AUGUST 1986

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TELEVISION

SERVICING·PROJECTS·VIDEO·DEVELOPMENTS

Satellite TVRO Installation

Simple RGB Interface Circuit

Scan Yokes for Colour Tubes

Timebase Synchronisation • DX-TV

Operation of Electric Motors

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So many readers have taken advantage of this award-winning service that the economies made are being passed on to you. Despite inflation, prices for Superprints are the same as for last year, and prices for standard size prints are even lower! Here is the price range—and remember, Superprints give you 30 per cent more picture area.

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Extra set of prints (any size) £1.40.

RELIABILITY AND QUALITY

All our prints are made on super high-gloss Kodak paper. They are checked at every processing stage for accurate colour reproduction by the Kodak Monitoring Service—a Gold Award Winner in both 1984 and 1985. After allowing for postal and peak-period delays, you should normally expect your prints by First Class return post after seven to ten days.

ALL YOU HAVE TO DO

Send your film together with cheque or postal order in the Freepost envelope enclosed with this issue. Or fill in the coupon below and send together with your film and remittance in a strong envelope to: Readers Photo Service, FREEPOST, PO Box No. 42, Brunel Road, Newton Abbot, Devon TQ12 4XJ. All popular makes and sizes of film are accepted, and you have a full money-back guarantee. Credit is given for prints that do not come out.

PERSONALISED SERVICE

Readers know we care for their prints. If you have any queries, phone 0626 67150.

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Even if you do not have an exposed film ready for processing, you can obtain films from us at highly competitive prices. Fresh Kodacolor VR Film for colour prints from only £1.99. Konica SR High Resolution Film for colour prints from £1.50 and when you order three you get another one FREE.

To take advantage of this offer, you must use the special order form on this page.

Sizes of Photos (Approx.)
Superprint sizes: 4"x4" (126) 4"x5" (110 and Disc) 4"x6" (135)
Standard print sizes: 3.5"x3.5" (126) 3.5"x4.5" (110 and Disc) 3.5"x5" (135)

USE THIS LABEL IF YOU HAVE NO ENVELOPE OR PASS TO A FRIEND. IT IS USED TO ENCLOSE YOUR PRINTS.

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Please write quanity required in the box(es) below.

	size	each	quty	amount
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	135.24	£1.99		
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Cheque/PO payable to READERS PHOTO SERVICE £

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	size	each	quty	4 for 3	amount
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	110.24	£1.50		£4.50	
	135.24	£1.50		£4.50	
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Please send (tick boxes)

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Standard Prints ☐
EXTRA SET OF PRINTS ☐

I enclose cheque/PO for
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If you are not satisfied with your order please return it for rework credit or refund Our liability for loss or damage is limited to the cost of unexposed film and any prepaid processing Additional liability is undertaken at a supplementary charge Minimum order value £1 00 Prices and materials correct at time of printing and are subject to change without notice This service is operated in association with Nashua Photo Products Ltd Brunel Road Newton Abbot Devon TQ12 4PB Registered no 1021605 England

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 £14 in the UK, £17 overseas (by surface mail). Send orders with payment to Quadrant Subscription Services Ltd., Oakfield House, Perrymount Road, Haywards Heath, Sussex, RH16 3DH.

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Send orders for binders (£4·50) and indexes (75p) to the Editorial Office, Television, IPC Magazines Ltd., King's Reach Tower, Stamford Street, London SE1 9LS. Prices include VAT and postage. Add 60p for overseas orders.

BACK NUMBERS
Some back issues published during the last six months are available from the Editorial Office at £1·40 inclusive of postage and packing. Address as above.

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").

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OUR NEXT ISSUE DATED SEPTEMBER WILL BE PUBLISHED ON AUGUST 20

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.

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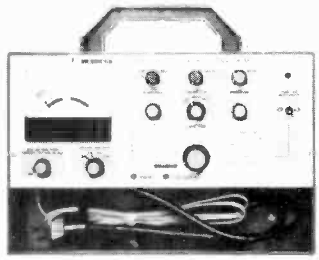

PRICE £260 + £39 VAT

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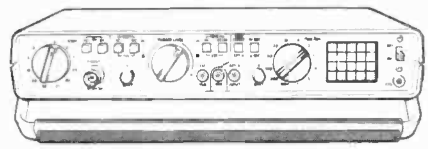

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Full Sized Performance
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LARGE S.A.E. FOR COMPLETE LIST.

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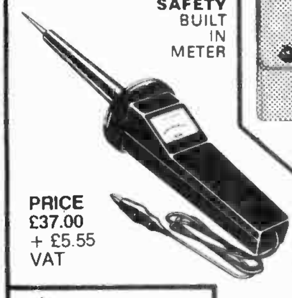

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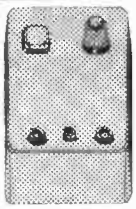

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Revolutionary L.O.P.T. tester. Operates in dynamic mode which actually tests the L.O.P.T. under high voltage conditions without de-soldering or removal.
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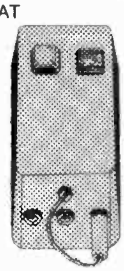

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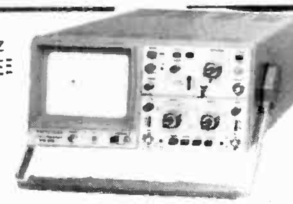

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TELE-PART

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PRICE £18.35 (Inc. VAT)
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- *POCKET SIZE FOR OUTSIDE SERVICE*
- *PP3 BATTERY POWER SOURCE*
- *FIVE DIFFERENT TEST PATTERNS FOR COLOUR & MONO TV*
- *CROSSHATCH GRID * DOT MATRIX*
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- *3.5mm JACK SOCKET FOR OPTIONAL P.S.U.*

A lightweight, extremely portable and versatile pattern generator for black/white and colour T.V. alignment and service at the customer's home. At the turn of a switch, the generator can provide five essential test patterns for correct installation, fast checks and repairs. Pattern stability is first class and compares favourably with other more costly bulky generators only suitable for bench work. The generator is pocket size measuring 10 × 7.5 × 4 cm and weighs only 190 grams. Switched 3.5 mm jack socket allows use of external power supply with battery in situ.

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- *EXCEPTIONALLY LIGHT & DURABLE*
- *COMPACT 10 × 12 × 4.5 cms*
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- *BLUE RASTER*
- *COLOUR BARS*
- *3.5 mm JACK SOCKET FOR P.S.U.*
- *PROVIDES UHF SIGNAL APPROX. CHANNEL 35*

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Goods are despatched on the day we receive your order. If for any reason we are out of stock we will try to inform you as quickly as possible. We try our best to give a speedy, fair and efficient service. V.A.T. invoice on request. Give us a ring – we'll give you service. Please ask if what you need is not listed – we will try to help. Prices are subject to change without notice. In some cases we may have to supply an equivalent.

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AC126	34
AC127	34
AC128	34
AC128K	40
AC141	62
AC141K	39
AC176	35
AC176K	35
AC186	41
AC187	38
AC187K	46
AC188	35
AC188K	46
AD142	92
AD143=OC28	82
AD161	54
AD162	54
AD161/62 MP	1.15
AF106	49
AF114	89
AF118	1.20
AF121	75
AF124	48
AF125	53
AF126	53
AF127	53
AF139	63
AF178	1.54
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BC107	20
BC108	20
BC109	20
BC114	12
BC115	17
BC116A	35
BC117	30
BC118	24
BC119	36
BC139	32
BC140	32
BC141	30
BC142	30
BC143	31
BC147	13
BC148	9
BC149	12
BC157	16
BC158	16
BC159	15
BC160	52
BC161	32
BC170B	15
BC171	15
BC172	15
BC173	16
BC174	10
BC177	27
BC178	26
BC182L	15
BC183L	15
BC184L	15
BC186	35
BC187	25
BC204	10
BC208	13
BC209	10
BC212	15
BC212L	15
BC213	15
BC214	15
BC237	14
BC236	14
BC251A	18
BC252	12
BC261	33
BC262	30
BC300	50
BC301	53
BC303	33
BC307	20
BC308	25
BC323	99
BC327	22
BC328	18
BC337	18
BC338	18
BC461	42
BC527	35
BC547	13
BC548	13
BCX32 = BC637	39
BC549	10

BC550	10
BC557	10
BC558	9
BC635	19
BC637	23
BC639	30
BC640	32
BCY72	13
BD115	45
BD116A	90
BD124P	84
BD131	50
BD132	49
BD133	60
BD135	38
BD136	38
BD137	38
BD138	35
BD139	35
BD140	44
BD144	1.70
BD150	60
BD159	65
BD160	1.60
BD166	52
BD179	70
BD182	1.20
BD183	1.18
BD201	85
BD202	91
BD203	80
BD204	99
BD222	46
BD223	56
BD225	47
BD232	82
BD233	60
BD234	63
BD235	60
BD236	65
BD237	57
BD238	65
BD243	85
BD244	85
BD410	79
BD434	74
BD437	86
BD436	94
BD507	69
BD508	80
BD509	86
BD510	86
BD278A	81
BD517	60
BD519	1.08
BD520	75
BD535	82
BD536	91
BD696A	1.49
BD697	1.24
BD698=702	1.50
BD701	1.63
BD707	95
BDX32	2.10
BF115	38
BF117	36
BF125	26
BF127	47
BF154	15
BF158	18
BF160	27
BF167	24
BF173	36
BF177	52
BF178	46
BF179	42
BF180	39
BF181	39
BF182	36
BF183	29
BF184	42
BF185	36
BF194/394	16
BF195	16
BF196	16
BF197	16
BF198	18
BF199	21
BF200	35
BF224	40
BF225	20
BF241	38
BF256	60
BF257	34
BF258	34
BF259	34
BF262	84
BF263	81

BF271	24
BF273	24
BF274	24
BF336	40
BF337	41
BF338	41
BF355	56
BF362	68
BF363	72
BF371	30
BF392	35
BF422	34
BF423	46
BF435 = BF491	35
BF457	35
BF458	43
BF459	58
BF460 = BF462	86
BF469	63
BF470	66
BF597	16
BF757	54
BF756	54
BFR39	27
BFR40	30
BFR79	85
BFR90	1.74
BFT42	42
BFT43	42
BFW10	60
BFX29	40
BFX84	42
BFX65	30
BFX86	30
BFX88	46
BFY50	32
BFY51	32
BFY52	32
BFY90	95
BR100	34
BR101	95
BR103	83
BR303	1.46
BRC4443	94
BRC4444	98
BRY39	56
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BSR59	1.80
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BT100	1.65
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BT116	1.87
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BU208D	2.20
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OT112	1.91
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RCA16029	1.18
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RCA16092	1.18
RCA16040	96
RCA16041	84
RCA16334	90
=ON447	
RCA16335	90
=ON448	
RCA16957	2.88
TIC45	90
TIC46	60
TIC47	72
TIL32	65
TIL78	48
TIP29C	43
TIP30A	47
TIP30C	43
TIP31C	55
TIP32C	42
TIP33B	75
TIP34B	1.06
TIP41C	47
TIP42C	50
TIP47	93
TIP120	65
TIP161	2.15
TIP2955	90
TIP3055	63
TIS91	32
TU106/02	1.80
2N696	21
2N918	82
2N2904	51
2N2905	28
2N3054	60
2N3055	79
2N3702	16
2N3703	16
2N3705	10
2N3706	10
2N3708	17
2N5294	48
2N5296	48
2N5298	69
2SB337	1.86
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2N6109	81
2SA715	1.98
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2SC643A	1.82
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2SC1307	3.00
2SC1449	1.67
2SC1520	68
2SC1678	2.67
2SC1909	2.90
2SC1953	1.44
2SC1986	
=2SC1061	2.94
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AN6341N	8.97
AN6344	7.85
BA521	2.80
BA536	3.00
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CA556	84
CA741	25
CA748	45
CA1532	4.20
CA3065	1.80
HA1151	3.89
HA1342	2.49
HA1306N	2.60
HA1366WR	2.80
HA1392	3.95
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HA11244	4.04
LA3350	1.59
LA4031P	3.21
LA4032P	3.15
LA4102	3.37
LA4112	3.25
LA4400	3.05
LA4422	3.28
LA4440	4.07
LC7130	5.93
LC7120	5.87
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LM8361=	
MM5387ANN	3.69
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MC1310P	1.84
MC1327	1.70
MC1351P	2.93
MC1349	1.99
MC1350	1.50
MC1352	1.75
MC1358P	1.50
MC1495L	3.00
MC14011BCP	66
MC14049UB	43
MC7742	1.35
MC7812	1.35
ML231	2.20
ETTR6016	
ML232	2.20
ML236	5.35
ML237	2.50
ML238	6.00
ML239	2.50
ML920	4.12
ML922	3.29
ML928	2.18
MM5387ANN	4.15
MRF475	2.50
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MSN5807	7.87
MS1513L	2.80
MS1515L	3.28
SAA1025	8.50
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SAF1032	6.30
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SL1327Q	1.20
SL1430	1.58
SL1432	3.36
SL76544	2.05
SN76110N	1.42
SN76115N	2.27

SN76131N	2.00
SN76226DN	2.72
SN76227N	1.18
SN76533N	1.70
SN76033N	2.49
SN76544N	2.35
SN76650N	1.24
SN76660N	80
SN76666N	1.52
SN76530A	1.47
STK015	7.36
STK032 = STK078	13.25
STK433	5.65
STK435	9.06
STK436	6.50
STK437	7.85
STK439	8.40
STK459	9.50
STK441	11.57
STK461=465	12.60
STK463	14.30
STR441	6.50
STR451	6.50
STR6020	8.50
SW153	3.90
TA7050P	95
TA7051P	95
TA7063P	2.20
TA7074P	3.46
TA7108P	3.43
TA7120P	2.43
TA7129AP	3.76
TA7130P	1.93
TA7146P	4.67
TA7193P	5.67
TA7171P	8.30
TA7172P	8.90
TA7173P	8.90
TA7176P	2.50
TA7202P	4.27
TA7204P	3.77
TA7205AP	3.72
TA7208P	3.40
TA7210P	6.60
TA7222	2.42
TA7223P	3.74
TA7227P	5.98
TA7228P	5.98
TA7310P	2.78
TA7609P	4.39
TA7611AP	2.92
TAA570	3.98
TAA310	2.83
TAA320	2.00
TAA550	55
TAA630	3.90
TAA8400S1	1.96
TAA661B	1.20
TBA120A	1.49
(A),(S),(AS),(SA).	
TBA120B	1.30
TBA120SB	1.37
TBA120T	1.49
TBA120U	1.49
TBA1440G	1.56
TBA395	1.75
TBA396	1.75
TBA440N	2.75
(TBA1441)	
TBA440P	2.50
TBA480Q	1.82
TBA510	3.00
TBA520(Q)	1.68
TBA530(Q)	1.38
TBA540	1.76
TBA560(Q)	1.93
TBA570	1.79
TBA690	1.50
TBA641BX1	3.50
TBA673	2.45
TBA700	2.12
TBA720	2.64
TBA750	2.98
TBA800	1.62
TBA810AS	1.38
TBA820	1.70
TBA820M	1.25
TBA890	3.94
TBA920(Q)	3.00
TBA950(2X)	3.25
TBA970	4.09
TBA990	1.90
TCA760	2.30
TCA270SQ	2.50
TCA800	5.95
TCA830	3.44

TCA900	2.20
TCA910	2.20
TCA940	1.95
TDA440	2.20
TDA1002	1.95
TDA1003A	5.60
TDA1006A	2.50
TDA1005	3.60
TDA1010	3.30
TDA1011	4.00
TDA1035	4.70
TDA1037	2.95
TDA1044	4.37
TDA1060A	4.44
TDA1062	1.56
TDA1083	1.68
TDA1170S	3.00
TDA1190	3.50
TDA1190P	3.50
TDA1180	2.91
TDA1200	2.95
TDA1220A	2.12
TDA1270	3.95
TDA1327	1.70
TDA1352B	1.60
TDA1412	1.50
TDA1415	1.40
TDA1470	4.67
TDA1770	5.60
TDA1908A	1.95
TDA2002	2.80
TDA2003	1.20
TDA2004	2.52
TDA2006	1.78
TDA2010	2.40
TDA2140	5.95
TDA2150	2.22
Superceded by	
TDA2151	3.25
TDA2190	3.30
TDA2020	4.66
TDA2030	2.80
TDA2522	2.66
TDA2523	3.40
TDA2524	2.25
TDA2525	4.00
TDA2530	2.70
TDA2532	2.90
TDA2540	3.84
TDA2541	3.84
TDA2560	3.50
TDA2571	4.90
TDA2576	3.75
TDA2576A	3.75
TDA2577	4.73
TDA2581	3.30
TDA2582	2.60
TDA2593	2.95
TDA2600	6.90
TDA2610	3.20
TDA2611A	2.35
TDA2640	2.92
TDA2652	7.31
TDA2653	5.90
TDA2680	3.40
TDA2690	2.72
TDA2710	5.67
TDA2720/1	6.77
TDA3190	2.00
TDA3500	6.90
TDA3560	6.00
TDA3561	6.66
TDA3562	8.60
TDA3571	3.75
TDA3651A	4.50
TDA4420	5.55
TDA4600	2.95
TDA4600-2D	2.95
TDA9503	4.21
TEA1009	1.86
UPC554	2.63
UPC566H	2.95
UPC575C2	3.40
UPC576H	2.60
UPC585	3.06
UPC587C2	2.34
UPC1025H	2.95
UPC1026H	1.24
UPC1028H	2.52
UPC1032H	94
UPC1042C	1.56
UPC1156H	4.26
UPC1158H	3.50
UPC1163H	2.48
UPC1167C2	2.70
UPC1168C	3.20
UPC1176C	2.53

UPC1177H	3.15
UPC1178C	4.21
UPC1180C	1.84
UPC1181H	1.62
UPC1182H	2.95
UPC1183H	2.48
UPC1185H	3.66
UPC1186H	1.60
UPC1188H	4.99
UPC1190G	1.20
UPC1198C	4.00
UPC1200V	1.18
UPC1211V	2.70
UPC1212V	1.34
UPC1215V	1.66
UPC1216V	1.20
UPC1217G	2.24
UPC1218H	1.80
UPC1223C	2.20
UPC1225H	2.00
UPC1226C	1.50
UPC1227V	1.20
UPC1228H	54
UPC1230H	4.39
UPC1238V	1.89
UPC1245V	1.35
UPC1350C	4.15
UPC1353C	4.76
UPC1365C	6.38
UPC1356C2	2.08
UPC1367	2.08
UPC1378H	2.70
UPC1358H	1.88
UPC1360C	2.20
UPC1363C	2.16
UPC1366C	1.84
UPC1368H2	2.15
UPC1370C2	2.58
UPC1382C	1.08
UPC1384	3.78
UPC1447H	58
UPC41C	2.80
UPC577H	2.46
UPC585C	1.28

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4116	1.10
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Large	6.20

VOLTAGE REG.

7805	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

DIODES

AA119	9
BA102	17
BA115	13
BA145	17
BA148	17
BA154	6
BA155	14
BA156	15
BA157	20
BA317	26
BAX13	4
BAX16	8
BB105G	30
BY122	96
BY126	12
BY127	11
BY133	15
BY164	45
BY176	85
BY179	63
BY182	87
BY184	55
BY199	28
BY206	14
BY210/600	28
BY210/800	33
BY223	90
BY227	28
BY298	22
BY299	22
BYX10	20
BYX36/10	30
BYX55/600	30
BYX71/600	90
BY224	2.00
OA47	20
OA91	10
OA95	6
OA202	11
IN914	4
IN4001	4
IN4002	4
IN4003	4
IN4004	5
IN4005	5
IN4006	10
IN4007	10
IN4148	5
IN4448	10
IN5401	12
IN5402	14
IN5403	12
IN5404	12
IN5405	13
IN5406	16
IN5407	16
IN5408	20
ITT2002 = BAX16	
Y969 – Disc.	
REP BZX85 30V	
General Purpose Triac	95
SKE4F	£1.19
SKE5F	£1.19

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BZV15 C12	1.24
BZX61 130V	28
BZX61 Range (1.3W)	20
BZX79 Range (400mV)	10
BZY88 Range (400mV)	10
BZY93, 90 (18V)	1.18

I.C. SOCKETS DIL to DIL

8 way	22
14 way	29
16 way	32
18 way	32
20 way	32
24 way	34
28 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

We try very hard to stock all that we advertise but if for any reason beyond our control we do run out of anything we will inform you as quickly as possible. Some prices may change because of product availability.

THERMISTORS

VA1104	90
VA1040	75
VA8650	55
VA1039	35
GEC DUAL POS.	1.68
GEC DUAL THERM. CKI	1.98

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6526	15.50
6569	15.50
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9.94MHz	6.00
10.692MHz	6.00

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5mm Red, Green, Yellow	14
T1 ¾ Amber	22
T1 3mm Red, Green, Yellow	14
Flashing Red CQX21	62
CQX22	66
Panel Clips 3mm	04
5mm	04

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4-way 13A Mains Conn. 5.00
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Probes (x1) 10.90
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Nozzles 81
Trim Tools
Metal End 30
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Lg. Neon Screwdriver 65
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TA51 Car Battery Leads/port. TV Thorn 1613/1615 3.66
Car Battery Leads/port. TV Philips 3.95
Universal Car Accessory Cable 1.99
Dynascan 467 Rejuv. Testers 399
Dynascan 470 Rejuv. Testers 299

B+K tube bases Dynascan

No. 1	9.09	No. 14	16.63
No. 3	9.50	No. 15	16.44
No. 5	9.09	No. 18	10.83
No. 6	11.08	No. 19	10.83
No. 7	9.09	No. 21	14.40
No. 8	10.08	No. 23	13.86
No. 9	9.09	No. 24	27.07
No. 13	11.11	No. 25	12.57

C15 computer cass. 30
C20 computer cass. 33
5¼" floppy disc s/s s/d 1.61
2M Fly Lead 70
4M Fly Lead 1.20
10M Fly Lead 1.90
Figure 8 Mains Lead 62
Computer to TV 97
7 pin din to 5 pin din 98
5 pin din to 5 pin din 98
Fluorescent Starter 4-80W) 15p
Tinned Copper Wire
14SWG 100 Amp 1.86
17SWG 60 Amp 1.86
19SWG 45 Amp 1.86
20SWG 2.75
22SWG 25 Amp 1.86
Insulated Copper Wire (0.4mm dia.) 9.11
Battery Press Studs Min. 11
Std. 15

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Up to 25mm diameter, 100 at 54p
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320A Single Gang 1.30
320B Single Switched 1.95
320C Two Gang 2.53
320D Two Switched 3.92
Switches
320E One Gang/One Way 80
320F One Gang/Two Way 1.05
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6.5V 0.3A
12V 2 2W

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L20m x D5mm
6V 0.025A
12-14V 0.1A

CAPLESS LAMPS 28p
L11mm x D4m
6V 0.04A
12V 0.04A

TUBULAR LAMPS CAPPED 31p
L31mm x D6.3mm
6.3V 0.15A
6.3V 0.25A
6.3V 0.3A
8V 0.15A
8V 0.25A
8V 0.3A
12V 0.15A
12V 0.25A
12V 0.2A

WIRE NEONS 9p
65VAC/90VDC Series res
100K for 110V – 330K for 240V

WIRE ENDED LAMPS 25p
D3.2mm
6V 0.04A
8V 0.04A
12V 0.04A
14V 0.025A
14V 0.04A
D4.2mm
4.5V 0.06A
6V 0.06A
6.3V 0.025A
6.3V 0.08A
8V 0.04A
8V 0.06A
8V 0.08A
12V 0.04A
12V 0.06A
14V 0.06A
14V 0.08A

TUBULAR LAMPS (Wire ended) 31p
L22m x D4.25m
3V 0.06A
6V 0.05A
8V 0.05A
9V 0.045A
12V 0.05A
14V 0.05A

PLUGS AND SOCKETS

5 pin DIN plugs 180° 20
5 pin DIN chassis sockets 180° 28
5 pin DIN line sockets 180° 28
5 pin DIN plugs 360° 20
5 pin DIN chassis sockets 360° 28
5 pin DIN line sockets 360° 28
6 pin DIN plugs 28
6 pin DIN chassis sockets 36
6 pin DIN line sockets 28
7 pin DIN plugs 35
7 pin DIN chassis sockets 36
7 pin DIN line sockets 30
8 pin DIN plugs 56
8 pin DIN chassis sockets 64
8 pin DIN line sockets 55
Phono plugs 12
Phono chassis sockets 10
Phono line sockets 20
2.5mm Jack plugs 11
2.5mm Chassis sockets 14
2.5mm Line sockets 17
3.5mm Jack plugs 15
3.5mm Chassis sockets 24
3.5mm Line sockets 18
3.5mm Stereo jack plugs 35
3.5mm Stereo chassis sockets 18
3.5mm Stereo line sockets 28
6.3mm Stereo jack plugs 36
6.3mm Stereo jack line sockets 25
Standard mono jack plugs 20
Loud speaker plugs 2 pin 10
I.D.C. plugs 36 conn. 5.90
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In Line Socket (Metal) 25
Banana Plug 60
Banana Socket 60

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PANASONIC	NVB300-333-370-777	4.35
SANYO	VTC9300:VBS7000	4.35
SONY	C7·J7:SLT7	4.35
JVC	TCE 3V00-01-06-16-23-24 JVC HR2200-3320-3330-3660-1100-7700	4.35
AKAI	VS9700	4.35
HITACHI	VT5000	4.35
SHARP	VC6300-6500	4.35

VIDEO BELT KITS

VEKIT 1 AKAI / JVC / TCE	VS9300:VS9500·VS9800 HR3300:HR3320: HR3330:HR3360 8903:3V00:3V16:3V22	3.50
VEKIT 2 PANASONIC	NV7000B:NV7200B	3.00
VEKIT 3 SONY	SLC5:SLC5EC:SLC5CH: SLC5E1: SLC5E:SLC5SA:SLC5UB: SLC7E: SLC7UB:SLC7EC:SLC7F: SLC7: SLC5·SLC7·SLT9MER:	3.75
VEKIT 4 SONY	SL8000AS:SL8000E: SL8000SA: SL8000UB:SL8080AN: SL8500: SL8600:SL8600A·	4.50
VEKIT 5 SONY	SL3000UB	4.00
VEKIT 6 PANASONIC	NV3000B	3.00
VEKIT 7 SANYO	9300P	4.25
VEKIT 8 PANASONIC	NV2000B	3.75
VEKIT 9 PANASONIC	NV8600B:NV8610B· V011	4.25
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VEKIT 12 SHARP	VC6300:VC6600	4.00
VEKIT 13 SANYO	VTC5000	1.95
VEKIT 14 SANYO	VTC5300	2.50
VEKIT 15 JVC	HR7650	2.50
VEKIT 19 HITACHI	VT8000	1.12
VEKIT 20 HITACHI	VT11/33	2.15
VEKIT 21 HITACHI	9500	1.12

VIDEO IDLER TYRES

	D.Dia	I.Dia	Width	
SONY	23.7	17.4	4.9	50p
SONY	24.2	18	5.1	50p
HITACHI	31.8	25	4.9	52p
HITACHI	39.5	30	4.2	52p
PANASONIC	37	27	3.9	52p
PANASONIC	34.5	27	3.1	50p
AKAI	26	20	3.9	50p
JVC	32.8	3.4	3.9	56p
JVC	23.9	4.8	4	56p

REPAIR KITS

Remote control handsets for Philips sets KT3/K30 chassis inc. foil unit button matrix and instructions.

Philips part numbers:
Foil 212 275 82 or 212 275 83.
Button matrices: 432 370 37 or 432 370 38.
No. 1 without Teletext,
No. 2 with Teletext £4.50

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Some are original some are compatible types.

