/P PC 706B3 (Export) £12.00
GEC Line O/P PC 659B3 £6.00
2110 GEC Power Panel £8.00
GEC Power Supply (Export) £10.00
G11 dynamic correction panel £6
CVC 20 Front panel with sliders + mains input panel £4
CVC 40 PUSH BUTTON ASSY with sliders: complete with lamp assy + pots £14
CVC 5 Mains on/off + 5 pots £2
Universal Focus. Fits Pye, Thorn and Decca Units.
Large Type 75p
Decca Small 75p
KT3 Focus Unit 75p
K30 Focus Pot 75p
TX10 Focus Units £6.00
CVC 32 Focus Unit 75p
3500 Thorn Focus Unit £1.00
G11 focus £2.00
ITT Small for use with Split Diode 50p
TV11 50p
Remo TV12SP 50p
TV13 50p
TV14 50p
TV18 60p
TV20 £1.00
TV45 50p
Thorn 14/1500 rec stick 5p
16 Button Key Pad 1 to 0 + * + #+ 4 blank (Cherry) £3.00

G7000 Philips Video Games Packs
11 types £8.75 each

G11 drawer ASS 3 pots Mains switch and lead £2.00

Line O/P panel GEC 2217/2218/2213/2214/2226/2227/2228 £10

3500 thick film £2.00
4000 thick film £2.00
PYE 731 thick film £2.00

DISPLAYS

4040 Clock £1.00
7seg Red LED 50p
2 digit LED 8.8 50p
2 digit LED ÷1.8 with panel + MC14511 £1.00
4700/63 £1.50

250/64 10p
3300/70 50p
.1/100 5p
1/100 × 10 30p
22/100 10p
4.7M/100 5p
470/100 20p
2000/100 70p
4700/100 75p
47/160 10p
600M/300V £1.00
800/160 50p
.1/250 Pulse 5p
G11 0.47/250 10p
2.2 250v 10p
3n3/250 A.C. 10p
.33/250V 20p
.39/250V 15p
4n7/250 tested 5KV 25p
.91/250 35p
.91/400 30p
22/250 15p
47/250 10p
100/250 20p
G11 470/250V £1.75
GEC600/250 60p
700/250 £1
600M/300 £1.00
800/250 40p
32/300 20p
4/350 5p
8/350 8p
12/300 10p
4.7M/350v 10p
16/350 25p
33/350 20p
50/350 10p
220/350 30p
300/350 40p
400/350 50p
10/375 10p
22/375 15p
220/385 75p
330/385 CVC 820HT 60p
0.1/400 15p
KT3 E/W .39/400 20p
.56K/400v 20p
4700pf/400 10p
.22/400 10p
8/400 15p
33/400 20p
400/400 40p
394K/400V 20p
220/450 40p
.47/500 25p
0.1/600 15p
.047/600 15p
0.047/1000 10p
0.01/1000 10p
0.1/1000 10p
.15/1000 20p
.47/250V A.C. 10p
.001K/1250 10p
0.0047/1500 10p
.005/1500 10p
.0105/1500 10p
1n8/1500 15p
2n0/1500 10p
2n2/1500 15p
G11.11000/1500 15p
.01/1600 15p
G11.8200/2KV 15p
0.1/2KV 20p
10n/2KV 15p
3n9/2KV 15p
0.0015/2KV 10p
5n2/2KV 10p
6n2/2KV 15p
2n0/2KV 15p
2n2/2KV 15p
7500pf/2KV 10p
4n7/2KV 15p
8n2/2KV 15p
0.0082/2500 15p
150/3500 10p
1800/4KV 5p
4.7nf/5KV 10p
170/8KV 10p
180/8KV 10p
210/8KV 10p
1000/10KV 10p

Infra Red and Ultrasonic G11 Teletext Decoder Panel £30
RANK & ITT Mains Remote On-Off Switch (720R) £1.50
RANK & ITT Mains Remote Switch 2865 ohm £1.50
RANK & ITT Remote Switch 2800 ohm £1.50
G11 Mains Switch 50p
4 amp Mains Switch 25p
GEC Mains Switch 4 amp 30p
KT3 Mainswitch £1.00
THORN Rotary Mains Switch 50p
G8 Mains Switch 75p
Thyristor 600/4 amp C106/2 24p
G11 Preh Red LED P/Button for C.H. Change 20p
RANK TOSHIBA Transductors TPC-2011 50p
CVC 5 Mains on/off
+250K+100K+500K+50K+500K Pot on Panel £2.00
Thorn 12 or 24 volt battery convertor for portable colour T/V £12.00
Tape Heads R/Play/Back Mono/Stereo £1.00