DECCA 100/101 US **Non** T.Text	US8513	23.80
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GRUNDIG TELEPILOT 8 IR	RTP05	25.10
GRUNDIG TELEPILOT 160 IR	RTP06	25.10
GRUNDIG TELEPILOT 300 IR	RTP07	18.87
PHILIPS G11 US Non Text	US8253	22.00
PHILIPS G11 8 way.IR Text	IR8435	23.80
PHILIPS G11 US 31 Button	69117187	27.00
PHILIPS G11 US 2 function	US8518	21.00
PHILIPS KT3/30 IR Text 1234	IR1234	19.87
PHILIPS KT3/30 IR **Non** Text 1201	IR1201	19.87
THORN TX10/JVC IR Text	TP8431R	22.00
Remote Control Tester		29.94

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TDV1 Trans. Data Dictionary 7.50

TURNTABLE DRIVE BELTS ALL £1.20

TB42 Most Thorens Models
TB23 Most Philips Models
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TB03 Most BSR

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3HSS UHS 30.00
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PS3B Beta/Sony 35.00
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Philips 1700 64.00
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Toshiba 9600 50.00
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Sharp 6300 58.00
Sharp 7300/7700/7750 58.00
Sharp 8300 58.00
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Hitachi VT33E/GEC 4004 35.62
Hitachi VT11/GEC 4100 35.62
Beta eccentricity gauge 55.00

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	L750	3.20
Scotch	E30	3.66
	E60	4.00
	E120	3.24
	E180	3.86
Beta	L750	5.22
VCC	240 While	6.20
	360 Stocks	6.33
	480 Last	7.23
LVC 1700} Philips 1200		17.50

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· CM7082 UHF VHF DA 65.69 ·
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SERVISOL Excel Polish 96
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Super 40 1.66
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Heat Sink Compound 25G 1.10
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Solda Mop standard reel 77

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R20S 39
R6B 15
R14S 33
R03B 18
PP3B 54
PP3S 74
PP6 1.15
PP7 1.15
PP9 1.17
1289 63

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A Splitter 70
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Coax Plugs per 10 1.80
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J Bolts 25

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COB11 Outlet 96
CS1000 Combiner/Splitter 6.15
PU1240 Power Unit 11.65
UP1300 MHA 9.09
XS2U Xtraset 14.56
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BA312	1.25
BA511A	1.95
BA521	1.85
BA532	1.95
BA536	2.55
HA1166	2.65
HA1322	2.10
HA1338	2.78
HA1339	2.40
HA1342A	2.20
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HA1374	2.45
HA1377	3.80
HA1388	4.20
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LA1230	2.30
LA1365	2.45
LA3350	1.65
LA4101	1.50
LA4102	1.95
LA4400	2.50
LA4430	2.45
LA4440	3.55
LA4445	2.65
LA4460	2.95
LA4461	2.95
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MB3713	2.25
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ML232B	2.55
SAA1250	3.85
SAA1251	4.95
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SAA5012	5.70
SAF1032P	3.25
SAF1039P	4.55
SAS560S	1.95
SAS570S	1.95
SAS580S	2.40
SAS590S	2.40
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SL1432	1.75

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STK078	7.45
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STK465	9.95
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TA7227P	2.95
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TA7313	1.45
TAA550	.43
TBA120AS	.95
TBA120SB	.90
TBA120T	1.25
TBA120U	1.00
TBA520	1.30
TBA530Q	1.00
TBA540	1.37
TBA550	2.45
TBA560	1.60
TBA720A	2.65
TBA750	2.45
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TBA810	1.35
TBA820	1.40
TBA890	2.95
TBA920	1.50
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TCA940	1.55
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TDA2190M	6.95
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TDA2577	4.85
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TDA1037	1.95
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TDA2020	2.95
TDA2522	1.80
TDA2523	2.25
TDA2530	2.10
TDA2532	2.20
TDA2540	1.95
TDA2560	1.80
TDA2578A	3.25
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TDA2582	2.20
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TDA2611A	1.50
TDA2640	2.40
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UPC585C	1.40
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UPC1238H	2.35
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7805	0.65
7812	0.65

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BC108	.14
BC109	.14
BC141	.26
BC142	.23
BC143	.25
BC147	.09
BC148	.09
BC157	.10
BC158	.11
BC159	.11
BC237	.11
BC327	.11
BC328	.12
BC337	.11
BC338	.10
BC547	.10
BC548	.10
BC557	.10
BC558	.10
BC637	.35
BC638	.25
BC639	.25
BD124M	1.05
BD131	.33
BD132	.33
BD222	.50
BD225	.55
BD235	.32
BD236	.43
BD237	.40
BD238	.39
BD410	.50
BD437	.70
BD438	.78
BD439	.70
BD677	.70

TYPE	PRICE
BD701	.85
BD707	1.05
BF337	.28
BF338	.30
BF458	.30
BF459	.36
BF757	.75
BFR90	1.60
BR100	.18
BR101	.32
BR103	.55
BR303	2.95
BT106	1.15
BT116	1.30
BT151/800R	1.10
BU126	1.78
BU205	1.42
BU208A	1.45
BU208D	1.85
BU326A	1.48
BU407	1.12
BU407D	1.45
BU500	1.95
BU508A	1.95
BU526	2.00
BU807	1.30
BU826A	3.20
R2010B	1.45
R2540	2.35
TIP31C	.46
TIP32C	.47
TIP33	.80
TIP34	.95
TIP41C	.48
TIP42C	.48
TIP47	.75
TIP2955	.70
TIP3055	.70

TYPE	PRICE
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2N3773	3.45
15/80H	2.25
15/85R	2.25
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BY299/800	.25
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BYX55/600	.26
BYX71/600	.93
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2910 T8500 PLASTIC CUT OUT 3.72
2918 T9000 FOCUS UNIT 4.95
4556 T9000 FR1 THICK FILM 1.65
2919 T9000 OVER VOLT THICK FILM 3.95
4555 T9000 T701 CHOPPER TX. 13.75
4982 T9600 0.33 2KV CAP 2.35
2914 T9600 CHOPPER TX T512 8.11
2916 T9600 FOCUS UNIT 2.95
2913 T9600 SWITCH MODE TX T511 9.98
2917 T9800 FOCUS UNIT 5.93
4429 T9800 MAINS CHOKE 11.03
4437 TX10 .0022 2KV 0.25
4658 TX10 100K TUNING POT 0.64
2938 TX10 CHOPPER DRIVER TX 3.27
5427 TX10 SW NONREM CONT. 2.32
2922 TX10 TUNER DRAWER ASSY 1.95
4859 TX9 4" RND 15R SPEAKER 6.95
2937 TX9 INPUT CHOKE L65 12.05
2936 TX9 L64 BILIFAR CHOKE 4.25

DECCA SPARES
4616 DECCA 100 0.01 2KV CAP 0.98
2933 DECCA 100 BEDIGE TX 2.35
2932 DECCA 100 FOCUS CONTROL 2.77
2919 DECCA 100 LINE DRIVE TX 2.25
2928 DECCA 100SER 470K SH+VOL 2.15
4603 DECCA 2230 10R FUSIBLE 0.70
2930 DECCA 2233 PSH PSH SH 5.14
2931 DECCA 2263 PSH PSH SH 4.20
2926 DECCA 30 SER 3R9 RESIS. 0.50
2924 DECCA 30 SER MAINS TX 12.35
2929 DECCA 30 SER 47K SH+VOL 2.45
2939 DECCA 80 470R SH+VOL 2.45

RESISTORS
CARBON
STANDARD RANGES
1/4 WATT X 10 0.29
1/2 WATT X 10 0.29
1 WATT X 10 0.45
2 WATT X 10 0.60
SAFETY CERAMIC
STANDARD RANGES
5 WATT X 5 0.90
7 WATT X 5 0.74
11 WATT X 5 0.89
17 WATT X 5 1.15

OTHER RESISTORS
3279 2M2 H/V FOCUS RESISTOR 0.46
3280 22M H/V FOCUS RESISTOR 1.50
3281 33M H/V FOCUS RESISTOR 1.50
3282 47M H/V FOCUS RESISTOR 1.50
3283 56M H/V FOCUS RESISTOR 1.50

MAINS DROPPERS
3025 MAINS DROPPER RANK A640 1.20
3013 MAINS DROPPER DECCA 80/100 1.60
3016 MAINS DROPPER GEC 2010 0.90
3031 MAINS DROPPER THORN 3600 0.98
3030 MAINS DROPPER THORN 1600 1.45
4910 MAINS DROPPER OECCA 100 2R5 0.82
3034 MAINS DROPPER THORN 9800 1.48
3027 MAINS DROPPER THORN 1400 1.50
3026 MAINS DROPPER RANK A823 1.10
3028 MAINS DROPPER THORN 1300 1.60
3029 MAINS DROPPER THORN 1500 1.75
3018 MAINS DROPPER PHILIPS G8 0.99
3022 MAINS DROPPER PYE 725/731 1.40
3017 MAINS DROPPER PHILIPS 210 0.98
3019 MAINS DROPPER PHILIPS G8 47R 0.65
3033 MAINS DROPPER THORN 8500/8800 0.98
5385 MAINS DROPPER DECCA 80 2.97
5386 MAINS DROPPER DECCA 100 1.88
5533 PYE CT200 PHILIPS 579 DROPPER 3.45

UNIVERSAL CONVERGENCE POTS
5R, 10R, 22R, 20R, 25R, 50R, 75R, 100R, 200R, 250R, 500R 0.48

FIDELITY SPARES
2940 CHOPPER TX FIDELITY CTV14R 4.50
2942 DRIVER TX FIDELITY CTV14R 2.65
2941 FOCUS UNIT FIDELITY CTV14R 0.50
5408 MAINS INPUT CHOKE ZX2000 3.45
5504 MAINS FILTER TX CTV14R 2.95
5505 DRIVER TX ZX3000 404387 2.95
6162 ON/OFF SH FIDELITY CTV14R 3.65
6163 ON/OFF SH FIDELITY CTV14S 1.65

GEC SPARES
2965 GEC 1401 CHOPPER TX 16.56
2964 GEC 1401 INPUT CHOKE 9.63
5531 GEC 1501 MAINS TX 5.25
4758 GEC 2100 3R FUSIBLE RES 1.45
4759 GEC 2110 SH2 2KV CAPS 2.39
2959 GEC 2100 ETC FOCUS VDR 1.60
2958 GEC 2100 THERMAL CUT OUT 0.97
4760 GEC 2110 FOCUS CONTROL 5.98
4771 GEC 2110 LUM. DELAY LINE 1.83
4728 GEC 2110 MAINS CHOKE 10.50
4996 GEC 2110 NEONS 0.20
4751 GEC 2114 VOL+SWITCH CONT 1.98
4656 GEC 22K MULTI TURN POT 0.98

GRUNDIG SPARES
2949 GRUNDIG 5010 FOCUS VDR 3.35
4633 GRUNDIG 5010 CONTROL TX 4.76
2948 GRUNDIG 5010 FOCUS UNIT 3.75
4865 GRUNDIG 5010 L515 CHOKE 1.63
4744 GRUNDIG 5010/6010 LID 2.62
4745 GRUNDIG 5011 LID 2.59
4637 GRUNOIG 5011 SH+SLIDERS 11.69
2952 GRUNDIG 6010 MIXIE MOD 22.50
4630 GRUNDIG 6011 MAINS SH 3.60
4631 GRUNDIG 6110 MAINS SH 4.86
2947 GRUNDIG A6400 MAINS SH 4.95

REMOTE CONTROL UNITS
PLEASE STATE MODEL NUMBER
4311 DECCA 100 NONTEXT RCU 21.50
4314 DECCA 100 (TEST+PREST) RCU 20.78
4310 DECCA 80/100 SERIES RCU 21.76
4315 DECCA 90/100 N/TXT RCU 20.78
4324 GEC 2 FUNCTION RCU 18.45
4325 GEC C2057H/2067H RCU 21.43
4326 GEC TELEMASTER 12 RCU 20.03
4327 GEC TELEMASTER 16 RCU 20.03
4328 GEC TELEMASTER 8 RCU 23.25
4332 GRUNDIG TELEPILOT 12 RCU 30.03
4333 GRUNDIG TELEPILOT 16 RCU 25.06
2955 GRUNDIG TELEPILOT 7 24.95
4334 GRUNOIG TELEPILOT 8 RCU 20.03
4357 KORTING 12 CHANNEL RCU 22.13
4358 KORTING 16 CHANNEL RCU 24.05
4380 PHILIPS G11 NONTEXT RCU 22.52
4378 PHILIPS G11 T/TEXT 8CH RCU 20.78
5409 PHILIPS G11 T/TEXT U/SONIC 24.50
5453 PHILIPS KT3 REMOTE RC4001 16.00
4379 PHILIPS/PYE G11 2 FUNC RCU 18.90
4359 PHILIPS/PYE KT3/KT30 16.13
4385 RBM 16CH NONTEXT RCU 21.95
4386 RBM 8CH NONTEXT RCU 19.20
4387 RBM TEXT&V/OATA RCU 20.78
2980 REMOTE CTRL UNIT PHILIPS G9 9.85
4390 TCE 9000CHAS 2 FUNC RCU 19.20
4398 TCE TX10(9653)+TEXT RCU 24.78
4400 TCE TX10(9670)+PREST RCU 21.78
4397 TCE TX9/TX10 19.20

PUSH BUTTON UNITS
2870 4 WAY DECCA ETC 8.25
2871 6 WAY OECCA 11.78
2873 4 WAY HITACHI ETC 5.50
2875 4 WAY PYE/TCE 10.87
2877 6 WAY GEC 2110 11.25
2878 7 WAY GEC 2112 6.25
2879 6 WAY T3500 2.75
2880 6 WAY PYE 713 15.75
2881 6 WAY T9000 7.25
2882 4 WAY BUSH A823 10.65
2884 6 WAY MOD CVC9 12.85
2885 6 WAY 520 PHILIPS 19.30
2886 6 WAY PHILIPS 550 14.98
2887 T1P SWITCH UNIT PHILIPS G11 27.50
2888 6 WAY PHILIPS G11 11.25
2889 PIANO KEY MOD DECCA 2631 22.48
4935 7 WAY ITT CVC5 12.90
5278 GEC 2136 TAPERED 10.95
5279 ITT 6 WAY +VCR 10.70
5280 6 WAY BUSH T20 11.50

ITT SPARES
2972 ITT CP340 PB ASSY 34.00
4501 ITT CP340 SLIDER ASSY 7.58
4683 ITT CV40 FDCUS UNIT 1.95
5543 ITT CVC20 LINE DRIVE TX 3.05
4571 ITT CVC20 MAINS SWITCH 1.36
4787 ITT CVC25 6N2 2KV CAP 1.35
4786 ITT CVC25 8N2 2KV CAPS 2.15
2970 ITT CVC25 BRIDGE COIL 4.05
4789 ITT CVC25 E/W LOAD COIL 1.92
4567 ITT CVC25/30 MAINS SW. 6.89
2969 ITT CVC32 DRIVER TX 2.55
4568 ITT CVC32 REMOTE MAIN SH 7.65
2971 ITT CVC32 SH MODE TX 5.00
4795 ITT CVC45 ON/OFF SWITCH 2.09
3286 ITT CVC5 1MFO 250V CAP 0.40
4569 ITT CVC5 MAINS SWITCH 1.85
4781 ITT CVC5 SHIFT POT 25R 1.82
4780 ITT CVC5 SLIDER BANK 7.41
2967 ITT CVC5-9 MAINS TX 8.48
4570 ITT CVC9 MAINS SWITCH 5.61

FUSES
STANDARD RANGES
20MM Q/B FUSE X 10 0.66
20MM A/S FUSE X 10
63MA - 160MA 1.80
200MA - 5A 1.20
1.25" Q/B FUSE X10
250MA - 800MA 0.95
1A - 5A 0.70
1.25" A/S FUSE X 10
250MA - 2A 1.50
2.5A - 5A 2.30
PLUG TO P FUSE X 10
2, 3, 5, 7, 10, 13A 0.95

SERVICE MANUALS
5011 DECCA 101/100 6.00
5047 DECCA 80 CHASIS 6.00
5442 OECCA/TATUNG 120 7.00
5022 GEC C2055H-C2255H 6.00
5023 GEC C2065H-C2265H 4.95
5026 GEC C2110-C2149 6.00
5068 HITACHI CPT2024 5.00
5074 HITACHI CPT2234 5.00
5094 ITT CVC20 4.00
5095 ITT CVC25+30 7.00
5096 ITT CVC40 9.00
5097 ITT CVC45/1 5.00
5513 ITT CVC800/801 4.00
5093 ITT CVC9 4.00
5123 MITSUBISHI CT200B 5.00
5527 PANASONIC TC2205 8.00
5116 PANASONIC TX2234 5.00
5127 PHILIPS G11 CHASSIS 4.00
5126 PHILIPS G8 CHASSIS 6.00
4515 PHILIPS KT3 SERV. 5.00
5135 PHILIPS T8-E 2.00
5136 PHILIPS TX 2.00
5143 PYE 725 731 SER 5.00
5145 REDIFFUSION MK1 3.00
5146 REDIFFUSION MK3 3.00
5147 REDIFFUSION MK4 5.00
5148 REDIFFUSION MK5 4.00
5167 THORN 1500 2.00
5168 THORN 1600 1.50
5171 THORN 1615 3.00
5172 THORN 1690-1691 5.00
5184 THORN 38030 2.00
5187 THDRN 3V01 12.00
5188 THORN 3V16 12.00
5178 THORN 9000 6.00
5182 THORN 9800 10.00

RANK RADIO SPARES
4650 RRI T20 SPEAKER 2.36
5524 RRI T24E ON/OFF + VOL SH 2.35
4842 RRI 1122 SH+VOL 22K PULL 3.10
4843 RRI A823 100K TUNER POT 1.78
4847 RRI A823 FOCUS ASSEMBLY 6.03
2998 RRI A823 PLASTIC CAM 0.35
5300 RRI A823ETC RING SPK GAP 0.55
4988 RRI T20 (TYPE) FOCUS ASY 0.60
3001 RRI T20 3K3 SH+VOL CTRL 2.67
4852 RRI T20 9N1 2KV CAP. 1.98
4853 RRI T20 CONTRAST+AFC POT 3.23
3003 RRI T20 E/W CORR. COIL 3.29
3000 RRI T20 FOCUS ASSY 5.69
3004 RRI T20 SH MODE TX 11.20
4849 RRI 2718 3K3 SH+VOLUME 3.36

PHILIPS PYE SPARES
4969 PHILIPS 128711 4K7 VOL+SH 4.45
3288 PHILIPS 300 470L VOL+SWITCH 3.25
4449 PHILIPS 570/713 IF MODULE 7.00
5425 PHILIPS CTX-S EHT LEAD 9.68
5418 PHILIPS CTX-S FOCUS UNIT 5.50
4655 PHILIPS G11 100K TUNER POT 0.64
2983 PHILIPS G11 CVC32 B/COIL 1.95
2984 PHILIPS G11 E/W CORR COIL 2.45
2985 PHILIPS G11 FILTER COIL 12.80
2986 PHILIPS G11 FOCUS UNIT 9.15
2987 PHILIPS G11 G2 CONTROL ASSY 7.98
4575 PHILIPS G11 RND SHAFT SH. 2.32
4576 PHILIPS G11 SQ SHAFT SWITCH 2.32
4645 PHILIPS G11 TDA2600 HOLDER 0.65
5284 PHILIPS G8 100K TUN P/SET 0.84
29/7 PHILIPS G8 10K COLOUR CTRL 0.98
4525 PHILIPS G8 10K CON POT (550) 0.87
4524 PHILIPS G8 15R CON POT (550) 1.07
2975 PHILIPS G8 2K2 BRIGHT CONTL 2.11
4526 PHILIPS G8 2H A1 POT (550) 3.80
4522 PHILIPS G8 5N1 1500V CAP. 1.88
4523 PHILIPS G8 5R CONV POT (550) 0.64
4858 PHILIPS G8 6×4" 7OR SPKR 5.98
2979 PHILIPS G8 EQUALIS. COIL 3.05
4503 PHILIPS G8 METAL SH 1.72
2978 PHILIPS G8 RED/GRW SYM COIL 4.63
4504 PHILIPS G8/G11 NON REM SH 1.72
5307 PHILIPS K12 THICK FILM UNIT 14.25
4649 PHILIPS KT3 4X4 SPEAKER 2.85
4566 PHILIPS KT3 MAINS SWITCH 8.60
4907 PHILIPS KT4 THICK FILM UNIT 10.29
4564 PHILIPS T173 MAINS SWITCH 3.45
4648 PHILIPS G11 6X4 SPEAKER 3.85
2992 PYE 169 LINE OSC COIL 3.45
4839 PYE 731 3R3 50W RESISTOR 1.98
4535 PYE 731 47K VOL. SWITCH 3.11
2992 PYE 731 FOCUS UNIT 3.45
5545 PYE 731 L/H 3X 100K PSET 3.20
5546 PYE 731 R/H 3X 100K PSET 3.20
2994 PYE 731 THICK FILM ASSY 1.55
4938 PYE KT2 FOCUS UNIT 2.85
4864 PYE T194/6 SPEAKER 5.05
5556 PHILIPS G11 SHORT SHAFT SH 2.01

THORN VIDEO SPARES (OVER 450 PARTS)
QUOTE THORN PART NUMBER IF POSSIBLE
5561 T3292 BOOSTER 44.62
5562 T3292 CAPSTAN BELT 3.48
5563 T3292 CAPSTAN MOTOR 51.16
5568 T3292 CASSETTE LAMP 1.80
5569 T3292 COUNTER BELT1 0.60
5571 T3292 COUNTER BELT2 0.60
5575 T3292 ORUM MOTOR 47.70
5577 T3292 F/F IOLER 2.02
5582 T3292 GUIDE ROLL. ASSY 11.40
5585 T3292 LOWER DRUM ASY 80.48
5587 T3292 PINCH ROLL. ASSY 9.84
5591 T3292 REWIND IDLER ASSY 7.04
5592 T3292 REWIND RUBBER TYRE 0.60
5621 T3292 UNLOADING BELT 0.78
5622 T3292 UNLDADING IDL. ASSY 6.43
5624 T3292 UPP/DRUM KIT+MOD 35.94
5629 T3V00 CAPS. MOTOR BELT 0.60
5635 T3V00 COUNTER BELT 1 0.60
5637 T3V00 DRUM MOTOR 49.39
5646 T3V00 PINCH ROLLER ASSY. 7.31
5648 T3V00 RECORDING LAMP 2.34
5650 T3V00 SERVICE MANUAL 17.57
5655 T3V00 T/U IDLER ASSY 6.33
5657 T3V00 UPPER DRUM+MDO KIT 35.94
5663 T3V16 PINCH ROLLER ASSY 7.31
5666 T3V00 CAPSTAN MOTOR 51.16
5688 T3V00 TENSION BAND 2.16
5689 T3V00 TIMING GEAR 4.12
5692 T3V00 UNLOADING IDLER ASSY 6.43
5710 T3V01 TENSION BAND 2.16
5716 T3V16 CAPSTAN BENT 3.85
5720 T3V16 CASSETTE LAMP 1.80
5721 T3V16 CHANGE GEAR 0.86
5726 T3V16 DIODE STACK 3.41
5727 T3V16 DRIVE ARM ASSY 4.50
5750 T3V16 SERVICE MANUAL 26.24
5758 T3V16 T/U IDLER ASSY 6.25
5759 T3V16 T/U IDLER ASSY (LA) 8.95
5765 T3V16 UNLOAOING IDLER 6.43
5772 T3V22 CAPSTAN MOTOR 51.16
5773 T3V22 CAPSTAN MOTOR BAND 0.60
5774 T3V22 CAPSTAN BELT 3.86
5790 T3V22 F/F IDLER 1.74
5803 T3V22 GUIDE ROLLER ASSY 8.39
5807 T3V22 MICRO SWITCH 4.25
5809 T3V22 PINCH ROLLER ASSY 7.31
5814 T3V22 REWIND IDLER ASSY 7.04
5822 T3V22 SUPP SPOOL CARRIER 4.00
5824 T3V22 TAKE UP IDLER SMALL 6.25
5825 T3V22 TAKE UP IDLER LARGE 8.95
5828 T3V22 TENSION BAND 2.16
5834 T3V22 UPPER DRUM ASSY 35.94
5840 T3V23 BOOSTER 24.71
5844 T3V23 CAPSTAN MOTOR 55.83
5852 T3V23 CONNECT GEAR ASSY 6.56
5856 T3V23 GUIDE ROLLER TYRE 0.60
5862 T3V23 PINCH ROLLER ARM AS 4.10
5868 T3V23 REEL IDLER ASSY 2.87
5869 T3V23 REEL MOTOR ASSY 32.81
5879 T3V23 T/U REEL DISK ASSY 5.17
5880 T3V23 TAKE UP REEL ASSY 2.58
5882 T3V23 UPPER ORUM ASSY 35.94
5885 T3V23 WORM GEAR SPINDLE 5.95
5886 T3V23 WORM GEAR SPROCKET 1.63
5888 T3V24 BRAKE SHOE 0.60
5896 T3V24 CASSETTE LAMP 1.80
5899 T3V24 DEW SENSOR ASSY 9.05
5902 T3V24 F/ERASE HEAD ASSY 10.41
5908 T3V24 LOADING GEAR ASSY 28.91
5909 T3V24 LOADING MOTOR 10.25
5912 T3V24 PINCH RLR LVR ASSY 0.62
5920 T3V24 SERVICE MANUAL 28.50
5945 T3V29/30 BOOSTER 24.71
5946 T3V29/30 BRAKE SHOE 0.67
5951 T3V29/30 CAPSTAN BELT 1.95
5952 T3V29/30 CAPSTAN MOTOR ASSY 27.32
5957 T3V29/30 CASSETTE LAMP 1.65
5962 T3V29/30 EJECT LCK ARM 0.60
5974 T3V29/30 LOADING MOTOR 10.25
5976 T3V29/30 LOHR DRUM ASSY 78.72
5980 T3V29/30 PINCH RLLR ASSY 8.66
5981 T3V29/30 PINCH RLLR SLND 19.50
5985 T3V29/30 REEL MTR ASSY 34.66
5990 T3V29 SERVICE MANUAL 25.85
5991 T3V30 SERVICE MANUAL 15.75
5998 T3V29/30 TAKE UP CLUTCH 0.60
5999 T3V29/30 T/U CLUTCH ASSY 2.75
6001 T3V29/30 T/U LDG RING ASSY 2.73
6003 T3V29/30 T/U SPL IDLER 2.60
6012 T3V31 BOOSTER 32.37
6016 T3V31 CAPSTAN BELT 1.95
6017 T3V31 CASSETTE LAMP 1.71
6027 T3V31 LOADING GEAR ASSY 6.60
6028 T3V31 LONG TRIMMING TOOL 0.93
6030 T3V31 PINCH ROLLER ASSY 8.66
6033 T3V31 SERVICE MANUAL 27.31
6034 T3V31 SERVO TEST JIG 49.94
6038 T3V31 TAKE UP CLUTCH ASSY 2.75
6039 T3V31 T/U LOAD/RING ASSY 2.73
6042 T3V31 UPPER ORUM ASSY 35.94
6044 T3V32 BOOSTER 32.37
6048 T3V32 CAPSTAN BELT 1.95
6053 T3V32 CASS MOTOR ASSY 9.45
6066 T3V32 LOADING GEAR ASSY 6.60
6068 T3V32 PINCH ROLLER ASSY 8.66
6071 T3V32 SERVICE MANUAL 18.50
6072 T3V32 SUPP/LDG RING ASSY 2.58
6081 T3V32 UPPER DRUM ASSY 35.94
6085 T3V35/6 BRAKE PAD X2 0.67
6086 T3V35/6 BRAKE SHOE 0.67
6087 T3V35/6 BRUSH ASSY 2.07
6090 T3V35/6 CAPSTAN MOTOR 23.91
6091 T3V35/6 CASSETTE MOTOR 8.10
6103 T3V35/6 PINCH ROLLER 9.84
6105 T3V35 REMOTE CONTROL 19.43
6107 T3V35/6 SERVICE MANUAL 27.00
6117 T3V35/6 TENSION BRAKE 0.60
6118 T3V35/6 UPPER DRUM ASSY 35.94
6119 T3V40 SERVICE MANUAL 15.00
6158 T3V29/30 UPPER ORM ASSY 35.94

SONY VIDEO
6133 SONY 8000UB FORWARD BELT 1.20
6136 SONY C6UB THREADING BELT 1.20
6138 SONY C6UB CAPSTAN BELT 1.77
6145 SONY C7UB BRAKE ASSEMBLY 1.77
6150 SONY C5UB CAPSTAN MOTOR 38.75
6152 SONY C6UB MK2 REEL MTR 23.00
6154 SONY C7 DC MTR (BHF/1100) 38.75
6155 SONY C7UB REMOTE CONTROL 43.75
6156 SONY C5UB REMOTE CONTROL 20.63
6157 SONY C6UB REMOTE CONTROL 18.13
4953 SONY C5/7 REWIND KIT 5.40
4954 SONY C6 REWIND KIT 5.40
4948 SONY SL-7/SL-T7 BELT KIT 4.00
4944 SDNY SLC7/SLJ7 BELT KIT 5.50
4949 SONY SLT 9ME/J9 BELT KIT 4.50

GEC
6173 V4000H UPPER CYLINDER 40.50
6174 V4000H RELAY 3.30
6175 V4000H PINCH ROLLER 6.81
6178 V4000H CAPSTAN MOTOR 38.78
6181 V4000H TAPE SENSOR LAMP 0.79
6185 V4001H PINCH ROLLER 5.81
6192 V4002H UPPER CYLINDER 40.50
6204 V4004 CLUTCH ASSY 11.18
6212 V4100 AUOIO CONTROL 28.13
6253 V4000H SERVICE MANUAL 10.50
6254 V4001H SERVICE MANUAL 8.31
6255 V4002H SERVICE MANUAL 11.08
6256 V4004 SERVICE MANUAL 11.50
6257 V4100 SERVICE MANUAL 8.31

HITACHI VIDEO SPARES
6214 8000 UPPER CYLINDER 38.99
6218 8000 AUDIO CONTROL 23.85
6220 8000 F/FWD REWIND ASSY 0.69
6224 9300E RELAY 3.30
6230 9300E TAPE SENSOR LAMP 0.95
6231 9300E TUNER 18.21
6240 VT33E UPPER CYLINOER 38.99
6244 VT33E CAPSTAN MOTOR 27.72
6249 VT11E F/FWD REWIND ARM 4.85
6252 VT11E CAPSTAN MOTOR 23.63

VIDEO HEADS
SEE FULL LIST FOR COMPARISON CHART
6258 BETA – A VIDEO HEAO 40.50
6259 BETA – B VIDEO HEAD 40.50
6265 VHS – A VIDEO HEAD 33.50
6266 VHS – A VIDEO HEAD 32.50
6274 PHILIPS H1500 VIDEO HEAD 50.95
6275 PHILIPS H1700/2 VIDEO HEAD 57.95
6276 PHILIPS 2020/2 VIDEO HEAD 57.95
6277 PHILIPS 2030 VIDEO HEAD 53.98

GENERAL SPARES
4999 ANTEX BIT 1/8" DIAMETER 1.45
5000 ANTEX BIT 3/16" DIAMETER 1.45
4452 ATTENUATOR 12DB 1.37
4469 ATTENUATOR 18DB 1.37
4451 ATTENUATOR 6DB 1.38
5419 COLOUR CRYSTAL 8.86MHz 0.60
4659 HEAT SINK COMPOUND 1.08
5001 QUICK TEST MAINS CONN 9.30
4700 SERVISOL FOAM CLEANER 1.05
4453 SERVISOL FREEZE-IT 1.15
4724 SERVISOL SW CLEANER 0.98
4516 SERVISOL VIDEO HEAD CLEANER 0.95
4976 SOLDER 0.5 KILO REEL 8.60
4466 SUPER WICK 2MMX1.6M 0.95
4970 TV LOOP AERIAL 0.55
4998 WELLER INST. HEAT GUN TIP 0.62

PLEASE ADD £1.25 POST & HANDLING THEN 15% VAT TO TOTAL.

QUICK SAVE TV SPARES
THE COACH HOUSE, MUXTON LANE, TELFORD, SALOP

FULL LIST OF OVER 3000 ITEMS SENT WITH ORDER OR SEND 9" × 4" SAE. PLEASE USE STOCK NUMBER WHEN ORDERING, OR USE SET MAKER'S PART NUMBER. ACCESS AND VISA ACCEPTED. OFFICIAL ORDERS FROM GOVERNMENT OR SCHOOLS WELCOMED. ALL GOODS ARE STOCK ITEMS.

TELEVISION

Broadcasting Options

At the time of writing this, official publication of the report from the Peacock committee, set up by the previous Home Secretary to consider the future financing of broadcasting in the UK, is still a couple of days off. Not very helpful timing for us! There has nevertheless been a lot more leaking of the committee's conclusions. The report has been under consideration by a Cabinet subcommittee and it appears that disagreement amongst ministers has been the basis of the considerable press coverage that has appeared recently.

It seems that the report could instigate quite a lively public debate. In fact this could possibly be its main aim – to stir up discussion and see what comes of this, whether or not specific recommendations made in the report are adopted. Strong words have already appeared in the press. According to the *Financial Times*, the present Home Secretary feels that "the committee did not appear to have understood the nature of public service broadcasting, had gone beyond its brief and had produced a mixture of incompatible proposals that would offer very little obvious benefit to the public". He has been asked to prepare a more diplomatic statement for the House of Commons.

What lies behind this dissension? As far as TV broadcasting is concerned the Peacock committee's views seem to envisage a three-phase development during the period up to the end of the century. In the first phase the BBC would be left to continue as at present, with its income tied to changes in the cost of living. ITV franchises would be put up for auction when they lapse. The second phase would see a strong move towards subscription services, with scrambled transmissions. It's emphasized that changes during this phase would depend on technological developments. Phase three would see a move towards consumer purchase of the individual programmes he wishes to view, a computerised credit card system being used for this purpose. While the Peacock committee makes definite recommendations for phase one it seems that its proposals for phases two and three are to be taken more as "possibilities which the government might care to consider".

Going beyond its brief? Well, the committee was originally set up, in early 1985, to consider the future financing of the BBC. It seems to have come to the conclusion along the line that it should broaden its terms to take an overall look at all forms of broadcasting. This is no bad thing in itself. There was a strong feeling when the committee was set up that its main purpose would be to commercialise the BBC. In the event it decided to take a much broader view – and to recommend shelving the idea of advertising on BBC during phase one.

Phases two and three would depend on the technology available. Scrambling and signal decoding are nothing new, but the idea of computerised programme selection is. Whether this would have to rely on cable distribution or whether enabling signals could be transmitted to a receiver/decoder in the set is not clear. It looks as if we shall have to wait to see what's technically feasible.

The Peacock committee included members with strong "free-market" views, i.e. that things – in this case programmes – should be paid for separately by the consumer. There's been a move in this direction in many fields, for example the provision of pensions and health care and the privatisation of services such as the supply of water and gas. The question here is whether broadcasting is in some fundamental way different. Some members of the committee seem to have felt that the public should purchase programmes in the same way that it buys newspapers, books, cassettes and so on. There is certainly some logic in this, but while a wide range of newspapers, cassettes, etc. can be made available to the public with broadcasting we come up against the limited number of channels available. Given this limitation, the emphasis has to be on "public service" – making the best use of the available broadcasting time to provide the public with a balanced supply of programmes giving reasonable choice.

This of course is a difficult problem that can lead to some unpleasant conclusions. What is balanced programming and who is to decide? The reason that the BBC lost its original monopoly was to some extent public feeling that the BBC took an unduly paternalistic view of what the public should be offered. Competition altered that. But would marketing of individual programmes change things for the better? Suck it and see seems to be the only possible answer, but the problem with this is that you jeopardise existing arrangements that by and large work perfectly well.

This brings us to the problem of whether the public is being well served. AGB Cable and Viewdata recently carried out, on behalf of Tyne Tees Television's Nightline programme, some research on public opinion in this field. It found that 45 per cent of all adults polled felt that the quality of TV had declined over the past five years – the percentage rose to 48 per cent of adults aged 35 and over. When asked whether television overall provides the programme mix viewers want 48 per cent answered no while 44 per cent answered yes. Amongst those aged under 35 59 per cent considered the mix to be wrong. The results were admittedly based on only a small sample – 555 adults – though the sample was weighted by age, sex and housing tenure to correspond with general UK census data. The findings should nevertheless leave broadcasters with an uneasy feeling.

Whether radical changes in the way that TV programmes are disseminated would end up by giving the public a better service is impossible to know. The safe policy seems to be to make the best of the institutions we already have, adapting them as the technology advances. One thing's for sure; the debate will go on!

EDITOR
John A. Reddihough

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TV BRANDS
Many thanks to readers who provided spares/data information on Tensai and Winthronics sets – see note in Teletopics (page 642). Can anyone help with information on Intel colour receivers? These sets seem to have been distributed mainly in N. Ireland.

COVER PHOTO
Not much explanation required this month – tuning in to satellite TV! See article on page 636.

Letters

TEST CARDS PLEASE

After reading the comments from Keith Lane (June) I wholeheartedly agree about the absence of test cards on our television network. Test Card F is the ideal test pattern for setting up a television receiver, not only for the more technically minded but for general purposes, i.e. line and field linearity, height, width etc. Also, I think most engineers will agree that the colours in the centre circle have become so well known that most of us can set the grey-scale, colour etc by eye with very good results – provided that tube emission is all right.

For early birds Test Card F is transmitted on BBC-2 between 8·30 and 9 a.m. I've recorded an HG three-hour VHS tape in half-hour sessions, putting on my own sound. It produces very good results despite two and a half years' use eight hours a day in the workshop. But of course it's not as good as an off-air Test Card F. So how about it BBC and ITV: let's have Test Card F on one channel where it can do us engineers proud. After all, we do have the best television service in the world, so let's keep our receivers giving optimum performance.

P.G.A. Crockett (thirty years' service),
D. Clarke – Radio and Television,
Hemel Hempstead, Herts.

TIFAX TELETEXT DECODERS

In view of recent letters in *Television* concerning the Tifax teletext decoder the following information may be helpful to your readers. The first joint BBC/IBA/BREMA teletext specification was issued in October 1974. Minor changes were added in January 1976. Certain control codes however were left undefined until September 1976, when the final teletext specification as used by broadcasters today was published.

The Texas Tifax XM11 decoder was the first to use custom LSI chips and was introduced before the final specification. It therefore lacks the features which at that time were undefined (double height, separated graphics, graphics hold, background colour) although a later version (XM11/DH) did offer double height.

There's another problem with the XM11 however, and this could be causing some of the effects described by your readers. It concerns row address decoding and arose following a refinement in the teletext specification introduced between 1974 and 1976. The manufacturer was aware of this and the XM11 was soon replaced by the XM12 mentioned by Mr. Sears. However only prototype quantities of this decoder were made before Texas withdrew from the market.

Each teletext TV line contains a 5-bit row address which can be of any value from zero to 31. Zero to 23 directly correspond with the 24 rows of text display. The range 24-31 was reserved for other uses, many of which have now been defined. Receivers offering additional features (e.g. page linking) provided by these should be available later this year.

Both 1976 specifications stated that decoders should ignore row addresses 24-31, but when confronted by one of these an XM11 ignores both that line and the following data line containing data intended for display. The effect is to miss out a row of text and either leave it blank or continue to display text left behind from another page. The chances are that this will be filled in next time round in the transmission sequence, providing it's not part of a rotating page set.

Since February 1982 the BBC has been transmitting occasional row numbers above 23 to assist with the development of the next generation of decoders. In September 1985 one teletext line per field blanking interval on BBC-2 was dedicated to Datacast, an experimental data service which also uses these row addresses. The remaining teletext lines (four initially, now five) carry the normal BBC-2 Cefax service. Unfortunately this has highlighted the row decoding fault, causing the effect described by Mr. Cummins, i.e. every fifth line of any BBC-2 Cefax is missed by the XM11.

The fact that these decoders are obsolete and that the problem is caused by them not precisely meeting the agreed specification is of no consolation to viewers still using them, especially as they gave satisfactory service initially. In view of this the BBC ran an experiment to try to establish how many XM11s are still in use. In late 1985 a message normally visible only with XM11 decoders was transmitted on the index page, asking viewers to call a telephone number. The response to this was so small that we came to the conclusion very few XM11s could still be in use. Those that are probably tend to be owned by television enthusiasts.

M.J. Winston, Senior Planning Engineer,
Planning and Installation Department, Television,
British Broadcasting Corporation.

Editorial note: Mr. G. Beard, who started this correspondence off, comments as follows: The index page referred to in Mr. Winston's letter could have been page 100 or the alphabetical index page, which in either case would be missed by numerous viewers as the XM11 doesn't initialise on page 100 and most viewers go straight to pages of their choice. Readers using XM11 decoders might like to notify the magazine: if the number of letters received is sufficient details could be forwarded to the BBC.

AMSTRAD CTV1400

Further to the note on the Amstrad CTV1400 (TV Fault Finding, June) the following may be of interest to readers. An apparently dead set with an audible whistle coming from the chopper transformer should direct attention to the soldered joints around the line driver transformer. Even when they appear to be good this has been the cause of the problem on a number of these sets.

D.G. Hopwood,
Worsley, Manchester.

VHF/UHF SOUND RECEIVER

I've received several letters from readers asking about my v.h.f./u.h.f. sound receiver (May issue). The 40673 dual-gate MOSFET mixer transistor, about which some readers enquired, is available from Maplin Electronics and East Cornwall Components. Cirkit have a similar device which is somewhat cheaper, type 3SK81.

For L3 a Maplin former type 722/8 (order no. LB21X) can be used with screening can type 15 (LB39N) and cores type 4 (LB41U). Ten turns instead of 13 will probably give the correct tuning range but I'd suggest using two 22pF film dielectric trimmers instead of the 10pF mica capacitors. An alternative circuit using prewound coils

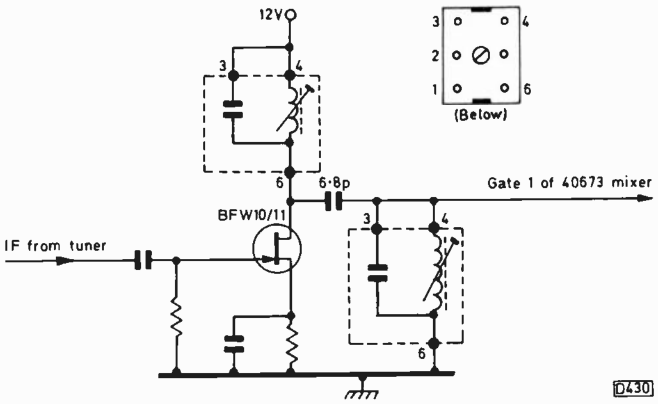

Fig. 1: Alternative circuit using prewound coils.

type TKXCA34732CON (Cirkit type 35-47320) is shown in Fig. 1. I've not tried this in the original receiver though it works in an alternative set-up I've built.
Paul Barton,
Harrogate, Yorks.

SOUTH AFRICAN VIEW

I am with your correspondent Keith Lane (June) on the matter of the failure of the BBC to broadcast test cards, having been one of these engineers who lobbied the BBC many years ago to change the early test card when its frequency charts were becoming outdated by the arrival of the 625-line services. Here in South Africa the SABC broadcasts a test pattern on TV2 during all non-programme hours: on TV3 there are teletext samples for 45 minutes in the hour and a test card during the other fifteen minutes. There are sometimes colour bars before each programme start.

The new M Net commercial, privately-owned service has started test transmissions here on channel 39, much to the annoyance of many viewers who are losing their reception of Bop TV on ch. 37 due to interference – at the moment there's a market for notch filters to help. The SABC have always been against us whites receiving Bop TV and have made it diffucult for us here in the Reef area to get more than a few microvolts – to this end they erected large side screens to prevent overspill into the suburbs of Johannesburg. The M Net system is owned by a consortium of local newspapers and will be a rental service – about R200 for a decoder plus approximately R30 per month to receive the station. About five hours of transmissions a day are planned and up-to-date movies are expected. The present service is TV1 alternately English/Africaans, TV2/3 vernacular – English mainly but some Africaans each night from 9·30 p.m. to midnight or thereabouts.

To return to the subject of test cards, if the SABC can do it with such a small population surely the BBC/IBA could manage some transmissions?
Leonard E. King,
Kempton Park, Transvaal, RSA.

FUSE PROBLEM

Here's a fault that had me running around in circles on a Grundig set fitted with the GSC100 chassis. The symptoms were lack of height with non-linearity at the top of the picture. My reaction was that the supply to the TDA1170 field timebase chip was low, and sure enough a check on the +D line revealed that it was at 15V instead of 18V. The supply is derived from the line output transformer but a thorough check on the rectifier and filter components failed to reveal anything amiss while the pulse input was correct. Changing the TDA1170 had no effect.

In desperation I changed the fuse in this supply, Si627 (1A anti-surge) – with immediate success. A check on its resistance produced a reading of 1Ω compared to 0·2/0·3Ω for a good fuse. Placed as it is between the cathode of the rectifier and the reservoir capacitor C628 this small resistance had a devastating effect on the +D supply. Maybe I was slow in diagnosing this fault but one does get used to thinking of an operational fuse as a short-circuit, which an anti-surge type certainly isn't.
L.P. Watkinson, Telesonic Services,
Holsworthy, Devon.

GRUNDIG CUC SERIES

I was interested in the article on the Grundig CUC series chassis (July). Here are a couple of faults I've come across on a number of occasions on these sets: (1) Distorted sound with the CUC220 and CUC720 – when the station is detuned the sound will come in perfectly but the picture will be distorted. The cause is the TDA120T intercarrier sound chip in the tuner/i.f. module. (2) Excessive width with the CUC720 chassis, the width control having no effect and the voltages around the BC875 diode modulator driver transistor T576 being low. The cause is modulator diode D572 (SKE4G2/06) being short-circuit.
George Farrueia,
M'xlokk, Malta.

NORDMENDE F10/F11 CHASSIS

A printing error occurred in my article on the NordMende F10/F11 chassis (June). In the caption to Fig. 3 it mentioned that RF12 is 3·3Ω in the F11 chassis whereas it's normally 2·7MΩ or on occasion 3MΩ. Since compiling the list of common faults one more has appeared in recent months – set dead due to failure of the mains fuse FP01 caused by the degaussing thermistor going short-circuit. This would appear to be due to a faulty batch of thermistors that fail after a few months' service.
Christopher Holland,
Dundalk, Co. Louth.

Editorial note: The error was our fault – we meant RF21 which is in series with the field scan coils. Our apologies.

COSSOR CDU150 OSCILLOSCOPE

Readers may be interested in the following modifications to the Cossor CDU150 oscilloscope. These twin-channel oscilloscopes have been sold on the surplus market for about £170. They are all solid-state and feature delayed timebases, a quoted bandwidth to 35MHz with observable signals at over 100MHz, and many features. They are also small and light despite the six inch screen. The rugged, military style construction should protect them against rough handling in the workshop or in the field.

My scope failed due to a flashover between the p.d.a. multiplier and the e.h.t. and blanking board. Remove the rear cover to locate these. I fitted an aluminium guard between them to prevent a recurrence.

I noticed that the c.r.t.'s heater glowed brightly at switch on before reaching an even temperature. Fearing that this could eventually lead to filament failure and costly c.r.t. replacement I have installed a slow-start circuit for the heater to eliminate the fault. It's built on an aluminium panel fixed to the tube base – the whole circuit floats at about the tube base potential. Fig. 2 shows the circuit. Power is obtained by using a bridge rectifier to rectify the heater voltage. At switch on the 3·3Ω resistor R3 is in series with the tube's heater. The 470μF electrolytic C2 charges slowly via R1, eventually switching on Tr1 to operate the relay and short out R3. Tr1 can be a BC384L or similar npn transistor. R3 needs to be a wirewound type. The relay is an STC type 4184GC.

This arrangement could be used for any c.r.t. heater or lamp that might be damaged by a switch on surge. Once the relay has closed the tube will receive the same heater current as in an unmodified unit. The only change will be the additional power dissipation in the 170Ω relay coil. With a 6·3V heater this will be under 0·5W, even allowing for rectification and smoothing.

This has little to do with oscilloscopes, but I've found a good way of stopping cables pulling out of 13A plugtops. With appliances such as garden tools the cable often slips out of the plug leaving only the insulated wires. To prevent this happening, put a blob of thermosetting glue on the cable inside the plug, past the clamp.

John de Rivaz, B.Sc (Eng.),
Porthtowan, Cornwall.

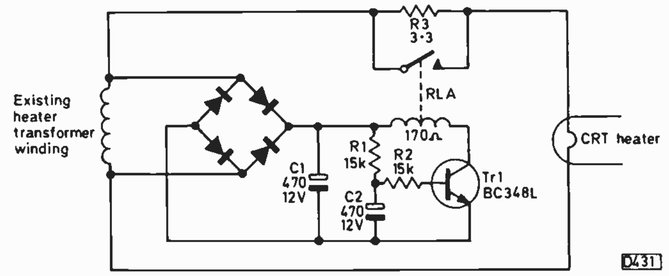

Fig. 2: Slow-start c.r.t. heater circuit.

Single-channel Indoor Aerial

Ivor Nathan

A distant signal can often be received in only a quite closely-defined position: moving the receiving aerial by a few feet in either the vertical or horizontal plane may cause complete loss of signal. At my location in Southgate, North London even reception of the four local channels can be a problem because of the hilly nature of the surrounding district. I've nevertheless found it possible to receive alternative signals by using a separate indoor aerial and aerial amplifier.

I started experimenting using a commercial indoor log-periodic aerial and amplifier. This established that reception of TVS (Television South) on ch. 42 was feasible, providing a choice of extra programmes when they differed from the London ITV ones. The aerial was placed in various positions about the room. For a noise-free signal the best position was found to be three and a half feet above the floor, surprisingly not very near to a south-facing window – and with nothing of the correct height to rest the aerial upon. This prompted me to build the aerial and its floor-stand described in the present article: see Fig. 1, right.

The base of the stand can be made of plastic or wood: it needs to be heavy to ensure stability. The aerial itself consists of a half-wave dipole, reflector and director – all made of heavy-guage wire – on a boom, and an extra horizontal reflector made of domestic aluminium foil sheet. The height of the stand and the mounting position for the aerial depend on the locally available signal(s): trial and error with an existing indoor aerial is the only way to check on this, with an aerial amplifier if need be. The aerial element dimensions shown in Fig. 1 are calculated for ch. 42: if you wish to receive a different channel optimum results will be achieved only by recalculating the dimensions for the appropriate half-wave dipole and its associated elements and their spacings.

The dipole is assembled on a four-screw plastic terminal block: the connections to the low-loss coaxial feeder can be made as shown. Tape the feeder to the stand – the feeder should be long enough to enable the assembly to be placed anywhere in the room. The director and reflector are similarly assembled on four-screw plastic blocks. The extra reflector, which is mounted on an arm below the main array, provides a surprising degree of extra gain. It consists of a rectangular sheet of aluminium foil pasted on a piece of stout card.

It's best for the floor-stand support components to be of square or rectangular section rather than circular so that they can easily be joined together and so that the plastic terminal blocks and the foil reflector can readily be fitted to the supporting arms.

If an aerial amplifier is already in use it's a simple matter to change aerials at the amplifier input when using the newly constructed aerial instead of the existing local-channel installation. Regardless of whether an aerial amplifier is in use some readers may prefer to add a changeover switching system.

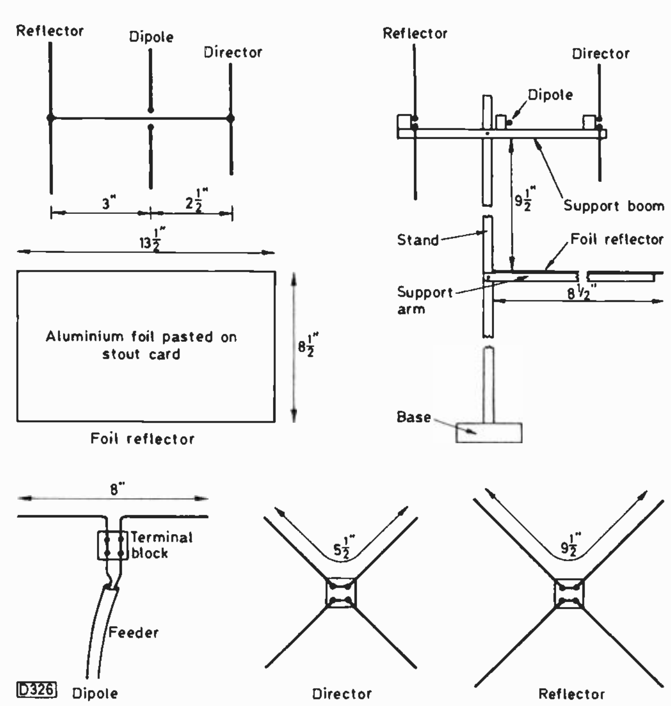

Fig. 1: Details of the aerial.

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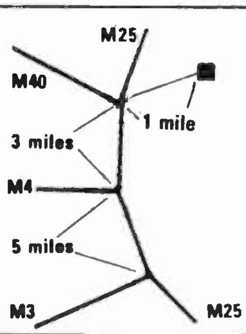

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Thanks Denis

Les Lawry-Johns

Some months back (January) I mentioned a Network colour portable – Model NW1414, fitted with the Grundig GSC100 chassis. The original fault was that the fusible resistor R607 in the start-up circuit would go open-circuit for no apparent reason. Resoldering it restored normal operation, and despite my suspicions nothing showed up during a prolonged soak test. Network's service manager Denis Mott subsequently got in touch and provided some tips. He drew my attention to his article in the September 1984 issue of *Television* and said that the set would come back to me. Well it did, after some months though.

This time I followed Denis's suggestions and also checked a number of other things. No fault could be found. I eventually resoldered R607 and everything was lovely for a day and a half. Then it pinged again and we started replacing components en bloc. The result of this was that the set refused to come on at all when R607 was resoldered. My language was deplorable and Zeb went away and hung his head. Spock jumped up on to the highest shelf in the shop. Honey Bunch was out so she didn't have to hear it. Suddenly I stopped swearing. This is what we'd wanted in the first place, a fault that was there all the time. Unless I'd put it there when replacing various resistors and transistors. Supposing one had been defective? But I'd tested them all before fitting, as I always do. So I put this thought out of my mind and started a general check.

The line output thyristor, which had checked all right during previous tests, was now open-circuit between its gate and cathode. It should record about 30Ω one way and about 200Ω the other, with no reading between the anode and the other two electrodes when disconnected. Now it showed no reading at all. It was speedily replaced: the set worked for the rest of the day and the week that followed.

The Blind Comes Up

A chap staggered in carrying a 26in. Ferguson set fitted with the TX10 chassis. He explained that after about an hour's use a blind came up from the bottom, leaving just a few inches of picture at the top with the rest of the screen blacked out. I'd never heard of this one before.

I let the set run for some time, not really expecting anything to happen as the shop is a lot cooler than the customer's home. Then I removed the back cover and brought the hairdryer into action. I directed hot air at the field output transistors and the surrounding components. When I lingered on the TDA1044 chip the bottom of the screen blacked out and the blind rose until only the top few inches of picture remained. I grabbed the freezer but with the heat off the blind came down again and a normal picture was displayed. Again I heated the chip and again the blind rose, only this time I was ready with the freezer and the blind came down as soon as the chip was cooled. I didn't have a TDA1044 in stock so I looked under it to see what the ventilation was like. As there wasn't any near the chip I drilled a hole to let in some air. I explained to the chap what I'd done and mentioned that the TDA1044 would be here when the blind came up again – if it does come up again.

The Bush BC6004

Shortly after our second encounter with the Network set a Bush BC6004 colour portable came in. Another German chassis, this time manufactured by Saba. The customer's complaint was that it would be fine for an hour then shut off! It's the set with the small enclosed unit at the top right containing the line output transistor (BU208), line driver transformer etc. I changed the BU208 and the set worked fine for the best part of an hour. Then it shut down again.

I tapped the BU208 with the handle of a screwdriver, more out of frustration than anything else. The set then started up and shut down after an hour. This time I moved the line output stage housing cautiously and the set started up again. So I took the housing out of its socket, having removed the two screws, and carefully resoldered all the input joints – though none looked suspicious. I then touched up any other joints that looked the slightest bit shaky and refitted the unit. It played away for the rest of the day and as far as I know it's still playing away quite happily. I wish I was.

GEC C1404H Series

These 14 and 16in. portables are made by ITT in W. Germany, using the CVC1110/CVC1112 series chassis. They suffer from a common fault: a bright white screen, suggesting that the tube's cathodes have lost their bias. The RGB output transistors with their 12kΩ collector load resistors are mounted on the tube base panel. No voltage will be found on these resistors. The source of the 150V supply is the line output transformer: the series-connected rectifier diodes D504 and D505 are on the right side of the main panel. There's a small surge-limiter resistor in the feed from the transformer, R514 (1·5Ω). It looks very small and is intended to be, acting as it does as a fuse. It doesn't burn out for nothing. The cause could be leakage in the diodes or in the associated 10μF reservoir capacitor C506 or the 1μF smoothing capacitor C1002 on the tube base panel. Occasionally one of the three RGB output transistors may be at fault, but this doesn't happen very often. Then of course it may be the tube . . .

This and That

The editor must be taken to task for a couple of mistakes that got into my column in the June issue. First about my overcoat. I said it cost 37/6d made to measure, also that this works at one pound eighty seven and a half pence. In print it said one pound thirty seven and a half pence. I also said that we filled up with petrol on the A2 just a little way from home. This came out as the A3, which is a long way from home. Oh well, I suppose we can't all be perfect . . .

It amazes me what Honey Bunch gets given to her. Boxes of chocolates by the dozen (we don't eat chocolates but Zeb does, so does her aunt). Last Sunday lunchtime we were in Dave's for a drink and H.B. happened to mention that she hadn't had duck's eggs for years. Next day one was brought in. I haven't had (given to me) a bottle of whisky since Christmas, and I'm not likely to till next Christmas. It won't be long now however. This year has simply rocketed by.

Satellite TVRO Installation

Part 1

Harold Peters

It's one thing to get a dish up and working outside your own premises with all your colleagues to help, quite another to install a satellite TV receiving system on the patio of one of your best customers. At that time you're on your own and possibly beginning to wish you'd given more attention to all those *Television* articles that didn't seem relevant at the time. So if your company has recently decided to expand into satellite TV here's a recap of the things you ought to know and a bit of background information to tie it all together. Some specialist firms are now offering equipment at below the £1,000 mark: we'll assume that one such outfit has arrived and that you've been selected to get it going. Fig. 1 shows a typical satellite TV receiving system block diagram.

Commissioning the Receiver

Commissioning the receiver will be the part most familiar to you, so we'll tackle this first. Hopefully the manufacturer will have air tested it and left it tuned to a known channel – usually Music Box. If so you leave the tuning severely alone: your first problem has been overcome before you start!

Table 1 gives a list of the satellite TV stations currently available in the UK. Receivers generally have a baseband video output of 1V at 75Ω, with a separate audio output at around the 300mV level. A modulator is usually included to give a standard u.h.f. TV signal at around channel 36. Where this is missing but needed a VCR's auxiliary input does equally well.

An integral part of the receiver is the low-noise amplifier and down-converter mounted on the dish. This assembly is often referred to as a low-noise block (LNB). An 18V d.c. supply goes from the main receiver to the LNB via the same coaxial feeder that the i.f. signal from the converter comes down to the receiver. It's a good policy therefore not to disconnect the LNB with the receiver powered up.

A rough and ready test can be applied before aligning the dish. With the receiver on but the LNB disconnected you should see about the same order of noise (snow) as on a domestic set. Connect the LNB and the snow should increase perceptibly. Point the LNB at a warm patch of sunlit ground and there should be more snow still. An AVO 8 on the low-ohms range connected across a cold LNB input should give a typical diode reading: low one way, high the other.

The Dish

Assembly of the dish from its flatpack is simply a matter of following the leaflet enclosed. Make sure that the dish doesn't get distorted: store it flat, not on edge.

There are two kinds of mount: "Az-El" (azimuth/elevation) with simple vertical and horizontal adjustment of the dish, and "polar" which permits the dish to be tracked across the sky, following the Clarke Orbit, and stopped at any satellite of your choice. Both types should be bolted to a firm base. The connections to the LNB and the LNB/feedhorn junction should be sealed over with waterproof material.

With the dish roughly in position, take care when working at the focus: you may need sunglasses to counter the glare concentrated by the dish – and watch out for passing jets that may cross the beam (dishes concentrate sound as well as s.h.f.!).

Siting the Dish

The whole dish must have a clear sight of the satellite you want. Eutelsat 1 (originally known as ECS-1 and officially designated Eutelstat I-F1) is at 13°E of south while Intelsat VA F11 is at 27·5°W of south. Their elevations are roughly 29° and 24° respectively above the horizon. As a rough guide, the sun should fall on the chosen spot between 11 a.m. and 3 p.m. in November and February. For more precise surveying you can make up a

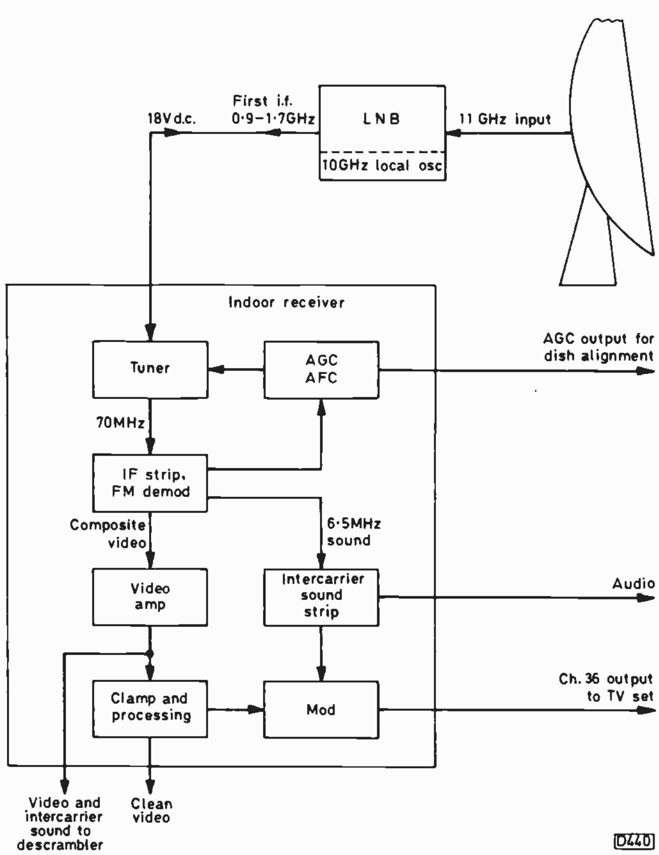


Fig. 1: Block diagram of a typical TVRO installation.

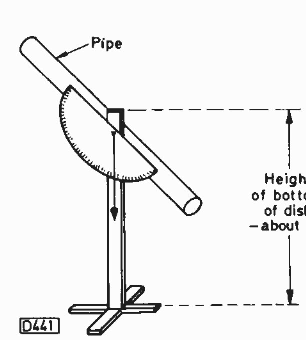


Fig. 2: A simple theodolite for site surveys. There's little point in making it taller than the dish bottom. Put the pipe at the satellite's elevation and set the azimuth with a compass. Look up the pipe and hope to see just the sky.

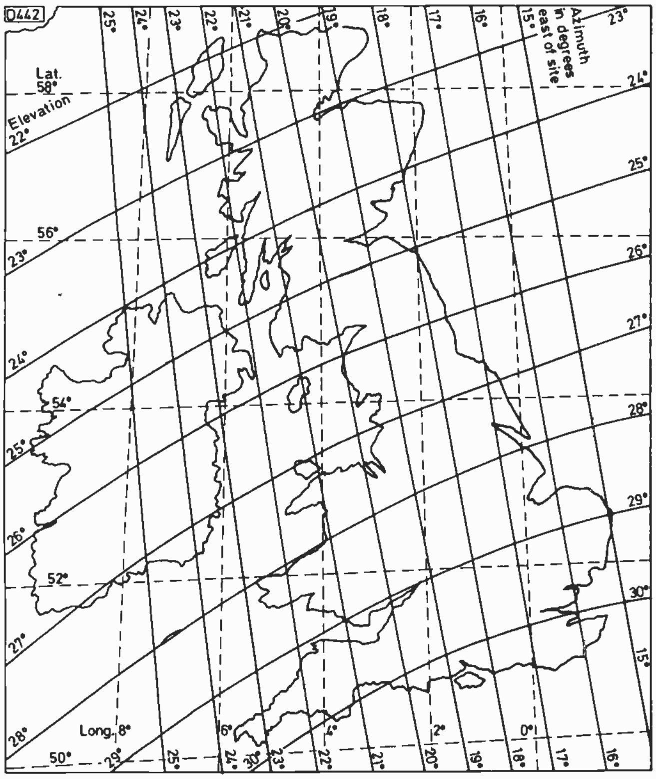


Fig. 3: Eutelsat 1 finder. Pinpoint your site on the map and interpolate dish elevation from the sloping horizontal lines and the azimuth east from your site from the vertical lines.

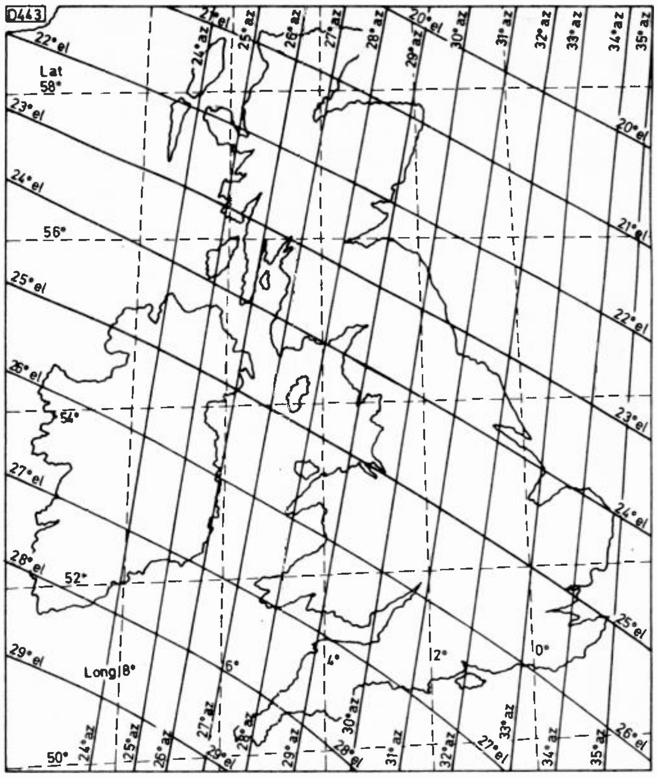


Fig. 4: Intelsat VA F11 finder. Pinpoint your site on the map and interpolate dish elevation from the sloping horizontal lines and the azimuth west from your site from the vertical lines.

simple theodolite as shown in Fig. 2. You'll be surprised how few domestic sites are suitable for mounting a 1·8m dish.

Finding due south is important, especially with a polar mount. You can use a compass, allowing for magnetic variation. True south is 7° to the right of magnetic south. The trouble with compasses is that unless they are used well away from the gear they always point to the dish or the van. The Pole Star is an accurate north, if you keep late hours, but there's nothing like the sun if it's available at the time.

Table 1: Station finding guide by frequency.

Frequency (GHz)	*Station/ polarisation*	*Satellite*
10·986	Teleclub/V	Eutelsat 1
11·005	RAI/H	Eutelsat 1
11·015	Premiere/Childrens/H	Intelsat VA F11
11·135	Screen Sport/H	Intelsat VA F11
11·138	Filmnet/V	Eutelsat 1
11·155	CNN/V	Intelsat VA F11
11·170	Europa/H	Eutelsat 1
11·471	TV5/H	Eutelsat 1
11·507	Sat-1/V	Eutelsat 1
11·650	Sky/H	Eutelsat 1
11·674	Music Box/V	Eutelsat 1
11·676	NRK/H	Eutelsat 2

Table 2: Solar transit times.