210/12KV 10p
1000/12KV 10p
1200/12KV 10p

NEW GRUNDIG SPARE PANELS

Mod Number
SC4127 From
SC4237 £5 to £10
SC6217 Send for
SC6237 panel number

Multi-Caps

470/250 G11 10 for £15
Thorn 3500
175/100/100/350v £1.75
KT3/200/25/25/385v £1.00
300+300+150+100+50MFD 350V £2
47/220/350v 60p
150/150/100/100/100/320v £2.00
2500/2500/63v 50p
470/470/250v 50p
150/200/200/300v 70p
400/400/200v £1.70
300/100/100/16/275v £1.50
100/200/325v 40p
150/150/100/375v £1.50
300/300/100/32/32/300v 2.00
1500/2000/30v 50p
Jelly pot Thorn 00D4/013 £3
150/150/100/100/320v £2.00
100/350 + 300/200/100/16/275v £2.00
300+300/300 £1.00
225+25/380 GEC 70p
200/100/100/350v £1.50
500/500/25v 50p
150/150/100/300v 75p
200/150/150/300v 1.00

ITT Panels

CVC 40/2 Chassis, new £30, complete with intrfase panel
CVC 820 Line O/P Panel
CVC20 Mains Panel £3.00
ITT 8 & 6 Push Button Unit £1.00
CVC40/2 New Chroma Panel £10.00
CMA 10 £2.00
CMA 11 £2.00
CMA 30 £2.00
CMA 40 £1.50
CMC 10/2 £5.00
CMC 16 £4.00
CMC 38 £8.00
CMC 45 £1.50
CMC 47 £1.00
CMC 52 £15
CMC 57 £6.00
CMC 58 £8.00
CMC 59 £8.00
CMC 67 £3.75
CMC 67/2 £4.00
CMC 68 £4.00
CMD 12 £10
CMD 32 £5.00
CMD 33 £5.00
CMD 40 £5.00
CMD 41 £5.00
CMF 25 £2.00
CMF 26 £2.00
CMF 40 £2.00
CMH 10 £1.50
CMH 31 £1.00
CMK 12 (untested) £4.00
CMK 30 (untested) £4.00
CMN 20 £1.50
CMN 21 £1.50
CMN 40 £1.00
CMN 45 25p
CMP 10 £2.00
CMP 11 £4.00
CMP 40 £2.00
CMS 11 £2.00
CMS 40 £2.00
CMU 12 £10.00
CMU 14 £8.00
CMU 30 £7.00
CMU 45 £7.00
CMZ 30 £5.00
GMA 90 £5.00
GMC 120 £2.50
GMR 64 £5.00
TMN 2 £2.00
VCA 20 £10
VCA 21 £10.00
VMC 26 £3.00
VMC 34 £5.00
VMC 44 + 45 £4.00
VMC 51 £5.00

Hand Sets

Transducer Hand Set Insert, crystal, transducer, SAA 1124 & lead £3.50
8 C.H. Ultrasonic GEC Full Remote C2014H/C2219H £15.00
New Replacement for G11 Ultrasonic Full Remote £12.00
Thorn 4000 insert with 7 buttons £5.00
Decca RC 11 £14.00
Decca RC 12 £14.00
G11 Infra-red full teletext £19.00
C11 Ultrasonic full teletext for G26c 674/02 and G22c 66/02 £16.00
G9 Philips R/C Transmitter £8.00
Rank, Infra-red £10.00
Dynatron-Full remote CTV 62, 63, 64 £19.00
Hitachi infra red handset £18
Philips full remote K13, 16C928/20C934; 7228/7324; K12 26C 797/1ST 66K 1826 £12.00
G11, Full remote top button assy. £12.00
G11, Full remote repair service (exchange unit) £12.00
Philips infra red full remote 9 channel for 60 CP2605 £6.00
Philips infra red full remote 12 channel for 60 CP2605 £12.00
Philips Key Pad set KT3/K30 £3.00
KT3/K30 T/Text £15.00
KT3/K30 Full remote £15.00
KT3 Power supply £4.00
Hitachi 8 button unit with resistor unit. Last year mod. £7.00
GEC infra-red 2236-2026 £4.00
GEC push pad hand set button blobs 10p each