Times (GMT – add one hour for BST) when the Sun is due south.

Aberdeen	12·08	Douglas	12·18	Manchester	12·08
Belfast	12·24	Dublin	12·25	Newcastle	12·06
Birmingham	12·08	Glasgow	12·16	Norwich	11·54
Bristol	12·10	Leeds	12·05	Plymouth	12·16
Edinburgh	12·12	London	12·00	Swansea	12·16

Allow four minutes of time for every degree you are off the meridian. The sun is due south at 12 noon GMT (1 p.m. BST) at Greenwich, Cleethorpes and Newhaven but at Ipswich you plot at 11·56 a.m., at Portsmouth and Nottingham 12·04 p.m., at Birmingham and Manchester 12·08 p.m. and at Liverpool and Carlisle 12·12 p.m. Table 2 shows some more times. As a double check use an Ordnance Survey map: the popular series shows magnetic and grid variations at the edge of the sheet.

The hinge where the dish swivels on the mount should be pointed due south. This need be only approximately so with an Az-El mount. With the dish in position and everything connected up, point the dish at the required satellite, using the maps (Figs. 3 and 4) and a simple inclinometer (see Fig. 5) to get the elevation as nearly correct as you can. Set the azimuth with respect to south.

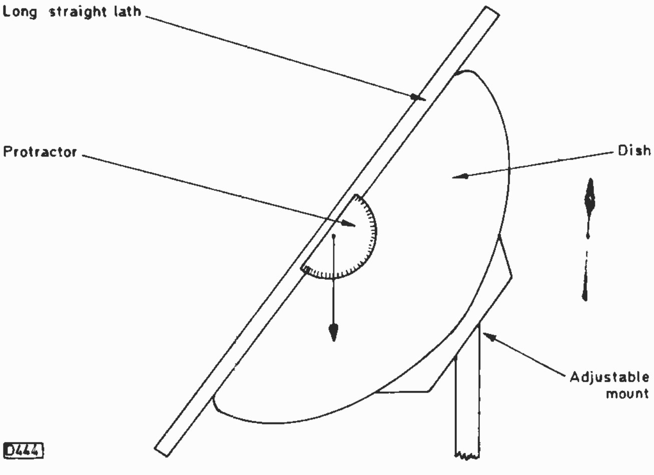


Fig. 5: A primitive inclinometer using a long straight lath and a protractor. Accurate enough at 4GHz and for dishes up to 1·8m at 11GHz.

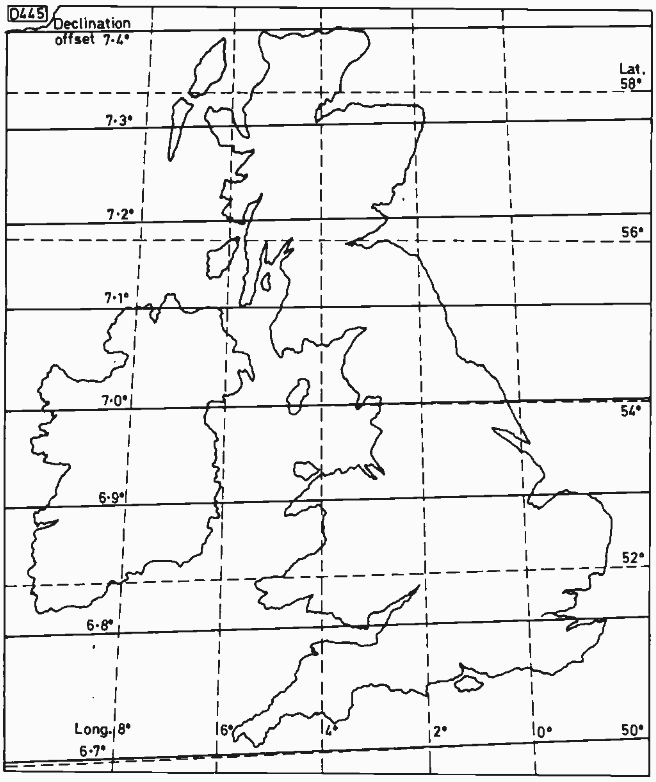


Fig. 6: Declination offset for polar mounts. Pinpoint your site on the map and read off to the nearest declination offset line.

You'll notice that the azimuth angle is always greater than the difference between the site longitude and the satellite longitude. For example Eutelsat 1 is at 13°E of south, Ipswich at 1°E of south, a difference of 12°. The azimuth setting however is 15°E of south. Why? Well the stated longitude of a satellite is that seen by an observer at the North Pole. The farther south you go the wider the azimuth angle becomes, until you reach the equator when you have only elevation to worry about.

Tuning in

Having done all the above according to the book, why do we still get nothing? With a 1·8m dish you have to be within 1·5° to get the slightest hint of a signal. Your LNB might be on the wrong polarity or the set not tuned to a station. Call your supplier if the latter is suspected – all those the writer has dealt with have been most helpful and can give you a dial setting to correspond with the wanted signal. Many leave them tuned to the station on which the set was air tested. If the polarity is in doubt turn the LNB to 45° when it should resolve a readable signal from transponders with either type of polarisation. Music Box and Sky share the same nominal band but their carriers are sufficiently offset to come in on quite different settings with the average receiver.

You will need to monitor the results at the dish. A battery operated monochrome set adapted to take a video feed is ideal. If the satellite receiver is provided with an a.g.c. port, take a meter out as well, with a long lead. If you're going to do a lot of installations a spectrum analyser is a worthwhile investment. It will do the whole job, better than a TV set. The writer has used the low-priced AVCOM PSA 35 (imported from the USA) to good effect.

Loosen the mount adjustments so that the dish can be rocked about 10° in both planes, then methodically scan the patch of sky thus covered. Don't go too fast, and be prepared to freeze at the first sniff of signal. Remember that the signals are f.m. and once captured will hold over a small amount of detuning.

From now on everything is a matter of squeezing the lemon to get the last picowatt of signal into the system. Optimise the azimuth, elevation, polarisation and receiver tuning, then go over the lot again until no improvement can be obtained. Bear in mind that you need to allow for some 2dB loss in heavy rain or snow.

If, having got a strong signal, you find that the picture jitters badly you've chosen the wrong video output port on the set. There are often two: one with the sound and the dispersal signal removed and another with both left in for feeding to a descrambler or whatever – that's the one you've got.

Don't be surprised to find that the polarisation of the LNB – this is best adjusted for minimum cross-polarisation of the unwanted signal – is not exactly horizontal or vertical. Unless the satellite is due south you'll be looking at it somewhat obliquely.

If you cannot make sense of Music Box you've either got Sky which is scrambled, or Norway on the wrong satellite (Eutelsat I-F2) with MAC-C encoding. If the picture looks o.k. but the sound is in German you're on the right satellite but the wrong channel – watching Music Box on Sat-1, one channel down.

Keep monitoring the signal as you tighten the adjusters on the mount. You can easily lose the picture altogether as you wrap up the job.

Polar Mounts

In the three decades during which this writer has contributed to *Television* he's always left the awkward bits till last. This is no exception.

The current trend is to use polar mounts. These permit the dish to be swung round either by hand or a motor to follow the Clarke Orbit, stopping at any satellite at will. If this could only be done by a single simple adjustment to the azimuth it would be a piece of cake, but unless you are either at the North Pole or the Equator (strictly speaking the Clarke Orbit isn't visible from the Pole) the orbit, as seen from the ground, is not a simple radius but an oblate ellipse. To correct the dish tracking truly, so that it follows the orbit exactly right down to the horizon, would require a complex tracking mechanism of the kind found on an observatory telescope. In practice however it's sufficient to offset the dish so that it leans a few degrees forward on its mount when facing due south.

For most of central England this declination is 7°. It varies by only the odd degree over the whole range of latitudes we occupy (see Fig. 6). If you swing a polar mount you will see that the effect of this offset is less as you get to the horizon, compensating for the extra distance between you and any satellites at the two ends in comparison with a satellite at the meridian a mere 22,300 miles away. All this is difficult to check because there are few satellites that can be received well enough at the horizon. Provided the dish tracks well enough over the centre of the range it will suffice for your purposes.

You must first ensure that the hinge of the dish is pointing exactly due south. Don't bolt it down yet as you may have miscalculated. Start with the average offset (or use the table provided with the dish) and capture Eutelsat I-F1 as previously described. Then swing round to Intelsat

VA F11 and note how much elevation (upwards) or declination (downwards) you need to capture the signal. So that you can get back to them, mark your settings at every turn on the adjusters using a Magic Marker. The best two channels to use for alignment are RAI on Eutelsat I-F1 – this is at the other end to Sky, with the same polarisation – and Children's Channel (shared in the evenings with Premier/MirrorVision) which has the same polarisation but is on Intelsat VA F11.

Since RAI is at 11·005GHz and Children's Channel at 11·015GHz virtually no retuning will be needed. Thus whatever errors there are will be due to incorrect setting of the polar mount. If for optimum resolution of Children's Channel you have to point the dish upwards it means that your hinge is too much to the east of south. If you have to point the dish downwards it's a little to the west. Adjust it and try again.

Once signals from these two satellites are coming in at equal strength check the polar tracking of the dish by picking up Eutelsat I-F2 at 10°E. This has NRK (Norway) with MAC-C encoding on virtually the same channel as Sky on Eutelsat I-F1. You should also now be able to pick up Intelsat V F2 at 1°W, where you can usually tune in two scrambled channels. This will enable a precise check on the declination adjustment to be made. If elevation adjustment is needed to optimise reception from this satellite do it with the declination screw, noting how much change is required, then set the declination to half the error, making up the rest with the elevation screw.

It's quite likely that the tracking may still be out towards the horizon, but there's little to see down there at present. The next launches of any interest, Eutelsat I-F4 at 7°E and the French/German DBS satellites at 11°W, are well within the arc of the adjustment achieved. A new head end will be needed for the DBS satellites since their channels start above the high end of the ones at present in use.

Note that for best results as you swing between Eutelsat I-F1 and Intelsat VA F11 the polarisation of the LNB should be optimised to reduce interference from signals with the other polarisation.

All that now remains is for you to tighten up all your adjustments and grease well around their threads.

Next Month

Having got you started, the next part in this series will recap on the basics of satellite TV reception and look at some of the equipment available. The final part will deal with the theory in more detail and discuss future trends.

VCR Clinic

Reports from Christopher Holland, Philip Blundell, Eng. Tech., Mick Dutton and Jeff Herbert, G4JJH

No Playback: JVC HR2650

Two general rules of thumb apply to VCRs that return to the stop mode a few seconds after play has been selected. First; if the tape loads to the heads, or even partially to the heads, and the machine then cuts out, the fast forward and rewind modes appearing to function correctly, suspect missing drum pick-up head pulses. If however the VCR plays for a few seconds before cutting out, while fast forward and rewind also trip out soon after selection, the problem is that the machine thinks the tape spools aren't rotating due to the absence of reel pulses or take-up pulses depending on the model in question. In this case there's usually no counter movement during the brief time that the tape is moving, since these pulses are used to drive the counter. This would apply to electronic counters and not the earlier mechanical counters, though it should be mentioned in passing that in the early JVC piano-key machines there are no take-up pulses when the counter belt is displaced.

And so to the machine under consideration. The HR2650 is a small portable VCR with stereo sound capability. It runs off a rechargeable 12V battery and has an accompanying tuner/charger unit. The fault with this one was no play, though an apparently good picture did appear for a few seconds. Fast forward and rewind were equally brief and what caught my eye was that the tape running indicator LED was illuminated all the time. All this pointed to an absence of take-up reel pulses, so the outside covers were removed and sure enough the pulses at pin 1 of connector 3 on the front control panel were found to be very weak, less than one tenth the amplitude the diagram said they should be. This voltage swing would be insufficient to activate the operational amplifier in IC6 and thus give an output to the tape running indicator, the counter and the mechanon panel. The problem was due to the reel sensor itself. Before condemning it we removed it and checked that there was no dirt affecting its optocoupler, something we've encountered previously with other machines. **C.H.**

Samsung V1510T

A number of these Korean made VCRs have passed through our workshops recently. Amongst the run of the mill problems of head cleaning and extracting foreign objects from the mechanism, something that seems to go with front-loading machines, we've on several occasions had no playback colour. The usual cause seems to be poor quality 4·43MHz crystals that either won't oscillate or can't be adjusted properly. If both crystal oscillator circuits work correctly however try a recording. If this shows that the drum servo is out of lock in the record mode the fault is due to the colour a.f.c. circuit which also provides sync pulses for the drum servo. Check for a bad joint at plug 11-16. **C.H.**

JVC HR7650/Ferguson 3V31

The machine JVC brought out to replace the HR7700 proved to be much more reliable. A problem I've encountered on several occasions however has been absence of any reel motor drive. A check on the mechacon panel will reveal that transistors Q18 and Q19 have blown apart physically. Further checks with an ohmmeter will show that Q10 and Q11 have also failed and will lead you to the ultimate cause of the mayhem – Q15 which will be found to be short-circuit. Don't use the nearest European style transistors as equivalents – this will only end in tears, not to mention small puffs of smoke as the replacements expire shortly afterwards.

Another problem I had with one of these machines was a complaint about intermittent failure to eject a cassette.

We could never produce the fault in the workshop and every time suggested that the owner bring along a tape that wouldn't eject. He replied that it happened only with library tapes and that this couldn't be the problem as no one else complained. Eventually the machine came in with the owner clutching a cassette. One attempt at ejecting the tape showed the cause of the problem: the library proprietor was sticking code numbers on dymo tape on the body of his cassettes in such a way that they caught on the left-hand side of the cassette housing during an attempt at ejecting them. Naturally only this model was affected. The customer was quite happy with the solution we offered: pull off the dymo tape each time and stick it back afterwards. **C.H.**

Philips VR6460 and Clones

These machines use special Torx screws to hold the motors but the manual doesn't say which size of screwdriver is needed – and there are 25 to choose from! Many thanks to my SEME rep. Dale for telling me that it's Torx size T10. This size doesn't fit the rotating guides however – does anyone know which size does? I've had a few cases of Finlux and Marantz VCRs with too little take-up torque – this causes tape spillage on forward search. Replacing the reel motor usually cures this. **P.B.**

Mitsubishi HS700B

Any intermittent sound or erase problems with this machine should be cured by removing plugs AF and DF and soldering the wires directly to the audio panel and the full erase head. **P.B.**

Hitachi VT11/GEC V4100

Over a period of several weeks I struggled with one of these machines that had a very intermittent capstan speed fault. What would happen is this: the machine would play a three-hour tape all the way through without a fault, but if it was rewound and played a second time the capstan would be "held back" and rotate very slowly – even though its voltage was sufficient. Changing the capstan motor had no effect, but changing the clutch assembly seems to have cured the fault. I hope . . . **P.B.**

Sharp VC9700

Timer display faults are quite common with this machine. The two usual ones are as follows: either no or intermittent display due to C5005 or the timer microcomputer chip I5002, or the display goes dim after an hour due to PR6601 on the audio board. **P.B.**

Blaupunkt VCR

This machine (a Panasonic NV333 in disguise) came in because the tape was playing too fast – it looked more like search speed than play speed. The output voltage from the servo was correct and an FG pulse was being fed back from the motor. We concluded that the capstan motor was faulty: a replacement plus setting up restored normal operation. **M.D.**

Hitachi VT7000

This portable had been dropped on to its base with the multi-plug that connects it to the timer/power supply unit plugged in. The result was a cracked PCB around the connection socket. There's a lot of very fine print in this area and much careful work was required. We eventually got the machine to work but there was no colour. This was traced to a crack in the chroma panel under a plastic fixing lug. **M.D.**

Ferguson 3V31

This machine wouldn't load a tape and the drum motor was running all the time. Although the loading arms were fully retracted it seemed the machine thought that loading was at least partly completed. An investigation of the lower mechanism revealed that the after-loading switch had jammed. Freeing this restored normal operation. **M.D.**

Ferguson 3V35

The complaint was that noise bands moved up the picture at regular intervals on playback. We found that a recording made on the faulty machine had the same noise bars (tracking errors) when played back on another machine. On both machines the sound was perfect, with no wow or flutter. The capstan servo was ruled out therefore and investigations were made in the drum servo circuit. While playing the standard test tape the usual "clover leaf" strobe effect on the head drum screws could be clearly seen to rotate at regular intervals that coincided with the noise bar travelling up the screen. Since the drum servo obviously wasn't locking the drum discriminator adjustment R463 was checked as detailed in the manual. The slightest turn resulted in the picture breaking up into lines (the servo going way off speed) then returning slowly to a locked picture. It was impossible to adjust for 4·6V at TP423 with a digital voltmeter as the voltage was varying all the time.

Scope checks on the drum FG signal were normal but the output from the frequency-voltage converter in IC404 was incorrect – pulsating d.c. at pin 15 with a superimposed sawtooth, where the stable drum speed correction voltage should be. Replacing IC404 made no difference but when the feedback resistor R466 (270kΩ) was checked it turned out to be open-circuit. Replacing R466 corrected IC404's output waveform and after R463 was adjusted a perfectly locked picture with no noise bands was obtained.

I had the same machine in a month before with a similar complaint, but at that time it could be locked by adjusting R463. I suspect that R466 goes high in value before going open-circuit and would recommend checking it whenever the drum servo requires adjustment. **J.H.**

Hitachi VT63/GEC V4005

The drum and capstan motors both stopped just after the tape had loaded: the spool rotation sensor then returned the machine to the stop mode. When rewind or fast forward were pressed the brakes released but there was no spool rotation. This turned out to be due to loss of the 12V supply from the STK5451 regulator i.c. During motor start-up 16V is applied to the motor drive chip IC603. Once the motors are running the microcomputer i.c. switches on the regulator to provide the 12V output. The 16V line is used in the search mode to supply the extra load with the increased motor speeds. This provided the clue. Fitting a new regulator chip (IC151) cured the trouble – the internal 12V regulator produced no output.

We've found that the capstan bearing is very often noisy on these machines, causing groaning and vibration. This can be difficult to diagnose as it's often intermittent and stops when the machine is put on end to remove the bottom cover. Hitachi technical recommend that the capstan flywheel is removed and the chromed shaft checked for scoring. Renew if marked, then lubricate with Castrol MS3 grease. We now do this as a matter of course when these machines come into the workshop. To date lubrication has provided a cure in every case. **J.H.**

Simple RGB Interface Circuit

Brian Webb

Having recently bought a computer with RGB output, and realising the advantages of using this mode of direct c.r.t. drive to eliminate the cross-colour and bandwidth limitations that are inherent in the PAL system, I decided to convert a ten-year old GEC colour set to RGB input as cheaply and as simply as possible while still maintaining safety.

The first requirement (a must) was to provide mains isolation for the chassis. A suitably VA rated 1:1 ratio transformer is used for this purpose, with the set's chassis earthed via the earth pin of the mains plug. Such a transformer can be expensive: I have it in a separate box so that it can be readily used for other purposes, e.g. servicing, making the purchase more economic.

Circuit Description

The circuit I decided upon (see Fig. 1) was kept as simple as possible while maintaining an upper working frequency of around 10MHz. The 74LS240 TTL chip was chosen for its high speed and cheapness. It's an eight-stage inverting buffer with separate enabling for the two groups (A and B) of four buffer/inverters. The RGB inputs are applied to three of the A group buffer/inverters with enabling from the sync input, ensuring good blanking. The sync input goes to one of the B group buffers. Another can be used depending on the requirement for positive- or negative-going sync pulses in the timebase department. The output from a TTL circuit at 5V peak-to-peak may be too large for some timebase arrangements. Fig. 2 shows a simple emitter-follower to enable the pulses to be potted down. It may also be necessary to use this circuit where there's a long run to the timebases – a suitable screened cable may also be required.

The GEC solid-state C2110 series chassis, like many of its contemporaries produced during the early 70s, uses a TBA920 sync separator/line generator chip. This will work directly from a TTL buffer, positive-going sync pulses being required.

Should connecting the sync input to the timebase section of the set be rather impractical an alternative option that could be adopted is to use an off-air signal, feeding the demodulated video to the sync separator in the usual manner. The sync signal available at the RGB socket should still be used for blanking.

The digital RGB signals are fed to the emitters of the three BF259 RGB output transistors via 2·2kΩ presets. These are used in conjunction with the set's first anode controls to set up the black level.

Construction

Spread the circuit out as much as possible, bearing in mind that the output transistor collector load resistors dissipate a certain amount of heat – a heatsink should be provided for the transistors themselves. Also remember that since the upper working limit of the circuitry is hopefully around 10MHz suitable separation should be used – especially if construction is on Vero board.

I disconnected the i.f., sound, colour decoder and video drive sections of the set. This has the advantage of minimising the power across the isolating transformer.

The older type of delta-gun tube can give a good account of itself at up to 10MHz. The convergence has to be looked at carefully, especially with a computer display.

Remember good common chassis connections throughout.

I hope the circuit presented here will give you ideas for cheap ways to improve your computer displays. Have fun with it!

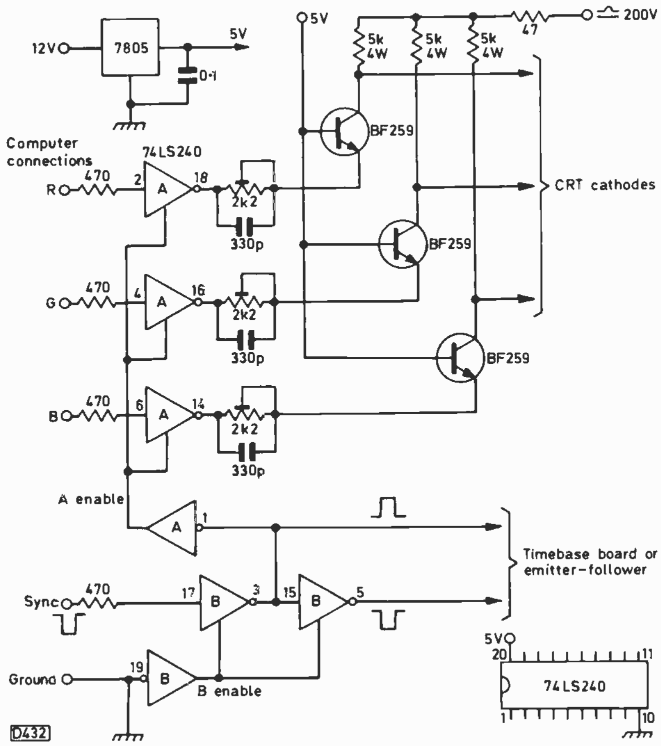


Fig. 1: RGB/sync interface circuit.

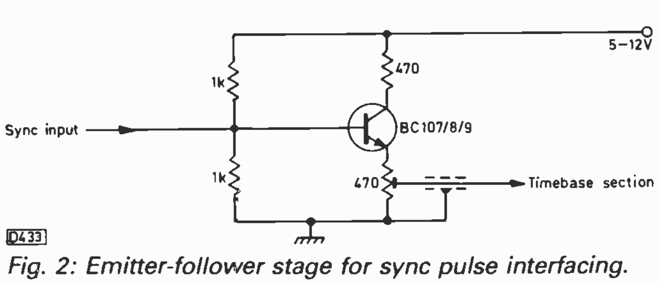


Fig. 2: Emitter-follower stage for sync pulse interfacing.

Teletopics

TVRO RECEIVER IN KIT FORM

Here's something of a breakthrough in the cost of satellite TV reception. Comex Systems Ltd. (Comet House, Unit 4, Bath Lane, Leicester LE3 5BF, telephone 053 325 084), the small order trade and retail distributors for Astec TVRO modules, TV and computer products, have introduced a TVRO receiver in kit form. The kit comprises a motherboard and components for mounting the r.f. and i.f. modules, the video, control and i.f. circuits, plus two Astec modules, a tunable converter covering 950-1,450MHz and an i.f. processor with wideband f.m. quadrature detector. The board is silkscreen printed and is simple to construct. Detailed paperwork covers the many possible options for the board's use – the kit has been designed for versatility. Comex is also able to supply much of the other equipment required for a satellite TV receiving installation – dishes, wideband preamplifiers, F type plugs (at least one is required for the board), scalar horns and Mitsubishi heterodyne converters. Price details are as follows:

TVRO receiver motherboard and component kit	£35·00
Motherboard only	£11·75
Astec AT1020 tuner module	£35·10
Astec AT3010 i.f./demodulator module	£54·65
F type plug for AT1020	£00·50
Mitsubishi 10GHz heterodyne receiver	£47·00
Scalar horn for above	£42·00
60-1,700MHz wideband, low-noise preamplifier kit	£35·00

F-to-BNC adaptors are available at £1·70 each. The prices include VAT. For orders below £100 add £1·50 post and packing, for orders above £100 add £2·50. Comex plans to introduce shortly a tuning display for the TVRO receiver, a tunable sound i.f. giving the kit stereo sound, a keyer unit and a portable power supply with 13·8V input and 18V output. A 1·6m spun aluminium dish with polar and horn mounts is available at £365. Comex can also supply ATV transmission equipment for the 23cm band.

IBA TO REPLACE TRANSMITTERS

The IBA has started a u.h.f. TV transmitter replacement programme that will involve expenditure of around £40 million – some of the existing transmitters are now over twenty years old. A £7·5 million contract with Marconi Communication Systems has been signed covering the first phase of the programme. This provides for replacement of the original fourteen high-power transmitters. Associated engineering work will bring the total cost to £11·5 million. The programme envisages transmitter replacement at a rate of six a year starting in 1988.

EUROPE ADOPTS MAC

European trade ministers, meeting in Luxembourg, have decided to adopt the MAC-packet system as the standard for satellite TV transmissions to Europe. The advantage over the Japanese high-definition system that has been advocated as a worldwide DBS standard is that MAC signals can be decoded and displayed on a standard TV receiver. The system allows for a wider aspect ratio with higher definition to be added, again compatible with existing European TV standards. The agreement lasts until the end of 1991 and allows each Community country to choose the system best suited to its needs, provided it conforms to the basic MAC specification – whilst C-MAC is favoured by the UK, a variant known as D2-MAC is favoured by France and W. Germany. A chip to make these two systems compatible is being developed. The whole DBS program has unfortunately been put back by the recent Shuttle and Ariane failures.

The board of Eutelsat has received a report on the potential for a European DBS system called Europsat. What further action to take on this project will be decided at the board's next meeting in September.

NEW SALORA/LUXOR TVRO EQUIPMENT

New satellite TV receiving equipment is to be introduced by Salora and Luxor at Cable 86 (July 8-10th), the satellite and cable TV show. Salora's new receiver, Model SRV1150, features remote control. The ACU1160 actuator control unit is also new and the equipment available includes an aerial actuator with polar mount and a polariser with 1·2m dish. A similar range is available under the Luxor brand name.

MICROELECTRONICS SERVICING SEMINAR

The Institution of Electronic and Radio Engineers (IERE) and the Society of Electronic and Radio Technicians (SERT) are to run a one-day seminar, entitled Microelectronics Repair and Maintenance, at the Royal Institution of Great Britain, 21 Albermarle Street, London W1 on September 9th. Application forms can be obtained from the IERE Conference Dept., 99 Gower Street, London WC1 (01-388 3071). Registration fees, inclusive of attendance, documentation, coffee, lunch and tea, are: £45 plus VAT, members rate £35 plus VAT (members of the IERE, IEE, SERT or IEEIE), or £16 plus VAT for student and retired members.

TENSAI AND WINTHRONICS SPARES

Our thanks to readers who have come up with sources of spares for Tensai and Winthronics TV sets. Spares and data for Tensai sets are available from the UK agents John Walker Ltd., First Floor Suite, 55 North Street, Thame, Oxfordshire OX9 3BN (telephone 084 421 6929). For Winthronics spares and data contact Laltex and Co., Ltd., 1 Canal Street, Manchester (061-832 6132).

ZANUSSI CHANGE

Seleco UK, 43 West Street, Reading have taken over from IAZ International (UK) Ltd. the UK distribution of Zanussi TV receivers. A new range of models is being introduced.

GOOD BUSINESS IN CASSETTES

The British Videogram Association reports record first quarter sales of prerecorded video cassetes by its members. Approaching a million cassettes worth over £24 million were distributed, an increase of 32 per cent compared to the same period in 1985.

A report entitled *Home Video Recorder Populations and Cassette Usage*, distributed in the UK by Benn Electronics Publications Ltd. (Chiltern House, 146 Midland Road, Luton, Beds LU2 0BL) for US consultants Magnetic Media Information Services Inc., predicts a fourfold increase in worldwide sales of video cassettes by 1989 (compared to 1984). It expects sales to reach 2·5 billion units in 1989, including both prerecorded and blank tapes. The report expects 140 million VCRs to be in use worldwide by 1989. A fall in Japanese VCR production of 10 per cent in 1986 (the first ever) is predicted, with further falls of 13 per cent and 15·5 per cent in 1987 and 1988 respectively. This is likely to depend very largely on currency movements. The report is available from Benn at US$995 per copy.

Market research consultants Mackintosh International (Mackintosh House, Napier Road, Luton, Beds LU1 1RG) have also published an optimistic report which predicts an "explosion" in the market for consumer tapes and discs over the next ten years. The 500-page report, entitled *Discs and Tapes – the next ten years*, expects the world market for consumer discs and tapes to reach a value of $30 billion by 1995.

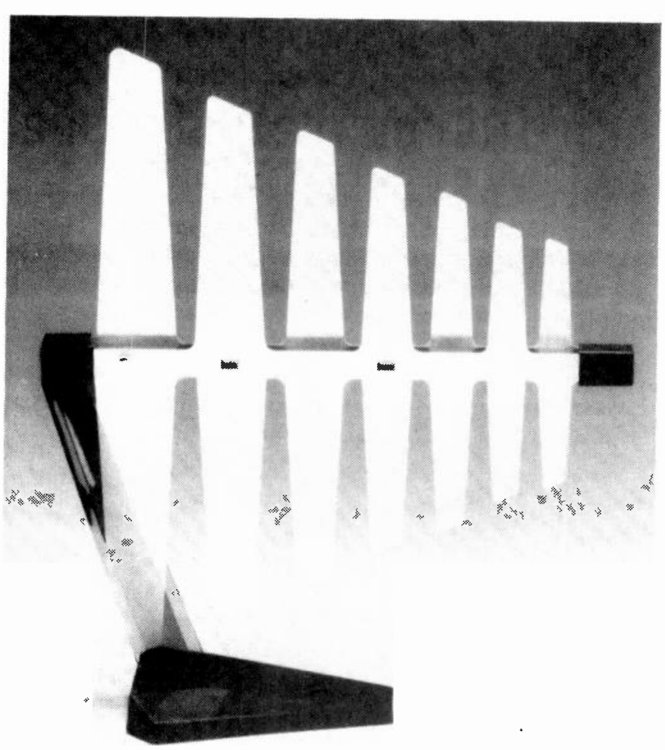
NEW GENERATION INDOOR TV AERIAL

Antiference have introduced an interesting new indoor aerial which has taken two years to develop at a cost of a quarter of a million pounds. Its performance is certainly impressive, with a forward gain of 6-8dBd across the entire u.h.f. bandwidth and good directivity. While the design is basically a log-periodic one the elements are formed on two aluminium sheets giving a large surface area. The Silver Sensor incorporates electrical isolation to BS5373 and is expected to retail at around £10. For further details apply to Antiference Ltd., Bicester Road, Aylesbury, Bucks.

TELELIFT's UK LAUNCH

One of the dangers – a very real one – to which those in the TV trade are exposed is injury caused by lifting and manipulating heavy TV sets. It will be avoided by the use of a new trolley which has been designed to enable one person to transport safely heavy TV receivers and other domestic appliances. The Telelift trolley comes to the UK after three years of extensive field trials both here and abroad. To date it has moved over half a million sets without injury to users. The trolley incorporates a number of well thought out features. It enables a bulky console set to be rotated to allow passage through narrow doorways, has a built-in suspension system to protect delicate mechanisms, provides lifting into and out of vehicles and incorporates a unique, patented stair climbing system. The Telelift is available from Courier Handtrucks Pty, Ltd., 59 Earls Court Road, London W8 6EE (01-937 1996) at £139 plus VAT and transport.

According to the National Institute for Safety and Health, Washington DC, USA serious and permanent spinal injury is likely if an attempt is made to lift a TV set or appliance weighing more than 44lb from ground level to workbench height, regardless of body size. Use of the Telelift trolley, which is solidly made and should give many years trouble-free service, is recommended.



The Antiference Silver Sensor log-periodic set-top aerial, shown here with the boom position for reception of vertically polarised transmissions.

NEW COLOUR PATTERN GENERATOR

A versatile, mains-operated colour pattern generator, designed and manufactured in the UK, has been introduced by Black Star Ltd., 4 Stephenson Road, St. Ives, Huntingdon, Cambs PE17 4WJ (048 062 440). The Orion pattern generator has been developed for those engaged in servicing, manufacture or design of TV sets, VCRs and monitors. Features include separate r.f. and composite video outputs with level control, tunable r.f. carrier, internal or external sound modulation, switchable sound carriers (5·5, 6 and 6·5MHz) and positive or negative vision modulation. A front panel source of field and line sync pulses is provided for scope triggering. The generator covers the v.h.f. and u.h.f. channels and is compatible with the PAL systems B, D, G, H, I and K. The full range of colour and monochrome test patterns includes colour bars, grey scale, focus, raster purity, dots, gratings and vertical/horizontal lines. There are also rear panel R, G, B and sync outputs with switchable signal levels and sync conditioning to ensure compatability with the majority of video and computer monitors. We expect to publish a review of this generator in the next few months.

VCR SPARES DISCONTINUED

Ferguson have announced that from August 1st spares will no longer be supplied for the following VCRs, tuners and cameras: Models 3292, 3V00, 3V01, 3V03, 3V04, 3V06 and 3V17. In addition cabinet and presentation parts will from the same date no longer be available for Models 3V20, 3V23, 3V24, 3V25, 3V26 and 3V28.

REMOTE CONTROL BOOSTER

A booster unit for use with infra-red remote control transmitters has been released by Advanced International Marketing (UK) Ltd., 74a Heath Road, Twickenham TW1 4BW (01-891 3644). The Tyron "power enhancer" is said to increase the range of an IR transmitter to 40-50ft and make careful aiming unnecessary. It simply clips on and operates from a 9V battery.

MITSUBISHI DEVELOPMENTS

Mitsubishi has announced in Japan the development of a 40in. colour tube along with a monitor/receiver to drive it. It's intended initially for business use and is to be shown at the Chicago Summer Consumer Electronics Show. Also announced are a 200in. projector system with a newly developed optical arrangement and the Mark II version of the Diamond Vision colour display system. The latter has a display size of 4·8 × 3·6m and weighs three tons.

Modern Receiver Circuitry

Part 5: Timebase Synchronisation

J. LeJeune

Faithful reproduction of a television picture depends not only on adequate video bandwidth, accurate colour decoding and luminance-chrominance registration but also on precise synchronisation of the line and field scanning in the camera and the receiver. The use of integrated circuits has led many service engineers to take synchronisation for granted, but a knowledge of the basic circuits and principles is always an advantage.

One requirement for precise synchronisation is that the received sync pulses are free from impulsive electrical interference and noise generated in the receiver's tuner and i.f. strip. With simple, direct sync the effect of noise is ragged verticals and occasional loss of field sync. An important step in improving the line synchronisation is to use an indirect system to control the line oscillator – the flywheel line sync system, in which the timing of the received line sync pulses and the line flyback pulses is compared by a phase detector which produces an error voltage to pull the oscillator back into lock. With this arrangement the oscillator is controlled by a voltage that's proportional to the phase difference between the incoming sync pulses and its own operation. The speed of the correction can be slowed down by including a time-constant in the phase detector's filter circuit: the effect of this is to give correction of longer-term drift while making the system immune to short-term disturbances such as interference and internally generated noise.

Simple Transistor Sync Separator Stage

Before any synchronising arrangement can work it requires a clean sync pulse which has been separated from the composite video signal. A simple transistor sync separator stage is shown in Fig. 1(a). The demodulated composite video signal, with positive-going sync pulses, is fed via C1 to the base of the transistor. The important thing is that the output should consist of sync pulses only, i.e. with no picture information. C1, R1, R2 in the base circuit provide the conditions required for this. R1 and R2 apply a small bias voltage to Tr1's base – too small to bias Tr1 as a normal class A amplifier. Tr1 conducts when a positive-going sync pulse appears at its base. The combination of the small bias provided by R1, R2 and the positive-going sync pulse drives Tr1 into saturation. As a result, the tip of the sync pulse is clipped, thus removing noise – see Fig. 1(b). When Tr1 saturates the coupling capacitor C1 will be charged by Tr1's base current, acquiring a negative charge on its right-hand plate. This holds the transistor cut off during the picture part of the line scan. During this period C1 discharges via R1. The time-constant is such that Tr1 will saturate rapidly as soon as the next sync pulse arrives. The value of R1 is thus important – it's a common cause of sync problems in some chassis.

Flywheel Line Sync

The sync separator stage itself cannot provide sufficient immunity against interference – which with negative-going vision modulation is of the same polarity as the sync pulses. Thus for good line locking the flywheel sync system already touched upon must be used.

Fig. 2 shows a typical discrete component flywheel line sync phase detector circuit. The inputs consist of negative-going line sync pulses which are coupled to the cathodes of diodes D1 and D2 by C1 and a flyback pulse from the line output transformer. The flyback pulse is integrated by R4 and C4 to produce a sawtooth waveform that's coupled to the detector circuit by C2. Capacitive coupling removes any d.c. component, ensuring that the waveform at the junction of D1, R1 swings positively and negatively about zero volts. D1 and D2 conduct when a negative-going sync pulse arrives. If the sawtooth voltage is at zero at this time synchronisation is correct and the circuit produces zero output. If the sawtooth is positive with respect to zero volts when the sync pulse arrives the circuit will be unbalanced: D1 will conduct more than D2 and C1 will acquire a positive charge. This is filtered and used to adjust the phasing of the line oscillator. Conversely if the sawtooth is negative with respect to zero when the sync pulse arrives D2 will conduct more than D1 and C1 will acquire a negative charge. C2 fulfils two functions in this circuit configuration: it acts as coupling capacitor for the sawtooth and as the reservoir capacitor for the output – the charge established on C1 when D1/2 conduct is transferred to C2 during the picture period. R3/C3 provide filtering and R5/C5 add a time-constant to the filtering action to damp the effect of short-term disturbances.

The Modern Approach

The circuit just described is rather crude in comparison with the arrangements used in modern sync processing/timebase generator chips. It nevertheless forms the basis of flywheel line sync action. A typical modern sync processing chip may provide line and field drive signals, AV switching, between-channel sound muting and a sandcastle pulse that's used for flyback blanking and burst gating.

A block diagram of a typical sync processor i.c., the TDA2578A, is shown in Fig. 3. Composite video is fed in at pin 5 where it goes to the sync separator. The slicing level is determined by the components connected to pins 6

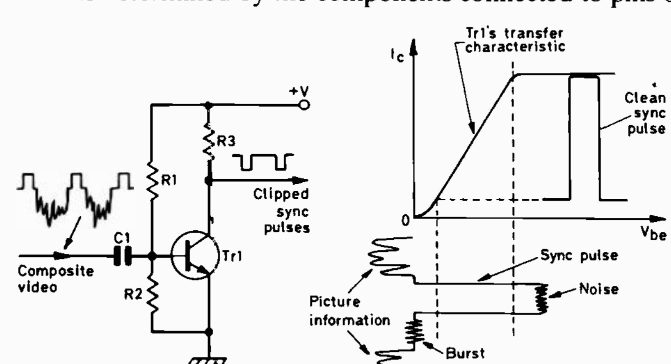


Fig. 1: Simple sync separator circuit using a transistor (a), operating conditions (b).

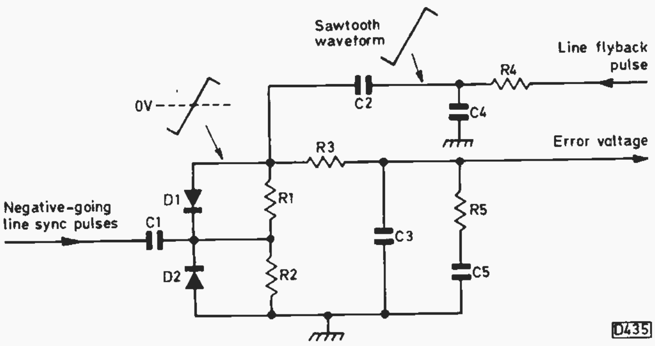


Fig. 2: Typical discrete component flywheel line sync circuit. Note the RC time-constant network in the filter.

and 7: this level is maintained over a wide range of video input signal levels. The output from the sync separator goes to a pair of phase detectors, 1 fast and 2 slow, to a coincidence detector, and to the field sync pulse integrating stage. It also goes to a burst timing circuit which produces a pulse to coincide with the colour burst: this pulse forms part of the sandcastle pulse output at pin 17.

Phase detectors 1 and 2 have different response times and are used to lock the line oscillator to the incoming line sync pulses. The gating circuit determines which phase detector is used. For good noise immunity with off-air reception the phase detector with the slow response time is used. With an off-tape signal a faster response time is required: the AV switching thus brings phase detector 1 into operation. The fast-acting phase control loop is also used to restore sync rapidly after momentary loss of signal due to a change of channel and when the set is first switched on.

In the absence of a video signal the coincidence detector brings the muting circuit into operation. The voltage at pin 13 will then be at about zero and can be used to give inter-station sound muting.

Although the line oscillator has been locked a further problem has to be overcome before a completely stable picture can be guaranteed. With a power transistor such as the type used in the line output stage there's a time delay between the removal of the base drive and the cessation of collector current. This delay lengthens as the demand made on the line output stage increases. Nearly all line output stages are called upon to generate flyback e.h.t., and the beam current requirements will vary rapidly from one moment to the next. The timing of the line drive switch-on is not too critical since there's some overlap in the operation of the line output transistor and the efficiency diode. The timing of the line drive switch-off, i.e. the start of the flyback, is critical however since it governs the position of the picture within the raster. A second control loop is used to offset the effect of delays in the line output device. Phase detector 3 compares the output from the line oscillator with the line flyback pulses. Its output adjusts the timing of the trailing edge of the line drive pulse via a pulse width modulator circuit. The central position of the picture is thus maintained. A d.c. voltage can be applied to pin 14 for horizontal shift purposes.

The field sync pulse integrating capacitor is connected to pin 4. The field oscillator stage is simply a discharge circuit for the field ramp capacitor connected to pin 3: the capacitor is charged from a relatively high voltage via a high value resistor. The sawtooth produced in this way is scan-corrected before passing to the linearity correction section where feedback from the field scan circuit is applied. The voltage at pin 2 is also monitored for tube protection purposes: if the voltage at pin 2 is less than 2·5V or more than 5V the screen blanking circuit produces 2·5V at pin 17 to give a blank screen.

The sandcastle pulse generator produces a composite blanking and burst gating pulse at pin 17. The output here is at three levels: 2·5V gives field flyback blanking and

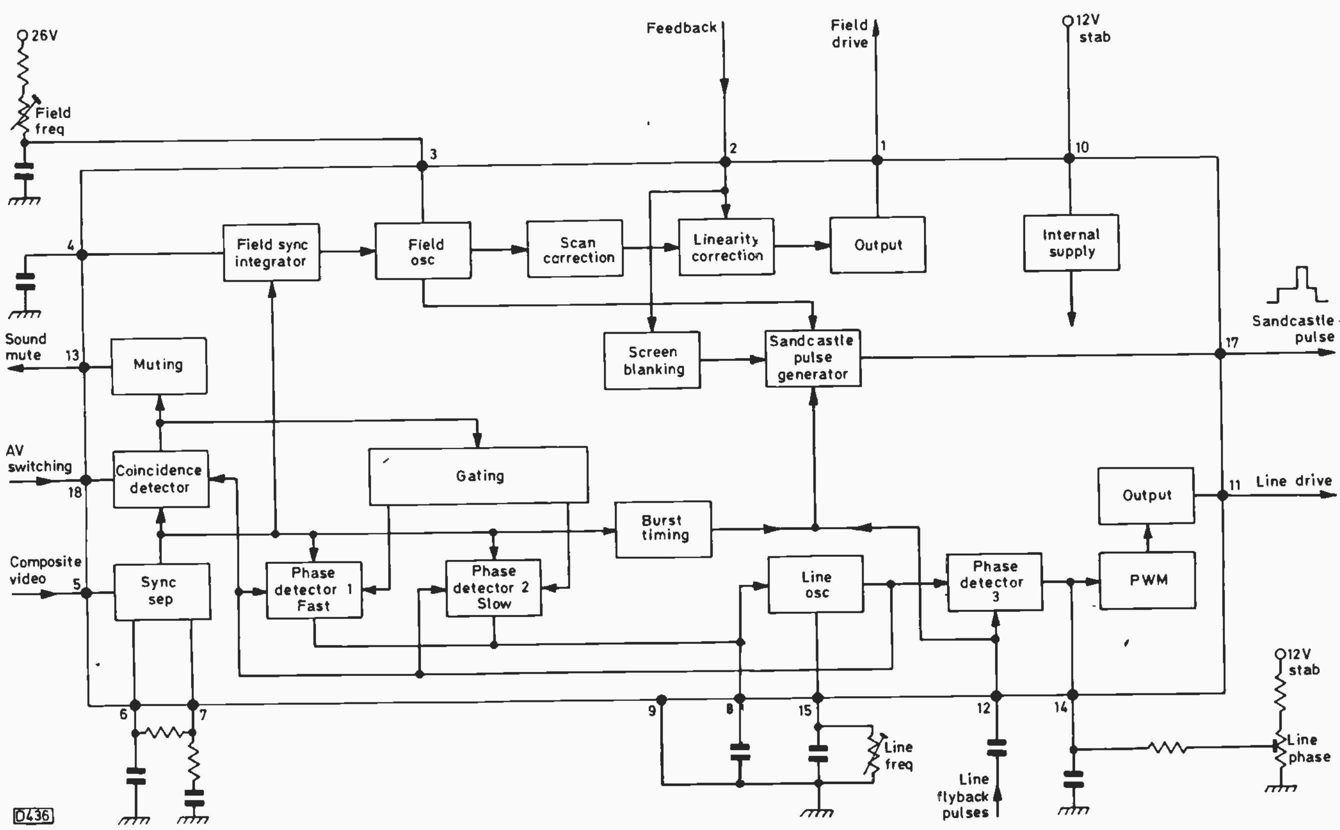


Fig. 3: Block diagram of a modern sync/timebase generator chip, the TDA2578A.

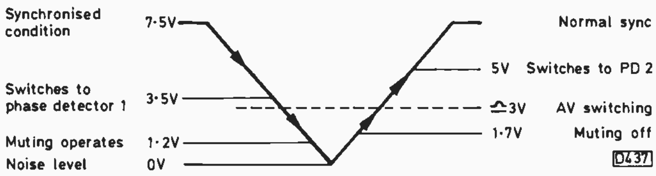


Fig. 4: Voltage conditions at pin 18 of the TDA2578A for flywheel sync phase detector switching and sound muting.

4·5V line flyback blanking. The 10V burst gating pulse sits on top of the line flyback blanking pulse.

Fig. 4 shows the voltage levels at pin 18 under various conditions. With the set receiving a TV transmission the synchronised condition will be marked by the presence of 7·5V, phase detector 2 will operate and the muting circuit will be inoperative. When the receiver is detuned the voltage at pin 18 will fall: phase detector 1 is switched in at 3·5V and muting operates at 1·2V. With no signal the voltage is approximately zero, rising again as another signal is tuned in. Muting ceases at 1·7V and return to control by phase detector 2 occurs at 5V. Application of an external AV voltage of approximately 3V for VCR or disc playback purposes should produce control by phase detector 1 without muting: the AV voltage should obviously be stable – to prevent unwanted switching to control by phase detector 2 or muting.

This then is the contemporary way of generating and synchronising the set's scanning signals.

TV Fault Finding

Reports from Steve Leatherbarrow, Philip Blundell, Eng. Tech., Hugh MacMullen, Keith Hamer, Garry Smith and J. K. Potts

Ferguson TX9 Chassis

Intermittent colour can be a problem and this case was no exception. A fellow engineer had attacked the set with freezer and a hairdryer: after demonstrating his ability to produce colour at will he replaced the crystal. The set then worked all right in the shop for a couple of days after which the colour went off. With the set back on the bench we found that heating the TDA3560 decoder chip brought back the colour. Unfortunately heating the replacement chip had the same effect.

Careful examination of a test pattern revealed what looked like a slight hum bar. Like a man possessed I stabbed the meter on the 115V rail. Bingo! – a good 6V low. Resetting the h.t. voltage removed the hum from the picture and put an end to the thermal sensitivity of the decoder circuitry.

This time the set gave four days' service before the colour went off again. I'll save you from reading through the rest of the torture. Suffice it to say that if similar problems come your way it pays to replace the chroma delay line before going any further. It seems that everyone was aware of this except me. **S.L.**

ITT CVC32 Chassis

This set had the rather daunting symptoms of no bottom scan accompanied by distorted sound. The remote control unit worked outside the set but not when in the "parked" position. What field scan there was in the top half of the screen was non-linear and "synchy". We eventually discovered that the 35V supply reservoir capacitor C64 (2,200μF) was responsible for all the symptoms, the only clue being that the 35V rail was 3V low.

While on this chassis, the symptom of low h.t. when cold (or sometimes when warm just to add to the fun), often intermittent and looking like a fault in the chopper control module, is often due to the h.t. smoothing capacitor C52 (47μF). This capacitor can also produce the fault permanently of course. **S.L.**

Grundig CUC41 Chassis

There was low output from the power supply and a loud whistling. The latter is symptomatic of a loaded h.t. rail. A check around the line output transformer revealed an 0·33Ω safety resistor that was burning. This provides a feed to the deflection module which, in an attempt to isolate the fault, was removed. The output from the power supply then returned to normal so attention was turned to the deflection module. The rectifier that produces the 25V supply for the TDA2655 field output chip lives on this module – D2751. When it goes short-circuit, as in this case, it loads down the line output transformer. A BY298 seemed to be a suitable replacement. **S.L.**

Tandberg CTV2 Chassis

The problem with this set was intermittent contrast variations – the fault was tappable (dry-joints are common in this otherwise excellent chassis). After carrying out some resoldering however the fault was still present. The board was particularly sensitive around the 12V regulator transistor's heatsink and a meter check revealed that the rail would rise to 14·5V. The transistor itself was responsible. **S.L.**

ITT 80-90° Chassis

If you're faced with one of these sets that suffers from tuning drift a good place to start looking is in the line output stage! If the 90V supply reservoir capacitor C514 (10μF) has dried up the supply will be low, affecting the regulation of the tuning voltage stabiliser. **P.B.**

Decca 80 Chassis

This set had suffered from poor field lock for several years. When the set came to us however the report was "dead". The usual faulty tripler had killed the line output transformer and BU208. There was also the common burning of the now famous orange wiring and connectors. After all this had been sorted out the set worked perfectly but with very poor field lock. A hole had been cut in the back for the customer to adjust the field hold control (a very unwise action) – the customer had mentioned that the trouble had been present from new.

The sync output from the TBA920 sync/line generator chip goes to the TDA1170 field timebase chip via an active field sync pulse integrator stage comprising Tr301 and associated components. A check here revealed that

Tr301 had no collector volts and about 2V at its base. In other words either the transistor was hard on or its load resistor R328 was open-circuit. Both the resistor and the transistor were o.k. however. We then found that the field sync pulse at the base of Tr301 was almost non-existent. The next step was to discover why Tr301 had a positive voltage at its base. Every resistor and capacitor in the base circuit was removed, also the transistor itself. We were alarmed to find that there was still a positive voltage at the base print – and the reading was now 100V. This voltage disappeared when the print was cut away ⅛in. back from the base hole. There was no sign of any burning, even when the panel was examined with a magnifying glass, but drilling a few small holes between the base print and the nearby red first anode print cured the fault. I can only assume that the panel had been defective from the start. Incidentally there was no discolouration around the first anode controls and their series resistors – a common problem with these sets. **H.MacM.**

Philips G11 Chassis

A G11 with persistent h.t. fuse blowing caused us quite a problem because the BU208A line output transistor was always o.k. The usual h.t. reservoir electrolytic on the power panel and other components here had been changed and a new BU208A tried just in case. Normal operation might last for days or in some cases weeks and there were never any faulty components to blow the fuse. Once again two pairs of specs and a magnifying glass came to the rescue. There was a microscopic pip on the BU208A's cooling plate. When this was compressed via the insulating pad the result was occasional earthing of the BU208A's collector – with no damage to the transistor itself. **H.MacM.**

Field Judder – sort of

I hesitate to include this item in a fault-finding section – but it shows that you sometimes have to study the owner as well. His complaint was of field judder, but only at certain times of viewing – his set was a brand new Philips receiver but could have been one of any type. We gave it a thorough soak test in the workshop and checked all relevant components but couldn't find anything amiss. After its return the customer made the same complaint – I might add that his previous set, which he'd traded in, had been an old 22in. GEC model with a very dim tube. When conversing with the owner I noticed that he chewed all the time. When he stopped chewing the field stopped bouncing! If you try chewing a tough boiled sweet while looking at the screen you'll find that the crack does cause a definite bounce. **H.MacM.**

Ferguson TX9 Teletext Chassis

The complaint was simple – no sound. Without further ado the sound channel chip's feed resistor R156 was checked for being open-circuit, which it wasn't. The loudspeaker and associated connections proved to be innocent but a check at pin 6 (volume control) of the i.c. produced a very low reading. Operation of the volume control had no effect whatsoever so our efforts were directed to the PC1515 remote control processing board. To prove that the sound chip was o.k. the lead between panel PC1515 and the d.c. volume control input pin on the main panel (pin 5 of PL8) was disconnected. This restored the sound at full blast. On checking around the volume control output transistor (TR106) on panel PC1515 we found that its emitter voltage was absent. This was due to a dry-joint at one end of D123 (AA143). A dob of solder soon put matters right and the musical delights of boring Ceefax blared out once more. **K.H.-G.S.**

Philips CTX-S Chassis

The symptom was a dead set and our first reaction was to check the 4·7Ω surge limiter resistor which commonly goes open-circuit. It was o.k. this time and there was voltage at the collector of the BUX84 chopper transistor. But not at its base and emitter. The BF422 driver transistor had the same voltages at its collector and base due to a collector-base short-circuit. **K.H.-G.S.**

Panasonic TC2031

A quickie on these sets. If you get called out because the remote-control unit is stuck inside turn the set upside down to release it. Then tighten the screw holding the remote control casing together. The screw works loose due to vibration: it then catches in the housing mechanism. **K.H.-G.S.**

GEC C2110 Series

An elderly GEC Model C2121 came our way recently. The customer insisted that the picture flashed up green intermittently and that water had entered the set from a burst pipe. We couldn't find any sign of water damage and as usual the fault refused to appear during our call (we did notice a dry-joint on the RGB output panel, but this was purely coincidental). Our attention was also drawn to the fact that the local "poke-and-hope" brigade had tried to trace the fault without success – a quick check revealed that the fuseholder had been linked with wire and a 3Ω fusible resistor mounted between dropper sections had been shorted out. These matters were attended to and the video drive presets were then cleaned – these are a common cause of colour flashing in this chassis.

The repair bounced and when we got the set back to the workshop we were able to analyse the fault more carefully. The picture's green content was indeed increasing, especially from cold. The voltage at pin 13 (green output) of the TBA530Q i.c. was erratic, and further discrepancies were encountered when we traced back to the preceding TBA990Q demodulator chip. We swapped over the drive connections between these two i.c.s and the picture then began flashing in blue. The demodulated colour-difference outputs from the TBA990Q are passed to the TBA530Q via simple *RC* filter networks: C313 (27pF) in the G − Y filter was the offending item – it read leaky on the AVO. **K.H.-G.S.**

Some Quickies

Sharp C2072: For lack of height check C511 (22μF) in the field output stage – it tends to dry out. For no sound check whether R319 (270Ω, 0·5W) is open-circuit.
Sharp C2095: Set dead – check whether the 130V, 1W zener diode ZD702 in the line oscillator supply is short-circuit.
Saba T51S20: A two-inch high unmodulated raster was traced to RL27 (4·7Ω, ⅛W) being open circuit. Don't be misled by no sound on this set due to interstation muting. **J.K.P.**

The Development of Colour Tubes

Part 3

Eugene Trundle

The basic job of the yoke is to deflect the electron beams so that they scan out a raster on the screen. In very small colour tubes the deflection angle may be as small as 50°. The most common deflection angle is 90°: 100° is widely used in the USA and 110° is popular for minimum cabinet depth, particularly in Europe. The widest deflection angle tubes in regular production are some Trinitron types that have a deflection angle of 114°. These deflection angles refer to the angle through which the beam is deflected in scanning the tube's diagonal. For a 90° tube the horizontal scan angle is 78°, the vertical scan angle 60°.

As we've seen, the key to the self-converging picture tube lies in the distribution of the magnetic field produced by the yoke. The principle was understood and proved as long ago as 1954, when Haantjes and Lubben filed a patent in the USA describing an in-line gun array operated in conjunction with an astigmatic deflection field.

The Precision Static Toroid

Some of the earliest in-line gun tubes used toroidally wound deflection yokes. The precision static toroid (PST) was shown in Fig. 12. It depends for its precision on the exact positioning of every single turn of copper wire in moulded slots at each end of the core. By this means the flux field shown in Fig. 11 is created with sufficient accuracy to need only a trimming adjustment at the factory – the flare end of the yoke is panned and tilted for optimum screen-edge convergence before being wedged and sealed to the glass with hot-melt adhesive.

The PST gives the best possible precision and repeatability in yoke manufacture but does have some drawbacks. Its deflection sensitivity is low, due to the relatively small number of turns that can be wound; it has a powerful stray field and strong coupling between the line and field coils; it runs very warm, due to low efficiency and resulting I^2R losses; it allows the designer almost no freedom in terms of impedance optimisation and restricts the setmaker to low-voltage, high-current output stages; and inherent in it is an effect called coma, i.e. the rasters produced by the outer beams are larger than the raster produced by the centre beam. To correct for coma, early PIL type tubes were fitted with internal magnetic field shapers that were incorporated in the guns – shunts and enhancers for the outer and centre beams respectively. Unfortunately these tended to have a deflection defocusing effect on the outer beams.

Semi-toroidal and Saddle Yokes

The traditional saddle-wound yoke is much more efficient and adaptable. More copper can be got into it and its greater length means that the electron beams stay under its influence longer, giving high deflection sensitivity. The problem is to achieve sufficient precision in the winding of a layered coil to provide the astigmatic fields required for self-convergence. Semi-toroidal yokes made an appearance initially. These have a layered toroidal winding for field deflection and a carefully wound pair of saddle coils for line deflection. The semi-toroidal yoke halved the power required for vertical deflection and improved the efficiency of the horizontal deflection by 25 per cent.

In their 20AX design Philips/Mullard introduced saddle/saddle yokes. These were refined and improved for the 30AX series. Modern in-line gun tubes use semi-toroidal and saddle/saddle yokes in a variety of designs.

Producing an Astigmatic Field

How is the astigmatic field produced? Fig. 26 shows the basic form of a symmetrical pair of single-turn deflection coils. The angle subtended by each is a. The critical angle for a is 120°: this will generate a homogeneous magnetic field in the gap between the coils. If the angle a is made less than 120° the magnetic field produced will be barrel-shaped: the wide spacing of the coil edges – see A in Fig. 27(a) – permits some of the flux to "escape" at the edges of the field gap, as shown. This is what's required for the field deflection coils. If on the other hand the angle subtended by the coil halves is greater than 120° the distance between the coil edges is small – B in Fig. 27(b) – and the result is a concentration of flux in this region. Here the diametric centre line is subject to the least flux density and the result is a pincushion-shaped field, as required for line deflection in a self-converging tube.

Astigmatism and coma both depend on the magnetic flux distribution. Whereas the main influence on astigmatism is the field distribution at the front (screen side) of the yoke, coma depends on the field distribution throughout the length of the yoke. Here lies the key to generating a coma-free astigmatic field. In the yoke design evolved for 20AX and 30AX tubes the field shape developed by each pair of deflection coils has both forms of astigmatism – see Fig. 28. To achieve this result the line coils are wound with an a angle of 90° at the electron gun end

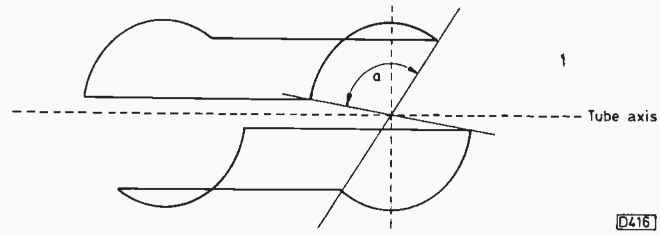


Fig. 26: Elementary scan-coil configuration.

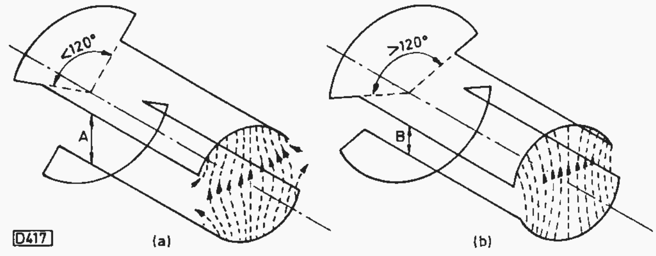


Fig. 27: Winding arrangements for generating astigmatic deflection fields.

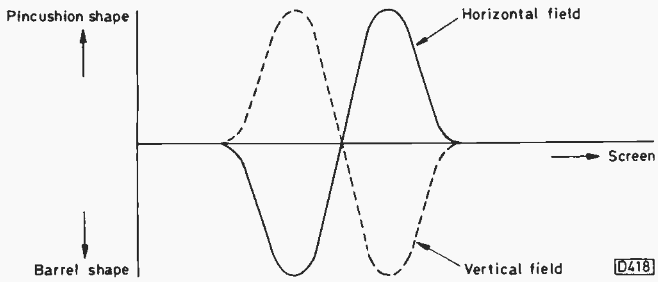


Fig. 28: Field shape engineering for minimum coma. The beam deflection characteristic depends mainly on the curves at the right.

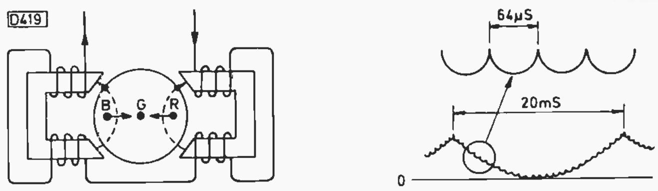


Fig. 29: Four-pole correction field generated by electromagnets. In some tube/yoke designs the outer faces of the ferrite U cores are capped by rotary permanent magnets for static convergence adjustment.

increasing to 150° at the screen end. Conversely the field coils have an angle of 150° at the rear end narrowing to 90° at the flare end. This winding arrangement imparts the necessary astigmatism to the deflection field without introducing the coma effect.

The required winding precision is achieved by the so-called "pin-shooting" technique. Each winding is divided into many sections, the starting point and direction of each being defined by a separate index pin. Cumulative errors are thus avoided.

Four-pole Convergence Coil

Not all in-line gun tubes are fully self-converging. In some consumer tube designs provision is made for dynamic line convergence by means of a four-pole coil – see Fig. 29. This has the effect of pulling the outer beams into registration with the central one and operates at both line and field frequency, as the waveforms show. Parabolic waveforms adjustable for tilt are fed to the coil which becomes the main source of convergence correction. In such tubes the deflection fields are wholly or nearly homogeneous for minimum aberration – Trinitron fine-pitch monitor tubes are an example.

Pincushion Distortion

The flatness of the screen's curvature relative to the image field gives rise to pincushion distortion. It's worse with 110° tubes than with 90° types and is more pronounced with FST screens than with the older, more radiused types. How much correction is called for in the scan drive circuits, in the form of amplitude modulation of the deflection current, depends very much on yoke design. The astigmatic fields required for self-convergence compensate for much of the NS pincushion effect while increasing the amount of EW pincushion distortion.

Various means of countering pincushion distortion can be built into the yoke: cutting and shaping the ferrite cup core; fitting permanent magnets; adding field sharpers on or within the yoke; and varying the density of winding across the coil's span are examples. By these means pincushion-distortion free tubes have been produced – mainly with 90° deflection. Wider deflection angle tubes require some EW correction, typically a modulation depth of 6-10 per cent of the line scan current for a 110° tube.

Shadowmasks

The four current shadowmask configurations are shown in Fig. 30. Delta-gun arrangements are now used only in special purpose tubes where very high resolution is required. Sophisticated dynamic convergence circuitry is

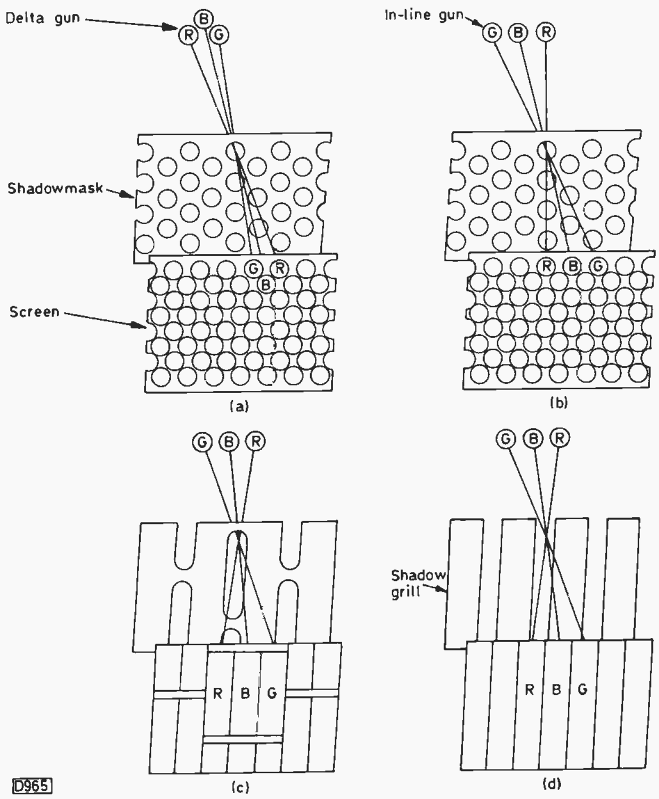


Fig. 30: Basic gun/mask/screen arrangements. (a) Delta-gun configuration. (b) In-line gun with dot screen. (c) Slotted shadowmask. (d) Trinitron system.

required in this case. The phosphor dot screen/in-line gun arrangement is used for medium and high resolution applications. The slotted mask is used in most domestic and monitor tubes and the Trinitron system in Sony TV sets and monitors.

Whatever form it takes, the task of the shadowmask is not to "guide" the electron beams to the correct phosphor dots/stripes but rather to provide a solid barrier to prevent the beam from any gun striking any but the appropriate phosphor. The apertures in the mask are not straight sided but chamfered in a special way to prevent electrons bouncing off the side walls and scattering on to surrounding phosphor material – see Fig. 31. Each mask is chemically etched from both sides to achieve this precise aperture profile.

The mask material is low-carbon steel which is washed and dried before being coated on both sides with photoresist material. The sheet is then clamped between two photographic glass plates and the image of the required shadowmask pattern is then fixed on both sides by pulsed xenon lamps. The resist areas exposed in this way are insoluble: a wash removes the unexposed areas to leave dots, slots or stripes, as the case may be, of bare steel for the acid etchant. These are smaller at the back (gun side) than at the front of the mask to give the profile shown in Fig. 31(b). Thus exact alignment of the two photographic glass plates is crucial. It's held to better than 2·5 microns by accurate alignment of registration marks on the plates.

A development in the mask pattern for in-line gun slotted screens is the contoured-line type in which the vertical phosphor lines are bowed to match the profile of the screen edges – see Fig. 32. The effect is pleasing to the eye whether the set is on or off. The biggest problem here is in the mathematics involved in computing and plotting the geometry of the master photographic plates used for mask etching. The bow at the sides must be gradually and evenly reduced until the lines become straight at the screen centre line. The etching pattern must also take into account the fact that the mask is domed, not necessarily to the same profile as the screen. Once the required pattern has been obtained however the contoured-line mask is easier to etch and the phosphor-fixing (lighthouse) process is also simpler.

Phosphor Fixing

For slot-mask tubes the ultra-violet lamp used for phosphor fixing is not a point source, as for phosphor-dot and Trinitron screens, but a vertical line source. This prevents the slot-bridges in the mask casting shadows on the phosphor and permits the formation of continuous lines of phosphor.

Phosphor fixing is not quite as simple as the usual description suggests. The problem (see Fig. 33) is that the apparent deflection centre varies with the deflection angle. A correction lens must therefore be interposed between the light source and the mask/screen ensemble. The beam landing accuracy at the corners of the screen depends very much on the design of this lens. For high-resolution tube manufacture Hitachi use a segmented correction lens that gives a closer simulation of the deflected beam paths.

Pitch Grading

To ensure correct purity at the screen edges and corners a reduced beam landing tolerance can be provided by decreasing the size of the mask apertures here. The presence and degree of this "pitch-grading" varies with different makes and types of tube. In current FS tubes a grading factor of 20 per cent is applied at the screen edges. The consequent 20 per cent loss of brightness goes virtually unnoticed by the human eye, largely because of the very gradual transition.

Mask Dissipation

The main problem with shadowmasks relates to heating effects. Depending on the tube design, around 80 per cent of the beam energy is intercepted by the mask. Since the total of the three beam currents with a bright scene and a large-screen tube can exceed 1·2mA at 25kV, mask dissipation can reach 24W. The average dissipation is way below this – say 5-10W for normal pictures and control settings – but the steel of which the mask is made expands as it gets hotter, and particularly where the beam current is strong in a small area (a stationary highlight on the screen) local overheating can occur. The mask then bulges to upset the colour registration at this point – in practice white usually gets a red tint.

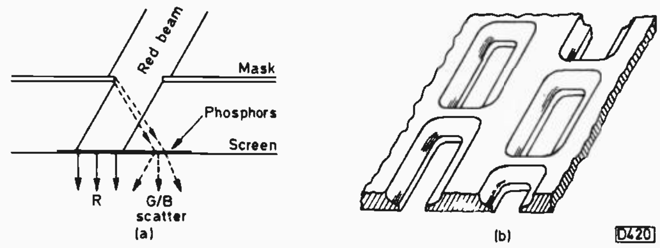


Fig. 31: Shadowmask hole contouring. To prevent the impurity and loss of definition caused by beam scattering – see (a) – the apertures in all types of mask are chamfered. A typical pattern for a slot mask is shown at (b), viewed from the screen side.

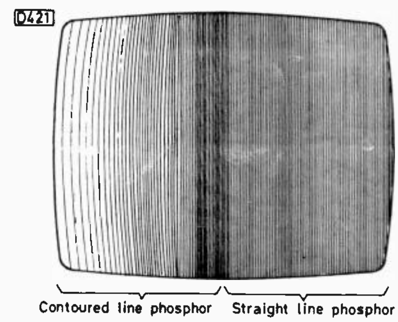


Fig. 32: Phosphor line patterns, new and old. Note the ugly foreshortening of the stripes at the right: contoured line phosphors were introduced in the late seventies.

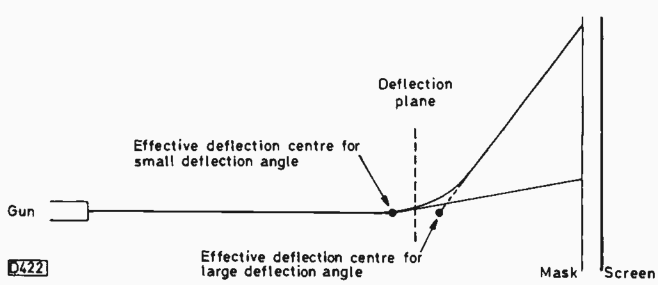


Fig. 33: The deflection centre appears to move forwards as the scan angle increases – the effect is due to the varying curvature of the beam paths.

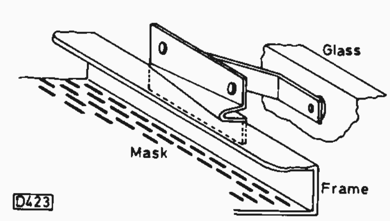


Fig. 34: Heat compensating suspension system for a shadowmask: bimetal mounting strips are used.

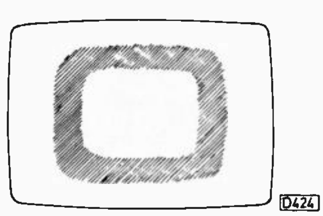


Fig. 35: The areas at risk of being impure during the initial warm up of a conventional shadowmask.

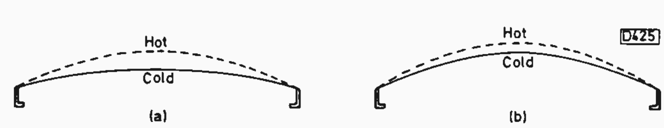


Fig. 36: Conventional shadowmask arrangement (a). Mask expansion has a greater effect on beam landing with this than with the Super Arch Mask shown in (b).

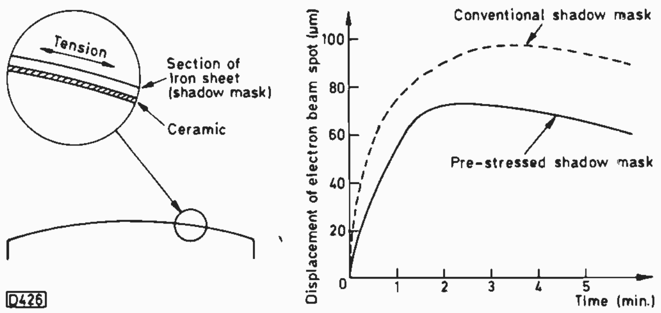


Fig. 37: Applying a ceramic coating to reduce hot bulge.

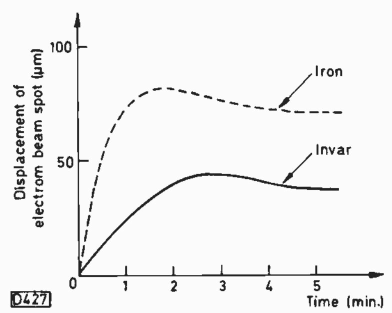


Fig. 38: Invar as an alternative mask material is less affected by high power dissipation.

Heat conductivity away from a hot spot is more difficult with a grille type mask (Trinitron), where in large-screen sizes three horizontal microfine tiebars are welded across the screen to stiffen the fine vertical grille strips. Local conductivity is better with other types of mask due to their continuous nature, though a concentrated stationary highlight can cause impurity with early types of tube, especially when the purity is not set up at centre tolerance or when the beam limiter is not doing its job properly.

Design Aims

Designers of shadowmasks have the triple aims of making the mask more "transparent" to the electron beams, minimising the heat developed in the mask and minimising the effects of their inevitable expansion when they do heat up. Some types of delta-gun tubes have masks with hexagonal rather the circular holes. This gives a small gain in transparency. Even so delta-gun mask transparency never exceeded more than about 17 per cent at the centre and 12 per cent at the corners. This compares with about 21/16 per cent for Trinitron tubes and 19/14 per cent for slot-mask tubes. "Hi-Bri" slot masks just exceed 20 per cent transparency.

Mounting the Mask

The mask would buckle as expansion occurs if it was rigidly mounted, completely upsetting the purity. To prevent this the frame on which the mask is mounted is fitted with bimetal temperature compensating elements on spring arms (see Fig. 34) to permit the whole mask assembly to move along the tube axis (towards the phosphor screen) as it heats up. There are usually four such mounting points that clip on to tapered studs heat-sealed into the panel side walls.

The bimetal mount system doesn't work until the mask and its heavy and thermally inert frame have reached thermal equilibrium. This leads to a risk of purity errors in the first five or ten minutes of operation. The regions most at risk are not at the screen centre, where mask doming has little effect on beam landing, nor at the extreme edges, where the heatsinking effect of the frame prevents rapid rise of temperature. It's the midway areas that suffer (see Fig. 35), and various remedies have been devised by tubemakers.

Super Arch Mask

An early one was RCA's Super Arch Mask, in which a very pronounced curvature is given to the cold mask. As a result, short-term, localised and warm-up expansion effects have much less effect on beam landing. This type of mask has greater slot spacing at the sides, which helps with beam-landing tolerances here but does slightly reduce the brightness at the extreme edges of the picture. Fig. 36 shows the Super Arch principle.

Surface Treatment

Some alternative approaches to the problem involve surface treatment of the mask. A simple and widespread technique is to blacken the mask. Many tubes have the back of the phosphor screen (after aluminising) painted black as well to act as a heatsink of sorts – the large glass screen has the makings of an excellent heat radiator. A further step is to coat the surface of the mask with a low thermal expansion ceramic material then fire it on the steel surface at high temperature in an oven. This leaves considerable residual tension in the mask material when cool – to be relieved in operation as the coated mask warms up. The presence of the ceramic coating reduces the mask temperature for a given dissipation while mask expansion is minimised by the relief of internal tension. The principle is not unlike that of continuous welded railway track. It gives a reduction of about 20 per cent in beam landing error (see Fig. 37).

Invar Mask

For fine-pitch tubes Toshiba use an alternative metal (Invar) for the mask – its coefficient of expansion is much lower than that of steel (see Fig. 38). Invar is more expensive than steel and more difficult to handle, hence its restriction to expensive fine-pitch tubes.

45AX Mounting System

A better way to avoid localised and transient overheating of the mask is to do away with the heavy metal frame and bimetal spring support system with their thermal inertia and long thermal paths. Philips/Mullard have adopted a completely new approach to mask suspension in their 45AX tube system. Here the mask is attached to a light diaphragm which defines the picture borders and is suspended at each corner by a swing link that pivots on a stud fused into the glass. As the mask warms up its expansion forces the suspension links to rotate about their mounting studs, moving the enlarged mask forward towards the screen to maintain correct beam landing. This system reaches thermal equilibrium within fifteen minutes of switch on and is unaffected by ambient temperature. The closer control and more precise placement of the mask allow a larger beam landing reserve.

Coming Next Month

Next month we will continue with screen phosphors.

ECONOMIC DEVICES, PO BOX 228, TELFORD TF2 8QP

15/80H	3.30
15/85R	3.30
16039	0.79
16181	1.04
16182	1.04
16334	0.98
16335	0.94
16446	0.98
16600	1.38
16802	1.27
17052	5.61
17053	5.61
17074	9.30
17089	5.35
17127	3.51
17376	1.58
17523	1.32
17524	1.32
1N4001	0.06
1N4002	0.06
1N4003	0.06
1N4004	0.06
1N4005	0.08
1N4006	0.08
1N4007	0.07
1N4148	0.04
1N4448	0.05
1N5401	0.14
1N5402	0.15
1N5403	0.16
1N5404	0.15
1N5408	0.35
1N914	0.04
IR3403	5.00
1S1555	0.20
1S44	0.10
1S5012A	0.81
1S921	0.10
2N1303	0.38
2N2219A	0.40
2N2222	0.38
2N2646	0.80
2N2904	0.36
2N2905	0.43
2N2906	0.38
2N2926	0.15
2N3053	0.27
2N3054	0.99
2N3055	0.61
2N3442	1.56
2N3702	0.14
2N3703	0.14
2N3705	0.16
2N3706	0.14
2N3707	0.16
2N3711	0.11
2N3771	2.04
2N3772	1.71
2N3773	2.29
2N3819	0.42
2N3823	1.17
2N3904	0.62
2N3908	0.62
2N4101	1.33
2N4240	3.30
2N4444	1.73
2N5293	0.50
2N5294	0.50
2N5296	0.49
2N5297	0.50
2N5298	0.61
2N5771	1.18
2N6109	1.58
2N6130	0.72
2N6133	1.25
2N6180	0.95
2N6292	1.65
2N696	0.43
2N698	0.43
2SA1006	1.50
2SA1011	1.65
2SA1015	0.49
2SA1012	1.25
2SA1020Y	0.86
2SA1027R	0.45
2SA473	0.75
2SA766S	4.95
2SC1173Y	1.25
2SC1474	1.25
2SC1509	1.35
2SD1391RL	3.95
2SA1095	4.10
2SA1103	6.55
2SA329	0.40
2SA351	1.17
2SA489	1.17
2SA490	1.67
2SA493	2.25
2SA562	0.57
2SA564	0.58
2SA614	4.88
2SA628	1.14
2SA639S	1.50
2SA659	0.49
2SA673	1.27
2SA684	1.61
2SA697	0.82
2SA699	1.75
2SA715	0.95
2SA747	8.26
2SA748	1.08
2SA817	0.65
2SA818	1.82
2SA835	2.50
2SA836	0.89
2SA844	0.35
2SA872	0.70
2SA884	2.15
2SA937R	0.97

2SA940	1.81
2SA940-2	2.14
2SA950	0.72
2SA951	1.26
2SA966-Y	1.16
2SA999	1.36
2SB774	1.15
2SB185	1.13
2SB375	3.87
2SB400	0.40
2SB405	1.03
2SB407	3.24
2SB449B	6.93
2SB511	2.50
2SB54	1.39
2SB546	3.75
2SB56	2.80
2SB618A	2.22
2SB631	3.25
2SB643	0.54
2SB669	3.67
2SB681	3.96
2SB695	1.98
2SB75	1.04
2SB774	0.65
2SB819	0.89
2SC1034	6.75
2SC1050	5.06
2SC1096	1.16
2SC1104	3.98
2SC1106	4.54
2SC1114	6.75
2SC1116	4.95
2SC1124	1.26
2SC1129	0.34
2SC1131	0.50
2SC1158	3.33
2SC1162	1.05
2SC1172	2.22
2SC1195	3.26
2SC1212A	1.97
2SC1213	0.89
2SC1226	1.46
2SC1293	0.90
2SC1306	1.98
2SC1316	4.10
2SC1317	0.87
2SC1364	0.49
2SC1383	1.20
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2SC1398	0.94
2SC1413A	3.05
2SC1446	1.25
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2SC1475	0.37
2SC1505	1.00
2SC1514	1.41
2SC1573Q	1.25
2SC1578	8.74
2SC1583	1.17
2SC1617	3.89
2SC675	1.41
2SC1678	1.98
2SC1741	1.25
2SC1810	1.70
2SC1815	0.66
2SC1826	0.65
2SC1829	2.22
2SC1875	5.19
2SC1881K	2.98
2SC1893	3.02
2SC1906	0.98
2SC1921	1.37
2SC1923	1.07
2SC1929	2.25
2SC1942	5.70
2SC1945	4.53
2SC1959	0.31
2SC1957	1.09
2SC1953	1.93
2SC1962	1.93
2SC1969	3.10
2SC1983	8.35
2SC1985	0.55
2SC2009	0.34
2SC2029	2.33
2SC2028	2.11
2SC2063	0.99
2SC2078	2.39
2SC2073	1.54
2SC2085-Q	1.40
2SC2091	1.30
2SC2141	1.86
2SC2166	1.98
2SC2216	0.69
2SC2233	2.20
2SC2236	1.65
2SC2278	1.14
2SC2314	2.17
2SC2335-KI	10.41
2SC2551	1.26
2SC2565	3.36
2SC2570	1.85
2SC2577	1.75
2SC2578	6.75
2SC2671	1.99
2SC2826	2.07
2SC288A	1.45
2SC3153	5.26
2SC372	1.40
2SC373	1.16
2SC383	1.33
2SC388	0.50
2SC394V	0.81
2SC403C	0.39
2SC41	2.19
2SC458	0.39
2SC495	0.92
2SC515A	2.85

2SC535	0.79
2SC536	0.41
2SC537	0.54
2SC605L	1.16
2SC620	1.46
2SC643A	1.54
2SC668	0.67
2SC681	4.40
2SC682	1.88
2SC684	1.65
2SC693	0.63
2SC710	0.69
2SC711A	0.50
2SC717	1.28
2SC734	1.43
2SC761-Y	0.95
2SC783	3.98
2SC790Y	1.64
2SC828	0.28
2SC867A	3.05
2SC876	0.96
2SC930	0.54
2SC935	4.13
2SC936	8.66
2SC940	4.68
2SD1128	2.90
2SD1138	0.99
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2SD1453	0.75
2SD152K	2.64
2SD198	3.87
2SD234	0.49
2SD235	0.60
2SD24	2.29
2SD257	2.94
2SD292	2.59
2SD313	2.59
2SD325D	1.95
2SD348	16.13
2SD350	5.20
2SD350A	2.80
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2SD401	2.55
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2SD471	2.13
2SD560	2.95
2SD588A	1.99
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2SD601R	0.65
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2SD621	12.85
2SD636	0.55
2SD639-R	0.85
2SD655	0.98
2SD657	2.85
2SD661A	0.80
2SD731	2.45
2SD773	0.33
2SD811	5.54
2SD823	1.98
2SD837	1.20
2SD841	3.65
2SD856	2.25
2SD857Q	1.84
2SD882	1.50
2SD894	1.50
2SD898	5.45
2SK105H	2.15
2SK152	2.95
2SK34	0.76
2SK41	1.07
2SK79	2.98
40408	0.50
40594	1.53
40636	1.43
4EX581	0.80
741	0.30
7805-T022	0.63
7806	0.73
7808	0.85
7812-T022	1.16
7815	0.64
7818	0.92
7824	0.64
7905	0.80
9368	10.70
AA133	0.12
AC133	0.12
AC123K	0.43
AC127	0.27
AC128	0.34
AC138	0.24
AC141	0.29
AC142K	0.44
AC151	0.28
AC176	0.30
AC179	0.28
AC183	0.72
AC187	0.39
AC187K	0.43
AC188	0.25
AC188-01	0.49
AC188K	0.43
AC193K	0.65
AC194K	0.65
AD140	1.06
AD143	1.25
AD145	1.60
AD161	0.56
AD162	0.45
AD262	1.25
AF114	2.47
AF115	1.24
AF118	1.20
AF127	0.50
AF139	0.53
AF178	1.45
AF179	0.55

AF180	0.55
AF181	0.53
AF186	0.53
AF239	0.43
AF279	0.88
AL113	1.36
AN115	3.98
AN155	1.89
AN206	2.58
AN208	3.55
AN210	2.28
AN211	3.25
AN214Q	2.75
AN231	14.65
AN234	5.92
AN236	3.78
AN239	6.95
AN240P	1.52
AN241	1.71
AN245	4.49
AN253	2.97
AN260	3.85
AN262	1.98
AN272	7.92
AN281	6.65
AN295	5.52
AN301	5.55
AN302	3.99
AN303	4.39
AN305	9.47
AN315	2.46
AN316	5.53
AN318	6.27
AN320	5.47
AN321	2.25
AN322	5.85
AN331	4.59
AN337	5.37
AN340P	1.17
AN355	5.98
AN362	1.75
AN370	3.95
AN5010	5.70
AN5111	2.92
AN5120N	4.50
AN5132	4.39
AN5250	2.89
AN5435	3.08
AN5610	7.43
AN5612	3.81
AN5613	3.80
AN5630	3.95
AN5701N	1.66
AN6250	2.95
AN6300	7.00
AN6310	8.74
AN6320N	4.28
AN6340	6.46
AN6341	2.40
AN6342	1.61
AN6363	16.00
AN6371	9.24
AN6387	7.95
AN6531	1.95
AN6551	1.35
AN6552	0.68
AN661D	2.40
AN6677	6.60
AN7111	1.45
AN7114E	5.94
AN7115	1.75
AN7120	4.65
AN7145	2.80
AN7146	4.35
AN7151	2.26
AN7156	2.85
AN7158	6.75
AN7218	1.64
AN7223	4.25
AU107	3.50
AU110	2.25
AU113	5.25
AY105K	2.08
AY106	1.09
BA524	8.21
B250	2.65
B40	1.55
BA130	0.14
BA1310	1.98
BA1320	1.38
BA1322	3.95
BA1330	2.75
BA145	0.19
BA148	0.33
BA154	0.40
BA155	0.12
BA156	0.05
BA159	0.15
BA182	0.24
BA222	1.66
BA302	1.24
BA311	1.32
BA312	0.97
BA313	0.76
BA317	0.08
BA318	0.09
BA328	4.77
BA333	1.37
BA335	6.27
BA5102A	3.78
BA511	2.92
BA514	2.25
BA521	2.02
BA524	8.94
BA526	7.98
BA527	2.98
BA532	1.56
BA536	2.95
BA6209	4.75

BA656	8.99
BA7100	10.85
BA841A	16.72
BA843	3.96
BA854	5.76
BAV18	0.21
BAV19	0.11
BAV20	0.31
BAV21	0.34
BAW62	0.19
BAX12	0.44
BAX13	0.11
BAX16	0.11
BC107	0.13
BC107A	0.11
BC107B	0.18
BC108	0.15
BC108B	0.15
BC109	0.12
BC109B	0.15
BC109C	0.12
BC113	0.14
BC119	0.36
BC126	0.20
BC132	0.14
BC135	0.14
BC137	0.18
BC138	0.34
BC139	0.28
BC140	0.45
BC141	0.34
BC142	0.34
BC143	0.33
BC147	0.08
BC148A	0.10
BC148B	0.13
BC148C	0.11
BC149	0.11
BC149B	0.13
BC153	0.14
BC154	0.14
BC159	0.36
BC160	0.40
BC161	0.28
BC168	0.36
BC169C	0.16
BC170	0.16
BC171	0.11
BC172	0.13
BC172B	0.27
BC173	0.17
BC174B	0.27
BC177	0.20
BC178	0.26
BC179	0.26
BC182	0.09
BC182L	0.10
BC182LB	0.14
BC183L	0.11
BC183LB	0.26
BC184	0.13
BC184L	0.14
BC184LB	0.26
BC186	0.27
BC187	0.28
BC204	0.16
BC207	0.14
BC212	0.11
BC212B	0.26
BC213L	0.10
BC213LB	0.15
BC214	0.10
BC214LB	0.26
BC225	0.40
BC237	0.10
BC237BJ	0.12
BC238	0.10
BC238A	0.13
BC238B	0.13
BC239	0.12
BC239B	0.25
BC251A	0.12
BC294	0.50
BC300	0.35
BC301	0.45
BC302	0.53
BC303	1.04
BC307	0.18
BC307A	0.14
BC308	0.18
BC308A	0.11
BC309	0.17
BC317A	0.13
BC327	0.15
BC328	0.11
BC337	0.09
BC338	0.34
BC368	0.24
BC440	1.09
BC441	0.44
BC454	0.36
BC460	0.42
BC461	0.47
BC462	1.15
BC463	0.64
BC477	0.37
BC478	0.32
BC479	0.41
BC532	0.28
BC546	0.17
BC547	0.10
BC548	0.10
BC549	0.10
BC550	0.40
BC556	0.16
BC557	0.10
BC558	0.10
BC559	0.10
BC559B	0.11

BC560C	0.14
BC635	0.36
BC636	0.42
BC637	0.24
BC639	0.20
BC640	0.24
BC879	0.39
BC880	0.31
BCX34	0.40
BCY70	0.30
BCY71	0.21
BCY72	0.20
BD115	0.46
BD116	0.70
BD124	1.31
BD124P+KIT	0.69
BD131	0.42
BD132	0.42
BD133	0.53
BD135	0.36
BD136	0.26
BD137	0.36
BD138	0.46
BD139	0.34
BD140	0.37
BD144	1.70
BD150	1.25
BD157	0.67
BD160	1.60
BD163	0.71
BD165	0.62
BD166	0.42
BD168	0.73
BD175	0.60
BD179	0.49
BD181	0.99
BD182	0.99
BD183	0.99
BD184	1.21
BD187	0.53
BD189	0.69
BD190	0.69
BD201	0.53
BD202	0.60
BD203	0.50
BD204	0.59
BD207	1.79
BD208	1.23
BD222	0.49
BD225	0.49
BD228	0.63
BD229	1.05
BD232	0.50
BD234	0.42
BD237	0.47
BD238	0.39
BD239	8.45
BD240	0.37
BD241	0.39
BD242	0.39
BD243A	0.37
BD243C	0.79
BD244	0.51
BD244C	0.79
BD245C	0.99
BD246C	0.89
BD253	1.05
BD278A	0.80
BD317	2.60
BD318	2.85
BD375	0.42
BD380	0.76
BD410	0.52
BD433	0.47
BD434	0.49
BD435	0.49
BD436	0.60
BD437	0.49
BD438	0.40
BD441	1.42
BD442	0.66
BD509	1.42
BD510	1.07
BD519	1.50
BD529	1.32
BD530	1.10
BD533	0.67
BD534	0.53
BD535	0.79
BD536	0.61
BD537	0.74
BD538	1.45
BD544B	0.83
BD598	1.25
BD677	0.53
BD679	0.57
BD680	0.76
BD681	1.48
BD696	2.47
BD699	3.49
BD700	3.70
BD707	1.06
BD709	1.12
BD710	0.80
BD809	0.75
BD810	0.69
BD879	0.74
BD880	0.79
BD895	2.31
BD899	2.48
BD901	0.79
BD902	0.84
BDW83C	1.56
BDW84C	1.56
BDX32	1.75
BDX53A	4.93
BDX53B	3.35
BDX54B	2.16
BDX62A	2.15

BDX63A	1.96
BDY20	1.21
BDY81	1.18
BF115	0.40
BF117	0.66
BF118	0.67
BF121	0.25
BF123	0.13
BF127	0.13
BF137	0.29
BF153	0.58
BF154	0.26
BF157	0.33
BF158	0.18
BF159	0.18
BF160	0.31
BF167	0.38
BF173	0.34
BF177	0.35
BF178	0.40
BF179	0.36
BF180	0.36
BF181	0.32
BF182	0.34
BF183	0.39
BF184	0.43
BF185	0.39
BF194	0.14
BF195	0.14
BF196	0.17
BF197	0.16
BF198	0.17
BF199	0.17
BF200	0.37
BF218	0.36
BF224	0.17
BF237	0.65
BF240	0.17
BF241	0.17
BF245	0.50
BF245A	0.37
BF245B	0.49
BF246A	2.52
BF255	0.20
BF256	0.28
BF256LB	0.42
BF256LC	0.42
BF257	0.34
BF258	0.36
BF259	0.34
BF262	0.57
BF263	0.57
BF271	0.34
BF273	0.20
BF274	0.20
BF324	0.23
BF336	0.33
BF337	0.40
BF338	0.44
BF355	0.49
BF362	0.66
BF363	0.60
BF371	0.50
BF391	0.25
BF417	0.84
BF418	1.87
BF422	0.29
BF423	0.52
BF450	0.35
BF451	0.29
BF457	0.41
BF458	0.39
BF459	0.52
BF460	1.56
BF469	0.31
BF470	0.55
BF471	0.31
BF472	0.33
BF479	0.61
BF480	1.38
BF491	1.99
BF495	0.64
BF506	0.43
BF509	0.41
BF523	0.24
BF532	0.45
BF596	0.18
BF597	0.27
BF694	0.22
BF757	0.59
BF759	0.47
BF761	1.05
BF762	0.75
BF869	0.65
BF870	0.30
BF959	0.42
BF960	0.69
BF970	0.69
BFR39	0.44
BFR61	0.50
BFR62	0.50
BFR79	0.29
BFR81	1.65
BFR86	1.08
BFR89	1.63
BFR90A	1.30
BFT42	0.43
BFT43	0.43
BFT84	0.40
BFW10	0.60
BFX29	0.34
BFX84	0.37
BFX85	0.41
BFX86	0.36
BFX87	0.55
BFX88	0.34
BFX89	0.44
BFY50	0.32
BFY51	0.50

BFY52	0.27
BFY79	0.49
BFY90	0.61
BLY49	2.20
BR00	0.22
BR01	0.75
BR03	0.75
BR03	1.26
BRC116	0.67
BRC300	2.01
BRC5296	0.77
BRC6109	0.83
BRC82	1.08
BRC83	2.19
BRC84	2.08
BRX44	0.60
BRX49	0.53
BRY39	0.69
BSS38	0.87
BSTB0140G	5.25
BSTC0246	7.25
BSTC0233	7.25
BSTCC0143	3.07
BSTD1043	2.85
BSV57B	3.49
BSW68	0.60
BSX19	0.34
BSX20	0.34
BSY52	0.50
BSY79	0.51
BT100A	1.61
BT106	1.55
BT108	1.45
BT119	1.76
BT120	2.17
BT121	2.48
BT123	1.98
TBA970	3.06
BT151-800R	1.15
BTT6018	2.42
BTT8124	4.89
BU106	2.48
BU108	1.50
BU109	2.25
BU110	5.69
BU111Y	4.16
BU125	2.48
BU126	1.55
BU137	9.25
BU205	1.08
BU206	1.27
BU207	1.65
BU208	1.12
BU208/02	1.97
BU208A	1.12
BU208D	1.95
BU209	1.93
BU226	2.95
BU326	2.00
BU326A	2.20
BU326S	2.20
BU406	1.49
BU406D	1.79
BU407	0.82
BU407D	1.09
BU412	9.15
BU426A	1.67
BU500	1.95
BU508A	1.89
BU536	5.80
BU608	2.65
BU705	4.07
BU806	1.79
BU807	0.80
BU826A	2.15
BUW84	1.39
BUX84	1.00
BUX85	1.10
BUY69A	2.04
BY126	0.13
BY127	0.13
BY133	0.11
BY164	0.47
BY176	0.52
BY179	0.62
BY182	1.05
BY184	0.47
BY187	0.77
BY189	1.79
BY198	1.62
BY201/2	1.50
BY203/20	0.59
BY207	0.22
BY208	0.46
BY210-400	0.18
BY210-600	0.27
BY210-800	0.34
BY218	1.64
BY223	1.23
BY224-600	1.88
BY225-100	1.13
BY226	0.25
BY227	0.49
BY228	0.60
BY229-1000	1.12
BY229-600	0.92
BY255	0.69
BY295-600	1.03
BY298	0.20
BY299	0.60
BY407	0.84
BY409	1.49
BY448	0.69
BY713	1.10
BYW19/1000	0.69
BYW56	0.34
BYX10	0.29
BYX55-600	0.19
BYX71-600	1.25

BYX71-350	0.72
BYX94	0.14
BYY56	1.20
BZY93C30	1.86
BZY88 RANGE	0.10
BZX61 RANGE	0.18
BZX79 RANGE	0.10
C106D	0.46
C106M	0.76
C1129	0.58
CA3046	2.06
CA3089	0.83
CA3090AQ	3.25
CA3094	2.20
CA3131EM	3.12
CBF16848N-071	1.56
CD4001	0.38
CD4002	0.27
CD4008	1.35
CD4011	0.29
CD4012	0.24
CD4013	0.47
CD4016	0.46
CD4017	0.82
CD4020	1.23
CD4021	0.39
CD4023	0.28
CD4025	0.64
CD4028	0.84
CD4040B	0.85
CD4047	1.06
CD4049	0.46
CD4052	0.75
CD4066	0.38
CD4069	0.29
CD4070	0.66
CD4081	0.35
CD4093	0.72
CD4511	1.10
CD4528	2.04
CD4556	3.47
CR02AM-8	1.55
CV12E	3.07
CX095D	3.14
CX104	9.64
CX108	10.50
CX109	7.86
CX130	8.76
CX134	11.04
CX136	11.49
CX139	11.83
CX157	4.84
CX158	4.10
CX177	6.75
CX187	5.26
CX755	12.95
CX885A	6.85
DEC1	2.20
DEC2	2.20
DS3486N	4.33
DS3487N	4.33
E1222	0.40
E5024	0.28
E5386	0.25
E9003	0.46
E9005	0.50
ESM310BP	4.15
FND500	5.78
GC374	1.65
GD243	4.95
GF758	0.84
GH3F	1.82
HA11215	5.06
HA11211	2.53
HA11225	4.29
HA11226	8.71
HA11229	2.88
HA11235	2.48
HA11124	5.25
HA11244	2.82
HA11251	4.47
HA1125	4.29
HA1137W	2.87
HA1138	5.03
HA11414	5.65
HA1144	7.87
HA1156	1.16
HA1160	4.78
HA1166	5.25
HA1166X	5.36
HA1167	5.36
HA11706	9.50
HA11705	8.00
HA11703	9.56
HA11701	9.56
HA11710	9.50
HA11713	8.13
HA11711	20.16
HA11715	8.13
HA11714	7.76
HA11716	13.10
HA11725	18.26
HA11725MP	16.00
HA117555P	6.23
HA11781	8.90
HA1180	5.15
HA1196	7.43
HA13001	6.25
HA1306	2.26
HA1338	7.50
HA1339	2.33
HA13402	7.87
HA13342	2.65
HA13365	4.02
HA1366WR	1.86
HA1367	4.32
HA1368R	2.45
HA1368	1.90
HA1370	3.71

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

TEL 0902 712083 TELEX 338490

HA1374	4.80
HA1377	3.96
HA1389R	2.05
HA1389	2.39
HA1392	3.90
HA1394	3.95
HA1397	3.76
HA1398	3.98
HA1406	2.07
HA1452	1.63
HBF4030AF	2.48
HD14538	2.07
HD38702-A2	7.45
HD38750A53	8.71
HD38750A-7	7.25
HD38800A50	14.09
HD44801A05	18.25
HEF4001BP	0.67
HISH1010	8.59
HISH1004	6.00
HISH1002	9.50
HM6231	9.81
HM6232	8.89
HM6251	5.70
HM7103	2.46
HM9032	3.22
HM9012	3.22
HM9015	3.24
HT4207	17.16
HT4208	18.25
IN5401	0.11
IR2403	4.25
IR2C05	4.25
IR3P06	2.25
IR3P08	4.95
IR94558	6.25
IS751	2.85
ITT425	0.18
IZ0003GE	5.37
IZ0020GE	5.93
K174YP	3.46
KA2101	2.92
KC581C	6.32
KC582C	3.97
KC583C	5.54
L200CV	1.69
LA1201	1.02
LA1210	1.56
LA1230	2.87
LA1320	2.87
LA1352	1.75
LA1357N	11.07
LA1363	7.25
LA1364	3.02
LA1365J	3.44
LA1385	1.94
LA1387	7.60
LA3155	1.25
LA3301	1.65
LA3350	1.43
LA3361	1.23
LA3365	3.98
LA3390	4.25
LA4030P	4.20
LA4031P	3.20
LA4032P	2.35
LA4100	1.25
LA4101	1.30
LA4102	2.81
LA4112	4.83
LA4125	2.25
LA4138	3.38
LA4140	1.15
LA4192	4.29
LA4220	1.62
LA4250	6.75
LA4400	2.25
LA4420	1.72
LA4422	1.72
LA4430	1.56
LA4440	4.95
LA4445	7.25
LA4460	2.32
LA4461	2.95
LA4505	5.94
LA5112N	2.65
LA7020	7.33
LA7025	8.05
LA7027	9.35
LA7040	9.20
LA7042	4.25
LA7800	2.65
LA7801	4.15
LB1274	3.08
LC7800	9.20
LD3120	1.13
LD3150	2.25
LM1017N	4.29
LM1877	10.92
LM224	1.75
LM2808	5.94
LM2877	4.93
LM317CKC	1.38
LM324N	0.75
LM339N	0.80
LM340K	11.85
LM342P	1.62
LM342P	1.62
LM342P	1.62
LM348N	2.15
LM380N	2.80
LM384N01	3.25
LM567CN	1.71
LM6402/011	10.23
LM6402A093	10.15
LM748	1.82
LM8360	3.87
LM8361	3.57
LR2612	11.95

LR3419	9.37
LR3471	9.37
LU1141	7.27
LU52012	5.95
LU52011	4.95
LU03112	12.37
M193	12.75
M21C	1.00
M23C	0.83
M293	9.15
M51102L	6.35
M5115P	5.24
M51203L	3.15
M51231P	3.04
M5134-9341	4.13
M51353P	5.25
M51381P	4.50
M51393AP	7.78
M51394P	11.97
M5142P	5.49
M5144P	4.25
M51513L	2.55
M51515BL	3.23
M51517L	3.71
M5192	2.20
M5194AP	5.74
M5231L	1.95
M53274P	1.33
M54532P	2.15
M54544L	4.75
M58478P	6.75
M58485P	10.74
MA06	1.07
MA8001	0.82
MA8003	1.16
MB3705	1.98
MB3712	1.85
MB3713	1.69
MB3730	3.25
MC13002	3.55
MC1310P	2.25
MC1327P	1.33
MC1330P	1.69
MC1350P	1.61
MC1351P	3.96
MC1352P	2.50
MC1357P	2.15
MC1358P	1.55
MC14001	2.40
MC14013	0.41
MC14493P	3.44
MC14494P	2.15
MC14497	3.65
MC14510BAL	3.75
MC14511BCP	1.10
MC14528BCP	2.70
MC1712	3.88
MC5192	13.50
MC7724CP	3.49
MC7818C	2.18
MCR100/7	1.65
MCR106-5/6	0.95
MCR220/7	2.28
ME0402	0.17
ME0404/2	0.47
ME0411	0.28
ME6002	0.26
ME6102	0.28
ME8001	0.34
ME0411	0.75
MJ2501	3.30
MJ3001	1.69
MJ481	1.53
MJ802	5.45
MJE2955	1.89
MJE3055	1.65
MJE340	0.49
MJE520	0.49
ML231	3.33
ML232B	2.15
ML237B	2.51
ML238	5.77
ML923	3.30
ML926	3.58
MM5314N	4.02
MM5316N	4.25
MM5318N	3.11
MM5369N	2.01
MM5387AA/N	6.20
MM5841N	6.64
MN1400VL	9.96
MN1405	9.52
MN1435VX	11.48
MN6016A	20.56
MP1192	5.07
MP2794	4.00
MP2812	5.07
MP8512	1.57
MPC596	2.13
MPF256C	0.60
MPS6570	0.48
MPSA42	0.65
MPSA56	0.27
MPSA92	0.45
MPSU05	0.86
MPSU10	1.56
MPSU56	0.64
MPSU60	1.33
MR818	0.33
MR854	0.72
MR914	1.20
MSM5816RS	17.35
MSM5840H	9.15
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R2029	1.33
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R2354A	2.01
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R2443	0.88
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R2540X	3.30
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X0056CE	5.11
X0057GE	6.00
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X0065CE	5.75
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X0077GE	15.96
X0079CE	4.95
X0092CE	4.95
X0096CE	4.29
X0109CE	10.90
X0113CE	2.07
X0195CE	4.00
X0204CE	8.74
X0261CE	8.75
X1222AF	3.63
IX0111CE	2.95
Y969	0.82
TDA3310	2.15
ZPY120	0.95
ZTK33	0.43

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The Operation of Electric Motors

Part 1

Mike Phelan

Most of the components we have to replace from time to time in consumer electronics equipment are relatively inexpensive – capacitors, resistors and the like. There are also more costly items such as cathode-ray tubes, wound components, etc. These are not normally scrapped without at least trying to do something with them. With VCRs, another group of expensive bits and pieces has joined the ranks. Of these the two that carry the highest prices are the video head assembly and the various motors. Sadly both have a limited life, due to mechanical wear.

Video head drums can now be refurbished by specialist companies. But to the best of our knowledge no equivalent facility is available for the motor, despite the fact that one of these can easily cost more than a video head assembly for the same machine.

This series of articles will attempt to redress the balance, by outlining the theory of electric motor operation and providing a few practical hints on how a motor can possibly be retrieved from the scrap bin and put to further service. We hasten to add that such a motor could be less reliable than a new one and that it's often not practical to attempt repair. But if we stuck to the principle of fitting new replacements every time we had to deal with a failure there would be no need for such things as tube boosters – maybe not even of switch cleaner! In addition one is quite often stuck for a part that's not immediately available: attempting a repair in these circumstances is quite justified.

The electric motor comes in many shapes, sizes and types. They can be broadly divided into two groups: the a.c. induction type and the universal commutator type that will run from an a.c. or a d.c. supply. We'll deal with the theory of each separately, though if you go back to first principles they are fundamentally the same. Indeed it's debatable to which group the direct-drive brushless motors we now have in VCRs belong. Table 1 shows a sort of motor family tree: we've left out types that are not relevant to the sort of equipment with which we are concerned – you won't find a three h.p. three-phase motor in a VCR (despite the propensity of some users to try to squeeze various large objects into the cassette slots of their machines . . .).

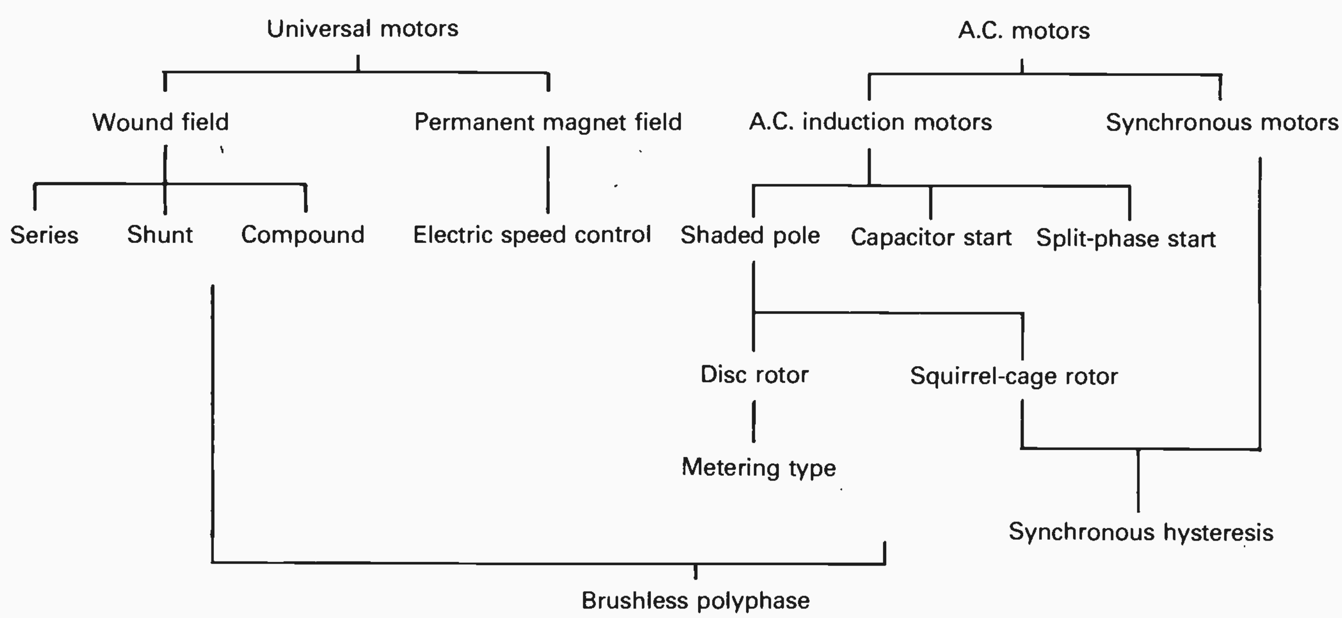
Basic Theory

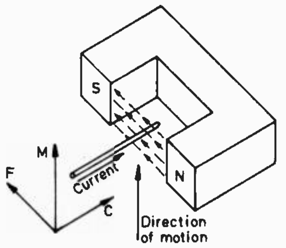
To return to the theory (sorry!), the basis of all electric motors is that a conductor carrying a current will try to move when positioned in a magnetic field. Its direction of movement depends on the directions of the flow of current and the magnetic field. Fleming's left-hand rule (see Fig. 1) gives the relationship between these three characteristics. If the left hand is held with the thumb, the first finger and the second finger at right angles to each other, then with the first finger (F) pointing in the direction of the magnetic field and the second finger (C) pointing in the direction of current flow the thumb (M) will point in the direction of motion of the conductor. In practice it's probably not necessary to know this. Suffice it to say that any conductor carrying a current will tend to move at right-angles to a magnetic field. As far as an electric motor is concerned the magnetic field may be provided by a permanent or an electromagnet and the current may be supplied to or induced in the conductor.

The AC Induction Motor

We'll discuss the a.c. induction motor first. As its name suggests, its operation depends on inducing a current into something. This type of motor was used in some first-

Table 1: Types of electric motor.





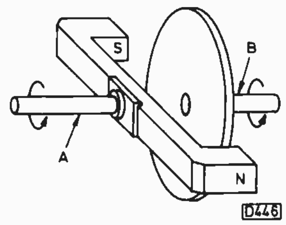
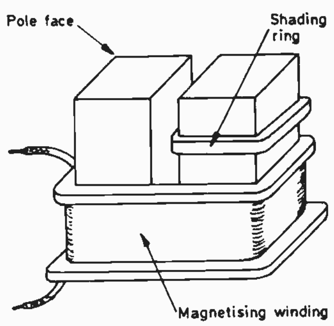


Fig. 1 (left): Fleming's left-hand rule.
Fig. 2 (right): Elements of a simple induction motor.



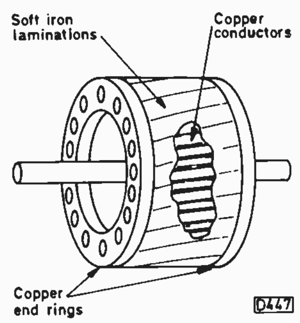


Fig. 3 (left): The shaded-pole arrangement.
Fig. 4 (right): The squirrel-cage rotor.

generation VCRs. It was also used with the motor-driven turret tuners employed in some television sets made in the sixties. Consider the arrangement shown in Fig. 2, consisting of a horseshoe magnet embracing a disc of conductive material, e.g. aluminium. If we rotate shaft A which carries the magnet shaft B will attempt to follow it but will never reach the same speed. This effect is due to induction: rotating the magnet around the disc will induce a current in the disc – this is in effect a dynamo. What we have here is the converse effect of the reaction between a magnet and a current carrying conductor – we'll refer to this as repulsion henceforth. The current induced in the disc by the rotating magnet repels the disc which thus tries to follow the magnet. It can never reach the same speed since if there was no relative movement between the two there would be no induced current in the disc.

If a mechanical load is applied to shaft B the disc will slow down. But the relative motion between the disc and the magnet, and therefore the induced current, will increase, thus giving more torque to drive the load. It can be seen that if we replace the mechanically driven magnet with a rotating electromagnetic field we shall have a motor of sorts. If you think that the device with the disc is useless, consider the situation when the disc's shaft is spring loaded and the disc carries a pointer. This will indicate the speed of shaft A and is the principle used for speedometers and revolution counters.

Producing a Rotating Field

We now have the makings of an electric motor but require a method of producing a rotating field. If instead of shaft A and its associated magnet in Fig. 2 we have a stationary electromagnet that's energised by a source of alternating current the direction of the magnetic field will reverse itself at twice the frequency of the a.c. This is not quite a rotating field but if shaft B, carrying the disc, is spun in either direction it will continue to rotate in that direction. The reason for this is that although a pulsating field cannot get the disc to rotate in either direction from rest the repulsion principle will provide sufficient impulse to maintain rotation if the disc is already rotating. This will become clearer when we come to consider synchronous motors.

All we now require to produce a motor to run on a.c. is some means of providing a rotating field to start the motor. If this rotating field is maintained for running the motor the result will be a smoother delivery of torque. One way of providing a rotating field, used in many small motors, is the "shaded pole" arrangement. The polepiece (see Fig. 3) is split into two lobes: around one of them there's a copper ring that acts as a shorted turn. The effect of this is that the flux in this half of the pole is delayed in its growth and decay as the current reverses. The moving field thus produced across the polepiece provides sufficient torque to overcome the initial inertia of the disc.

Rotors

At this point we should mention that a disc is not the usual form of rotor, as this part of an a.c. motor is called (the stationary part is called the stator). The type of rotor normally employed is the "squirrel cage" type – I decline to offer a reason for this odd term. The squirrel cage rotor (see Fig. 4) consists of a laminated soft iron cylinder, slotted or punched to carry typically about twenty axial copper rods, and two copper end rings into which the rods are soldered or riveted. Aluminium is sometimes used for the rods. The laminations, and thus the rods, are usually given a slight helical twist to provide smoother running. As you can see the rods form conductors which are connected in parallel by the end rings. A laminated core instead of an air core is used for greater magnetic efficiency: lamination is necessary to prevent currents being induced in the iron – its resistance would give rise to heating as a result of such "eddy currents".

This type of motor was used in the Philips N1500 VCR and in many autochanger mechanisms. It gives a fairly constant speed which is always just below the field's speed of rotation. The latter, for a two-pole motor run off a 50Hz mains supply, is 3,000 r.p.m. So the motor will run at something like 2,850 r.p.m. Incidentally this is the highest speed that can be achieved from an induction motor running off a domestic 50Hz mains supply – you cannot have fewer than two poles. A four-pole motor runs at approximately 1,425 r.p.m. – most audio motors were of this sort. The shaded-pole motor performs reasonably well with very light loads but always runs hot, due to the loss introduced by the shorted turns.

The disc rotor was actually used in some early gramophones, with a copper rotor some ten inches in diameter driving the 78 r.p.m. turntable directly. It also drove a governor of the brake variety – a hangover from the earlier spring-driven motors – as a result of which the motor ran at less than its free-running speed. This made the speed independent of the load.

The induction-disc motor is far from dead. Almost all of us use at least one. The humble electricity meter consists of an induction-disc motor loaded with a permanent magnet brake, with a winding in series with the house supply as well as one across it. This means that the speed depends on the energy supplied by both windings – in fact the product of current and voltage, i.e. watts. As the disc rotates in time it measures watts multiplied by time – kilowatt-hours.

Our saga will continue next month with more types of a.c. induction motor.

Servicing Sinclair Microcomputers

Part 4

Ken Taylor

Last month we dealt with the main parts of the Spectrum, including the CPU, ROM, ULA and 16K RAM. Fig. 1 showed the main computing circuitry (issue 3 version) while Fig. 4 showed the voltage stabiliser and generator circuits. Fig. 5 this month completes the Spectrum circuit: it covers the tape recorder input and output and sound sections, and the video circuits. You'll find several references to Figs. 1-4 in this month's article: these refer to last month's diagrams.

The 32K Extension RAM

Before looking at these new areas of the circuit there are a few points that remain to be dealt with concerning last month's circuitry. The first of these is the extension memory. This section, using IC15-IC26, extends the RAM memory from the initial 16K to 48K. It was originally an optional extra, with sockets provided to enable these i.c.s to be fitted later. So you sometimes find that these i.c.s can be easily removed for checking or for eliminating a possible source of trouble. The extension memory chips are IC15-IC22 and may be Texas TMS4532 or OKI MSM3732 chips – the memory chips must all be of the same type. These are both 64K DRAMs with only 32K of serviceable area. This area is sometimes in the address range zero to 32K and sometimes in the range 32K to 64K. This is why there's a link panel on the printed board (between the MIC socket and the edge connector – see Fig. 2 last month). The connections required for the various memory permutations are as follows:

Memory chip	*Links required*
Texas TMS4532-3	TI and 3
Texas TMS4532-4	TI and 4
OKI MSM3732-H	OKI and H
OKI MSM3732-L	OKI and L

The pin connections for these chips are shown in Fig. 6. Pin 9, which is normally the A7 address connection, is here referred to as AR – high/low memory address select: it's connected to either 5V or 0V depending on whether the useful memory area is high or low.

The other chips associated with the extension memory

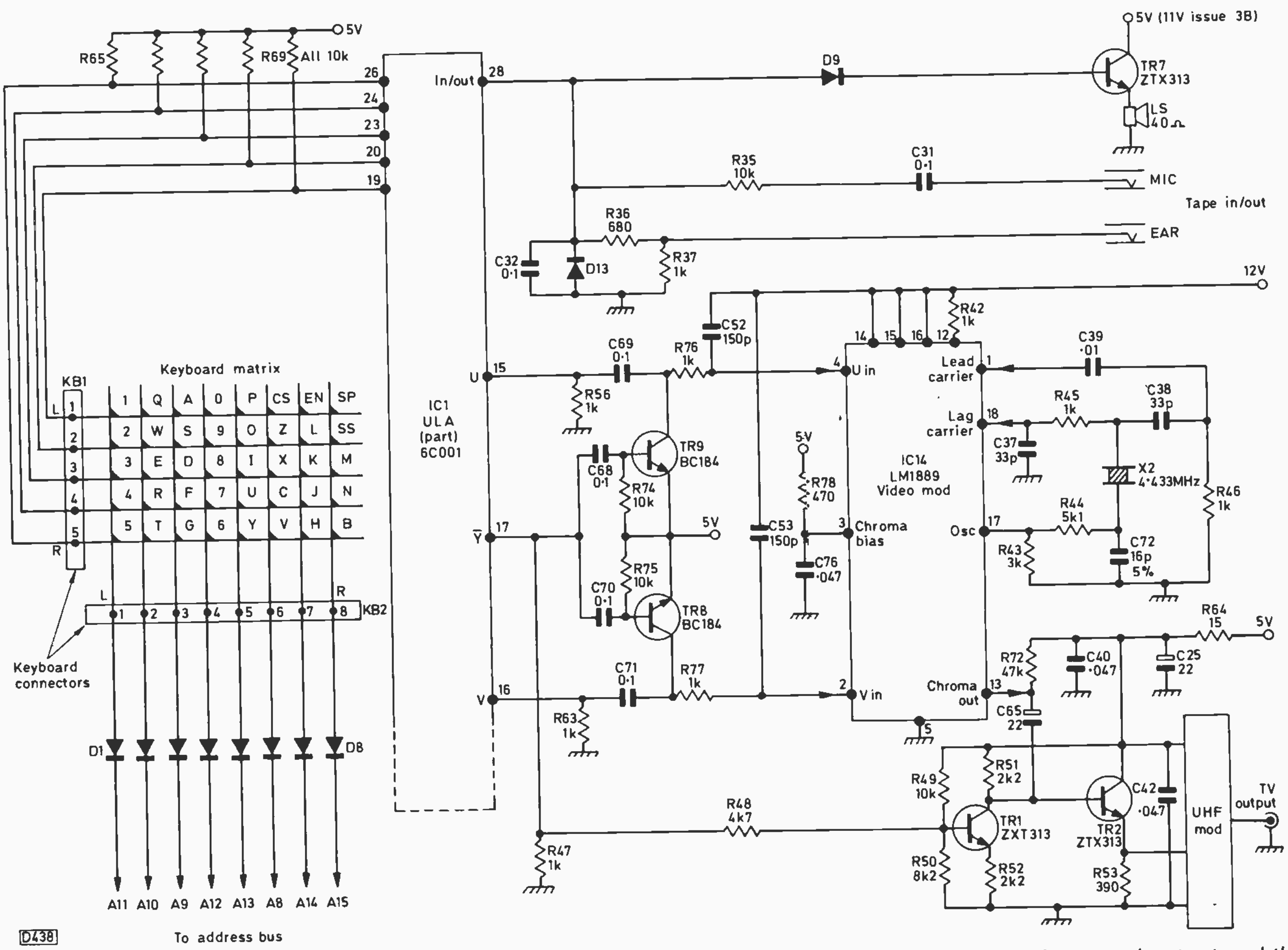


Fig. 5: Final part of the Spectrum issue 3 circuit diagram, showing the keyboard matrix, the tape input and output and the video and TV output circuitry. Note that C65 is 0·1µF in some issues of the Spectrum, also that to simplify the circuit many of the supply line decoupling capacitors have been omitted, also the edge connector connections (see Table 3). R47, R56 and R63 were 220Ω in early versions: C72 is present in issue 3B versions. Some pin numbers were missed off IC3/4 last month: R23 goes to pin 12, R22 to pin 4, R21 to pin 7, R20 to pin 9, R19 to pin 12, R18 to pin 4 and R17 to pin 7.

are the address decoders (IC23 and IC24) and the row/column multiplexers (IC25 and IC26). The decoders activate the memory only when the A15 address line is high, thus setting the address range from 32768 (decimal) upwards.

While we're discussing addresses it's worth noting the memory map for the Spectrum. The 16K ROM starts at address zero and is followed at 16K (16384 decimal) by the 16K RAM (the 4116 chips). This continues to address 32767 and is followed by the 32K extension memory which carries on to the final address of 64K (65535). The model description – 16K or 48K Spectrum – indicates the size of the RAM. The 48K model often has a label on the underside.

RAM Checks

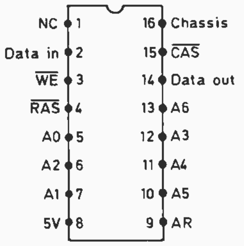
When you've finished a repair, especially when it has involved removing the extension memory, it's good practice to check that the entire memory is operational. This is a simple matter since one of the tasks in the initiation program is to determine the maximum usable memory available. This data is needed by the computer and is therefore stored in one of the system variables. Access is by entering the following line:

PRINT PEEK 23732 + 256 * PEEK 23733 (Enter)

Note that print and peek are words on the keys. The printout should be 65535, or 32767 if it's a 16K model. Any shortfall indicates that there's a memory fault that will have to be traced. If it's simply a defective memory chip diagnosis should be possible using the computer, because each i.c. is responsible for the same binary data bit at each of its addresses. If we can find the faulty bit in the data word and we know which i.c. handles which bit we shall be home and dry.

The above check will have told us that the faulty address is the one beyond the printout address number. We now need to find out which bit at this address is wrong. To do this we put 85 at this address, using the command poke. If you remember your binary you will know that 85 is 01010101. We next read what is in the address, using peek, and see if there's an error. If there is we can tell which i.c. is responsible because we know which data line goes to which i.c. (see Fig. 1). We also know that D0 is the least significant digit – the one at the right-hand end – and D7 the most significant digit, the first figure on the left.

So there we are. Except that an error may not show if the faulty cell registers the same digit we've put into it. In this case try again, this time putting in 170 which swaps the bits to 10101010. This must reveal the culprit.



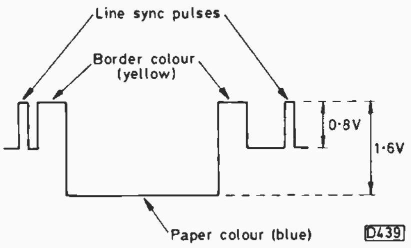


Fig. 6 (left): Pin connections for the 32K extension memory chips. Pin 3 is write enable, pin 4 row address strobe, pin 9 high/low address select, pin 15 column address strobe.

Fig. 7 (right): The TV line waveform at pin 18 of the edge connector when the computer is displaying a yellow border, blue paper and no characters.

Table 1: RAM check procedure.

The following routine will isolate a fault at one address of the RAM:

(1) Enter the following:
PRINT PEEK 23732 + 256 * PEEK 23733

(2) If the result is other than 65535 or 32767 (16K version) there's a fault.

(3) Add one to the faulty result. Let's say it was 54321. Enter:
POKE 54322,85 (Enter)
then:
PRINT PEEK 54322 (Enter)
Use your result + 1 in place of the example quoted above.

(4) If the answer returned is 85, repeat step (3) using 170 instead of 85.

(5) One of the answers should differ from the 85 or 170 entered. Provided there is only one faulty i.c. at the address, Table 2 will indicate which one it is. Find the line with the wrong data bit then refer to IC6-13 if the address is below 32768 or IC15-22 if the address is above 32768.

(6) Repeat step (1) after the repair to ensure that there isn't another fault.

Table 2: Identifying the faulty chip.

Wrong answer obtained from procedure given in Table 1	*Wrong data bit*	*Defective chip 16K*	*32K*
84 or 171	0	IC6	IC15
87 or 168	1	IC7	IC16
81 or 174	2	IC8	IC17
93 or 162	3	IC9	IC18
69 or 186	4	IC10	IC19
117 or 138	5	IC11	IC20
21 or 234	6	IC12	IC21
213 or 42	7	IC13	IC22

If you don't want to exercise your binary skills, Table 1 lists the check procedure and Table 2 the faulty i.c. against the number read out. Remember that the system works only for a single fault at an address, though it's unlikely that there will be more than one when all the rest of the memory is operational. But there may be a fault at a higher address, so repeat the procedure until the correct final address has been obtained.

ROM Check

The program given below will enable you to verify that the ROM is satisfactory:

```
10 LET 1=0
20 FOR n=28003 TO 28033
30 READ a
40 LET 1=1+a
50 POKE n,a
60 NEXT n
70 DATA 17,0,64,62,0,33,0,0,1,0,0,134,48,2,3,63,35,
   29,32,247,21,32,244,50,96,109,237,67,97,109,201
80 IF 1=2033 THEN GO TO 110
90 PRINT "Error in Data"
100 STOP
110 RANDOMIZE USR 28003
120 PRINT PEEK 28000 + 256 * PEEK 28001 + 65536 *
PEEK 28002
180 STOP
```

This will work with either make of ROM and should return the number 1926175. If "Error in Data" appears you've entered a wrong number in line 70. Incidentally if you remember that the ZX81 ROM check took over a minute to run you may be surprised at the speed of this one. Although the ROM is twice the size the check uses machine code, giving an almost instantaneous result. This is a measure of the difference between BASIC and machine code: when you consider that apart from all the addressing procedures etc. over 16000 additions have been made in the time you can see the potential speed of the CPU.

A connection link similar to that for the RAM is provided for the ROM. It provides for fitting a chip of either NEC or Hitachi manufacture. The link is no longer used since current ROMs work with either set of connections.

The Keyboard

Like the ZX81, the Spectrum's keyboard is of membrane construction wired in matrix form with decoding by the CPU. The keyboard (see Fig. 5) is scanned by sequentially putting a low on each of the address lines A8 to A15 and monitoring the data lines D0 to D4. If a key is pressed the appropriate pin of the ULA chip is pulled low: this is transmitted to the relevant data line via an inverter in the ULA.

Fault diagnosis is straightforward – the usual faults are in the tails that connect the membrane to the sockets. A fault here affects either a row or column of keys. It's a simple task, with the aid of the diagram, to determine which tail is at fault. If the whole keyboard is dead a quick check is to make connections across from one socket to the other in place of the keyboard. This can also be done quite safely when the keyboard is removed for servicing the computer. No damage will be done even if more than one socket contact is shorted.

The Spectrum Plus keyboard has an extra complication. In order to simulate the pressing of two keys by operation of one of its special keys it has a double-layer membrane. The connections between these are made by clamping the tails together, print side to print side, using a plastic clamp. This is not entirely satisfactory and can lead to some unexpected characters appearing. Replacing the Spectrum Plus keyboard is much simpler than with the earlier model however since it's assembled with screws instead of double-sided adhesive tape.

Keyboards are relatively cheap and as they often take a lot of punishment it's expedient to replace any that give trouble.

Tape and Sound Circuits

The tape recorder input and output and the speaker are always operated independently so only one pin of the ULA is used for all three. This combined circuit also provides a sound output from the speaker when the recorder is loading. There are few components in this area and it should be a simple matter to check that the circuit is working correctly. As a guide, a 5V peak-to-peak signal at the EAR socket should give a 2V p-p signal at the ULA. With almost all such tests however the best guide is to compare the suspect signal with that in a good machine. In this particular case, if the signal is o.k. but there's no

Table 3: Connections to edge connector pins.

Pin	*Component side (top)*		*Underside*	
1	A15	(1)	A14	(1)
2	A13	(1)	A12	(1)
3	D7	(1)	5V	
4	NC		9-11V	
5	Slot		Slot	
6	D0	(1)	Chassis	
7	D1	(1)	Chassis	
8	D2	(1)	Clock. ULA pin 32	
9	D6	(1)	A0	(1)
10	D5	(1)	A1	(1)
11	D3	(1)	A2	(1)
12	D4	(1)	A3	(1)
13	$\overline{\text{INT}}$. CPU pin 16		$\overline{\text{IORQULA}}$. ULA pin 33	
14	$\overline{\text{NMI}}$. CPU pin 17	(2)	Chassis	
15	$\overline{\text{HALT}}$. CPU pin 18	(2)	U.H.F. modulator input	
16	$\overline{\text{MREQ}}$. CPU pin 19		$\overline{\text{Y}}$. ULA pin 17	
17	$\overline{\text{IORQ}}$. CPU pin 20		V. ULA pin 16	
18	$\overline{\text{RD}}$. CPU pin 21		U. ULA pin 15	
19	$\overline{\text{WR}}$. CPU pin 22		$\overline{\text{BUSRQ}}$. CPU pin 25	(2)
20	−5V		$\overline{\text{RESET}}$. CPU pin 26	
21	$\overline{\text{WAIT}}$. CPU pin 24	(2)	A7	(1)
22	12V		A6	(1)
23	−12V	(3)	A5	(1)
24	$\overline{\text{MI}}$. CPU pin 27	(2)	A4	(1)
25	$\overline{\text{RFSH}}$. CPU pin 28	(2)	$\overline{\text{ROMCS}}$. ULA pin 34	(4)
26	A8	(1)	$\overline{\text{BUSAK}}$. ULA pin 23	(2)
27	A10	(1)	A9	(1)
28	NC		A11	(1)

Notes: (1) These pins connect directly to the CPU address or data lines.
(2) Some CPU control lines are used in the Spectrum, some are not. The latter connect only between the CPU and the edge connector and are not shown on our circuit diagrams.
(3) Sinclair refer to this as −12V. It actually connects to TR4's load coil (see Fig. 4). TR4's collector waveform superimposed on a d.c. voltage is present at this pin.
(4) This pin does not connect directly with pin 34 of the ULA: it goes to the ROM side of R33, at its junction with the ROM link (see Fig. 1).

loading the ULA must be at fault. From bitter experience I'd recommend that you make this test before quoting for the job: the ULA is the most expensive item in the computer, costing over eight pounds at present, so it's not the sort of pricing detail to overlook.

The tape output at the MIC socket should be sufficient to produce a clean recording on a standard mono tape recorder. As this level is rather low the easiest check is to save a simple one or two line program then check that it loads.

Colour and Video Circuits

The colour and video section is where you come into your own. At least you can work on signals you recognise, even though they are being assembled into a composite video signal rather than being decoded from it.

The initial organisation of the display is carried out by the ULA, which every fiftieth of a second reads the display file – the memory area that holds the display details – and produces U, V and inverted-Y output signals. The U and V signals are fed to pins 4 and 2 respectively of the LM1889 video modulator chip IC14 which produces a standard PAL chroma output signal at pin 13. The chip incorporates a 4·43MHz oscillator which, in conjunction with the external crystal network, produces phase-shifted subcarriers at pins 1 and 18. The inverted-Y output from the ULA is inverted by TR1 and added to the chroma signal at the base of TR2. The resultant composite video output is then fed to a standard Astec u.h.f. modulator which produces an output on channel 35.

If the sound output works all right but there's a problem with the display you'll need to check the circuit with a scope. One of the best points for making checks, if you have a suitable socket, is at the edge connector (see Table 3). Pin 15 on the underside of the connector is the u.h.f. modulator's video input, pin 16 carries the inverted-Y signal from pin 17 of the ULA while pins 17 and 18 carry the ULA's V and U outputs. With the computer initiated, i.e. switched on, and no key pressed pins 17 and 18 will carry only the sync pulses. These are positive-going and of 0·8V p-p amplitude. If a colour border, or paper, is displayed blocks appear between these sync pulses. Fig. 7 shows a typical waveform but you must appreciate that the amplitude and polarity of the signal, i.e. whether it's above or below the sync base line, changes with the colour.

With a full-screen display the inverted-luminance signal at pin 16 is a normal looking TV line signal of 2·5V p-p with no colour burst. The colour burst is very pronounced at pin 15, which carries the u.h.f. modulator's input signal. The overall signal here is only 1V p-p however.

The Edge Connector

Having just referred to the edge connector, this seems a good point at which to provide the details of this output port. It's a double-sided 28-pin board-edge connector – sockets to mate with it are readily available. Every useful line in the computer is brought out to a pin and the connector provides a ready means of linking the computer to the outside world. Rather too ready at times since, as I've said before, my belief is that most of the damage to these machines occurs when devices are fitted or removed without first switching off.

Next month we'll review some of the differences between earlier and later versions of the Spectrum.

Saturday Plight Fever

Chris Avis

Why does it all happen on Saturdays? From Monday to Friday business is just hectic: on Saturday the temperature rises to a fever pitch that no self-respecting fusible resistor would tolerate. Witness a few events during a typical Saturday in the life of yours truly. . .

8·30 a.m. Open shop-cum-workshop, then open bleary eyes and see Friday's leftover Ferguson 3765B (TX10, early version) on the bench. Complaint intermittent tripping. Find h.t. rail correct at 150V. Original focus unit replaced with improved version a few months before. Try further replacement anyway, just in case. Leave set on test.

9·00 a.m. Reconditioned Philips 550 (G8 chassis) running on display appears to have slight lack of height. About to remove back and adjust when first customer arrives with Rank T20 chassis (fortunately in cabinet).

"It's been going off for several weeks, but we could always get it back with a thump. Now it's gone right off."

Resist temptation to say it's probably concussed, agreeing instead with owner's request to collect set after lunch in time for wrestling – or boxing? TX10 trips again, but no tube flashover. T20 reveals an assortment of classic faults, including a short-circuit BU208A line output transistor and burnt pin 1 of connector 5Z1 on the line output panel. The BU208A's 1Ω base resistor (5R8) has been replaced with a 2·2Ω resistor and the 910Ω resistor (4R16) in the 12V regulator circuit with two paralleled 470Ω 1W resistors in series with one 680Ω 2W resistor! 5R8 replaced with a 1Ω, 4W resistor and 4R16 with a 1kΩ, 1W resistor mounted half an inch off the board. New BU208A fitted, set switched on and adjusted. Good picture, left on test.

10·00 a.m. TX10 back on bench. Decide to disconnect e.h.t. and focus leads from tube and try again.

10·15 a.m. Philips 550 definitely loosing height – and width too. Must investigate before potential buyer appears but diverted by arrival of Prinz T125 monochrome portable and Amstrad CTV1400 colour portable, closely followed by respective owners. Prinz "comes on then blacks out", Amstrad "makes loud buzzing noise but there's no sound or picture". Both owners happy to collect on Monday – considerate, my customers.

Tackle Prinz first and discover sound o.k. but dark, fluctuating picture with low e.h.t., then no picture. Start signing "Some day my Prinz will come on", beat time on chassis with screwdriver and picture appears. Remember common fault associated with TO3 cased line output transistors and tighten this one's mounting nuts and bolts: e.h.t. now normal with good picture.

11·00 a.m. Amstrad CTV1400 sounds like wasp sprayed with freezer. H.T. rail at zero. Switch off, extract nearly twenty sewing pins from surface of main PCB and switch on – wasp still shivering. For two pins feel like giving up, but lengthy search reveals just those very items still clinging to the line linearity coil's magnet and shorting across to the collector of the line output transistor. No damage caused, thanks to power supply protection circuitry. (Female owner later confessed to keeping needlework box on top of set – makes a change from flower vases.)

12·00 a.m. TX10 hasn't tripped for two hours. Reconnect e.h.t. lead only and try again. Philips 550 now no picture or sound with the h.t. down to 100V on the BA13 power supply panel. Parallel 100kΩ resistors R1386/1373 in the charging/phase shift network look immaculate but one is open-circuit. Replacement restores status quo (and picture).

12·30 p.m. Early lunch break, necessitated by diabetes and early breakfast.

12·45 p.m. Investigate previously reconditioned Thorn 1590 12in. monochrome portable that had misbehaved recently when demonstrated to an interested customer. The picture rolled erratically, though the set had appeared to be o.k. on test earlier. Sync crushing in the i.f. stages suspected, perhaps due to an a.g.c. fault? The voltage readings around the first two i.f. amplifier transistors VT2/3 were o.k. but closer inspection revealed that they had both been replaced at some time with BF194s. The correct BF196 is appropriate for forward a.g.c., the BF194 isn't, hence ineffective a.g.c., excessive i.f. amplification and crushed sync pulses. Fitting the correct transistors cured the trouble. The set was put back on the shelf to await further interest.

1·45 p.m. Still no hiccups from the TX10: reconnect focus lead and switch on again – set trips once then runs normally. Watch closely for ages (at least two minutes) but no repeats. Interrupt vigil to serve customer with Shure N70B stylus at £6·24 including VAT (Valuable Avis Time). "I've tried everywhere but nobody has them. One place said they could order it for £15 then tried to sell me a new cartridge." No wonder I'm still struggling. TX10 takes another trip. Remove focus connector cover on tube base but no clue at spark gap. Could it be?. . . Order new base from HRS and hope.

2·30 p.m. Mr. Karate calls and collects his satisfactorily performing T20. Says he can manage to load set into car boot unaided but tries to take shop door frame with him as he passes through.

Door remains intact enough to admit gentleman with Sony TV121 12in. monochrome portable. "The picture is very bright with poor contrast and won't keep still, then it almost disappears. Someone has looked at it and says the high gain control may be faulty but it would have to be looked at by a Sony approved dealer." Doubt whether Sony would approve of several Ghastly Catastrophic Semiconductor conversions I've successfully done to KV1810s, KV2000s etc. thanks to helpful *Television* articles but promise to search diligently for "high gain control". Fortunately this proves unnecessary as the picture is large enough for a 20in. tube and the l.t. rail is 15V instead of 11·6V due to a faulty error detector/driver transistor (Q602, type 2SC1209) in the series regulator circuit. Fit BC338 and find set none the worse for overdose of electronic adrenalin but put it on soak test to convalesce.

3·30 p.m. Mr. Karate returns with T20 and red face. "It's just the same as when I brought it in to you and paid good money for you to fix it." Well he didn't quite put it that way but that's what it amounted to. Set immediately checked on bench. Trips when switched on. Find plug 5Z2 on line output panel half off and EW modulator driver transistors 4VT17/18 damaged. Customer had put set into car boot on its back, which had pushed against 5Z2's plastic locating peg. Transistors replaced, 5Z2 refitted (peg length cut by 50 per cent) and set placed face down on back seat of car, all "under guarantee". We live and learn – though live and earn would be better.

4·00 p.m. Just the set to end the week comes in – a Sony KV1810 Mk. I with no sound or picture. Set plugged in with sinking heart and preparation for last rites when gloom is pierced by noise on sound and raster on screen, though attempts to tune in signals are thwarted by wildly erratic tuning voltage variations. Voltage at tuning supply stabilising zener diode D209 o.k. so channel selector unit replaced with one from scrapped set. No difference. These sets have a tuning meter to show the approximate channel positions. It's driven by a transistor (Q215, type 2SA678) whose base is connected to the selected tuning voltage. Fitting a BC213L in this position restored stable tuning and good performance to this ten year old Senior Sony, but how long before Guesswhats Commit Suicide?

So another week drew to a close as a weak and drawn engineer locked up and tilled up. Good, there's enough to see us through Sunday and some left over for the VAT return and the morgage and the rates and the Inland Revenue and. . . Oh well, at least the replacement TX10 tube base eventually cured the tripping. Makes it all worthwhile, doesn't it?

Resistor Troubles

Gordon Haigh

A good number of TV faults are due to resistor troubles of one sort or another. Here's a collection of resistor faults worth noting.

Thorn TX9 chassis: In the event of a poor, dark degraded picture with perhaps only the highlights present check the value of R233 (390kΩ, changed in late production sets to 300kΩ) which is in series with the first anode preset control. For reduced height or almost complete field collapse check R268 (1·5MΩ) and R269 (1·8MΩ) which are in series with the height control – in the early version of the chassis (main panel PC1001) a single 3·3MΩ resistor is fitted in this position (R268). If R223 (panels PC1001 and PC1040) is burning or distressed it's certain that the line driver transistor VT67/TR67 is faulty, also the 15V zener diode W87/D87: the replacement resistor should be a 470Ω type.

Thorn 3500 chassis: If the 10Ω wirewound resistor R751 on the convergence panel fails plenty of smoking, burning and damaged components will need replacing.

Fidelity CTV14R/CTV14S (ZX2000 chassis): If R826 (39Ω, 1W) goes high in value the chopper transistor TR13 will soon fail.

Grundig 2210/2222/2252R/5012/6022: The trouble with one of these sets was no +B supply (14V) for the line generator/driver circuits. This supply is derived from a mains transformer which also supplies the c.r.t.'s heaters. The mishap here was that the fine primary wires were too close to R615 (4W) and R643 (7W): having got toasted and brittle they'd finally gone open-circuit.

A point to note with any Grundig set using a cluster of vertical wirewounds and with an unstabilised h.t. supply is that the h.t. can be alarmingly high, say over 300V when it should be around 280V, if surge limiter/dropper resistors have been replaced with types of the wrong value. I had a case where over-generous resoldering had unwittingly shorted one out.

Autovox 2284GB/2684GB etc.: Failure of the resistors in the focus control network is a common problem and getting replacements is often difficult. The focus VDR (type E298ZZ/103) from a GEC, Decca or ITT hybrid colour chassis can be used instead with a series resistor – see Fig. 1.

JVC 7440GB: The problem with one of these sets, which had been fitted with a newly regunned tube, was alarming picture size expansion accompanied by clicking noises. I turned the h.t. down from 120V to the correct 110V but there was no change. All roads led to the tripler but the circuit I had showed this as a "black box" – no internal details were given. Experiments with universal types were not successful – the original is a special (it's a special price too at nearly £60). Feeling lumbered with the set and having a bit of spare time I decided to attempt an economy repair. After painstakingly removing the soft rubbery filler from the original tripler I found that all the original components could be recovered and that the design was conventional though with three additional 47MΩ resistors to provide a feed for the focus control (see Fig. 2). Using a universal tripler as a replacement, with the three recovered 47MΩ resistors, a stable, well focused picture was obtained though there are annoying brightness changes with camera switches (any ideas?). A complete waste of time? Not quite: I found out how the tripler had failed – the series resistor R had burnt out.

Harnesses and leads: I've been caught out on occasion through not tying up harnesses. I always now watch that the wires near the dropper in the G8's power supply don't touch the dropper – amongst other things the field output transistors don't then need to be changed. When the chassis is hinged up in solid-state Decca sets I always watch the RGB leads.

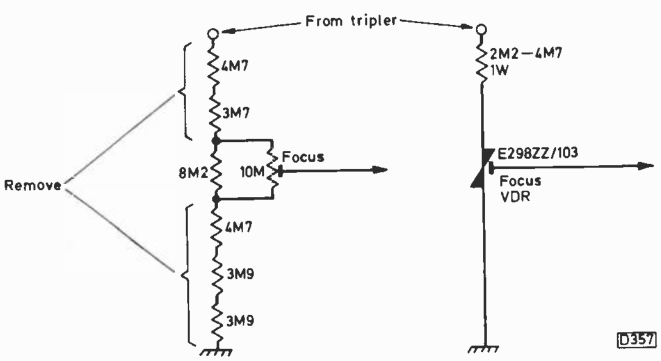


Fig. 1: Autovox focus circuit conversion – original circuit shown on the left. Bolt the focus v.d.r. to the right-hand heatsink on the Autovox chassis, high up, using a plastic nut and bolt.

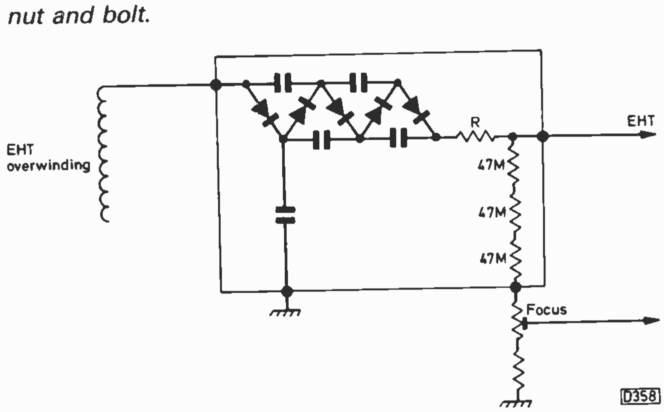


Fig. 2: JVC 7440GB tripler circuit.

Long-distance Television

Roger Bunney

Long-distance television reception conditions improved greatly during May. Many long, intense Sporadic E openings produced reception from most parts of Europe while several signals were received from Arabic sources. Here's a general log of SpE reception in the UK:

7/5/86 ORF (Austria) ch. E2A; TSS (USSR) R1, 2; TVR (Rumania) R2; ARD (West Germany) E2; RAI (Italy) IA; +PTT (Switzerland) E2; TVE (Spain) E2, 3.
8/5/86 CST (Czechoslovakia) R1, 2.
9/5/86 SR (Sweden) E2, 3, 4; CST R2; RTP (Portugal) E3; TVE E2, 3.
10/5/86 RAI IA; TVE E2, 3, 4; TSS R1.
11/5/86 TVE E2, 3, 4; RAI IA; ORF E2a; CST R1; TVP (Poland) R1; MTV (Hungary) R1.
12/5/86 TVE E2.
13/5/86 +PTT E2.
14/5/86 TSS R1; MTV R1.
15/5/86 TSS R1, 2, 3; CST R1; MTV R1; TVP R1, 2; JRT (Yugoslavia) E3; RAI IA, IB.
16/5/86 TSS R1, 2, 3, 4; YLE (Finland) E3, 4; SR E2, 3, 4; NRK (Norway) E2, 3, 4; TVP R1, 2; DR (Denmark) E3, 4; ARD E4; DFF (GDR-East Germany) E4; MTV R1; RAI IA; TVE E2, 3, 4; TVE-2 E2; RUV (Iceland) E3, 4.
17/5/86 NRK E2, 3, 4; SR E2, 3, 4; MTV R1; TSS R1, 2, 3, 4; TVP R1, 2; YLE E3, 4; +PTT E4; RUV E3, 4.
18/5/86 TSS R1; RUV E4; NRK E2, 4; RAI IA.
20/5/86 RAI IA.
21/5/86 CST R1, 2; MTV R1, 2; TSS R1, 3; TVR R2; JRT E3, 4; RAI IA, IB; ORF E2a.
22/5/86 RTP E3; TVE E2, 3, 4; TVE-2 E2.
26/5/86 TVE E3, 4; RTP E3; RAI IA, IB; JRT E3, 4; MTV R1, 2; TVR R1; ARD E2; RTS (Albania) IC.
27/5/86 RUV E4; NRK E2, 3; SR E2, 3; TVE E2, 3, 4.
28/5/86 TVE E2, 3, 4; RAI IA, IB; ARD E2, 3, 4; +PTT E2, 3; ORF E4; JRT E4.
29/5/86 NRK E2, 3, 4; SR E2.
30/5/86 TSS R1, 2, 3, 4; TVP R1, 2, YLE E3; RUV E3, 4; CST R1, 2; ORF E2a; ARD E2; MTV R1; RTS IC; RTP E3; TVE E2, 3, 4; +PTT E2; JRT E3, 4.
31/5/86 TSS R1, 2; RAI IA; NRK E2, 3, 4; SR E3; TVE E2, 3, 4; ARD E3; TVP R1, 2; RTM (Morocco) E4.
1/6/86 RUV E3, 4; NRK E2, 3; TVE E2, 3, 4; RAI IA.
2/6/86 SR E2; TSS R1, 2; TVP R1.
3/6/86 DFF E4; TSS R1, 2; RAI IA; TVP R2, 3.
4/6/86 TSS R1; RAI IA, IB; +PTT E2.

An extremely busy month then, with several points of interest. On the 15th and 16th the SpE m.u.f. reached the 2m (144MHz) amateur band – at 1900GMT on the 15th and for the whole morning from 0915 GMT on the 16th, the latter giving reception from Sweden, the USSR, etc.

At 1100GMT on the 16th Cyril Willis (Norfolk) noted a ch. E4 programme that went to Arabic credit titles at 1119. The same programme was visible on ch. E3 but much weaker. Any ideas? At 1358GMT on the 26th Cyril received a ch. E3 signal with poor picture quality and, in poor English, the following words: "Good evening. The Royal Garden Company will now play . . .". The signal was from the SSE. Thoughts are maybe NTA Nigeria, though the "good evening" would perhaps be too early! Again, any ideas?

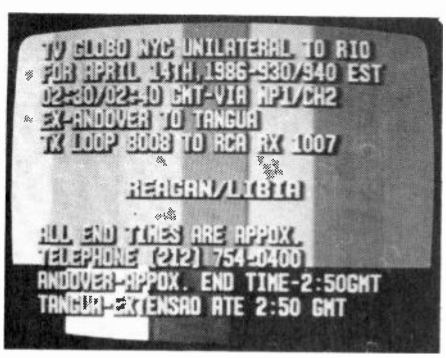
At 1403GMT on the 30th Cyril received RUV ch. E4, a very strong signal that was followed by and changed with a much weaker, fluttery and rolling signal. The latter could have been a 525-line signal on ch. A2. Later that day Tony Privett logged Arabic singing/chanting along with TVE on ch. E3 at 1647GMT. The following day Tony hit the jackpot with RTM (Morocco) ch. E4 at 1599-1620GMT, showing an Arabic film. The signal was from the south west.

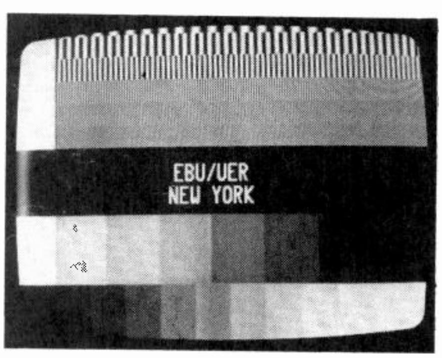
I had myself noted Arabic singing at 1356GMT on the 30th: the signal was at 52·8MHz, probably an obscure harmonic. On the same day here NCT or another Italian (ch. IA) private station was noted with a most unusual test card, vaguely resembling the FUBK pattern but with a prominent series of black/white squares across the top and a moving (right to left) caption at the lower centre.

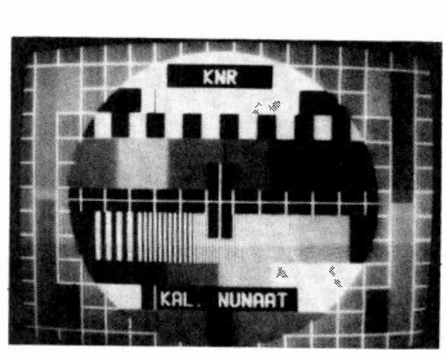
Other reception notes are few. A small aurora was noted in Scotland on May 6th. There was a tropospheric lift over the 24-25th, giving DXers in the central and southern UK high-level signals from W. Germany and the Benelux countries in Band III and at u.h.f. Dave Shirley and Tim Anderson (Hastings) have both received French TV5 signals from Paris ch. E30 and Maubeuge ch. E32. Thanks to the following for reception reports to supplement my own log: Derek Juniper (Angus), Roger Pates (Nottingham), Reg Roper (Torpoint), Bill Cotteril (Tipton), Iain Menzies (Aberdeen), Tony Privett (Basingstoke), Simon Hamer (Powys), Cyril Willis (Norfolk), and Dave Shirley and Tim Anderson at Hastings.

News Items

France: The TV5 and TV6 networks are being distributed







Left: Newsfeed via Satcom F1 transponder 5 during the Libyan crisis, showing the signal routing. Centre: Newsfeed from New York to A2 France. Both photos from Frank Lumen in Denver. Right: The PM5544 test pattern put out by Kalaallit Nunaata Radioa, Nuuk, Greenland. Six ch. E10 transmitters operate in the south west of the country with powers around 1-5W.

throughout mainland France by the Telecom satellite, in scrambled form to prevent unauthorised viewing. Close examination of off-air signals along the south coast of the UK should reveal telltale random black ends to the scanning lines to confirm scrambling.

Denmark: The new TV2 network should commence operations in 1988, with twelve main regional transmitters and eventually fill-in relays where necessary. The service will be independent of Danmarks Radio (DR) and will be commercially financed. A 100W ch. E9 relay is at present operating near the main ch. E7 Sonderjylland transmitter.

Stereo sound: The Italian RAI-3 network (u.h.f.) is at present experimenting with stereophonic sound, using the two-carrier system. There are some two hours of stereo transmissions a week. In the USA NBC is gradually converting its entire system to stereo: over twenty hours of stereo broadcasts a week are at present being transmitted from fifty main stations covering 47 per cent of mainland USA, with satellite signal distribution.

Satellite news: The 4GHz Intelstat bird at 31°W has ceased operations. Libya (transponder 17) and Argentina (transponder 24) have moved to the Intelstat satellite at 27·5°W. NTA (Lagos) is on transponder 19 with "appalling quality" – the sound is likened to speech down a cardboard tube! The USSR has been testing a new satellite, with three TV channels at 32dBW level, at 11°W. TSS-1 remains on the 3·675GHz satellite at 14°W. Thanks to Nick Harrold for this information on 4GHz transmissions.

An unusual Ku band aerial was shown by the US firm Focus Technology at a recent exhibition. It's a flat, frequency-selective device made from a two-inch thick sheet of aluminium on which concentric parabolas are machined. The feedhorn is mounted at the focal point of the centre parabola.

On a personal note, I was surprised to see lightning flashes displayed on the picture while watching the CNN Europe 11GHz feed via a 2m dish during a heavy thunderstorm! Then down came the summer rain, the picture became noisy and virtually disappeared with loss of syncs. The picture gradually returned to the noise-free condition as the torrent subsided.

Multi-standard TV Receivers

The use of multi-standard TV sets with automatic switching between standards is increasing. Luxor, Salora and Grundig all produce such sets. Our Brussels correspondent recently bought a Grundig P40/242/90 which can tune over 48-340MHz plus u.h.f., has 99 channel memory selection and a wide range of fine tuning. It covers systems B/G, L, I and D/K with switching between PAL/NTSC/SECAM – the NTSC option is useful for watching AFN-TV in suitable locations. The set's coverage includes the S channels used for cable distribution. Because losses are greater at u.h.f. than v.h.f. in a cable system there's a tendency for cable operators to convert to v.h.f. Table 1 lists S channel allocations.

Table 1: S channel allocations.

Ch.	*Bandwidth (MHz)*	*Ch.*	*Bandwidth (MHz)*	*Ch.*	*Bandwidth (MHz)*
S2	111-118	S14	251-258	S26	342-350
S3	118-125	S15	258-265	S27	350-358
S4	125-132	S16	265-272	S28	358-366
S5	132-139	S17	272-279	S29	366-374
S6	139-146	S18	279-286	S30	374-382
S7	146-153	S19	286-293	S31	382-390
S8	153-160	S20	293-300	S32	390-398
S9	160-167	S21	302-310	S33	398-406
S10	167-174	S22	310-318	S34	406-414
S11	230-237	S23	318-326	S35	414-422
S12	237-244	S24	326-334	S36	422-430
S13	244-251	S25	334-342	S37	430-438

Belgian variations: S1-S10 referred to as M1-M10, S11-S19 as U1-U9, S20-S37 not used. Belgian channel S1 is 69-76MHz, S2 76-83MHz, S3 83-90MHz.

Narrow-band IF Amplifier

The use of a narrow i.f. bandpass response for weak signal reception or for improved selectivity during an intense SpE opening gives greatly improved results. Most established DXers use a degree of switched selectivity. Originally use of a 405/625-line dual-standard receiver would do the trick, the 405-line section providing the narrow vision i.f. bandwidth required. Subsequently use has been made of surplus Philips G8 chassis vision selectivity modules and designs have appeared in this magazine (see the February 1982 issue). More recently HS Publications of Derby have introduced a commercial unit, type D100, that consists of an integrated tuner/i.f. strip with switched selectivity. Narrowing the i.f. bandwidth will reveal signals that are completely lost with a standard, wide i.f. bandwidth.

Paul Barton recently sent us a relatively simple circuit (see Fig. 1) that will provide a 2MHz bandwidth when correctly aligned. The components required are readily

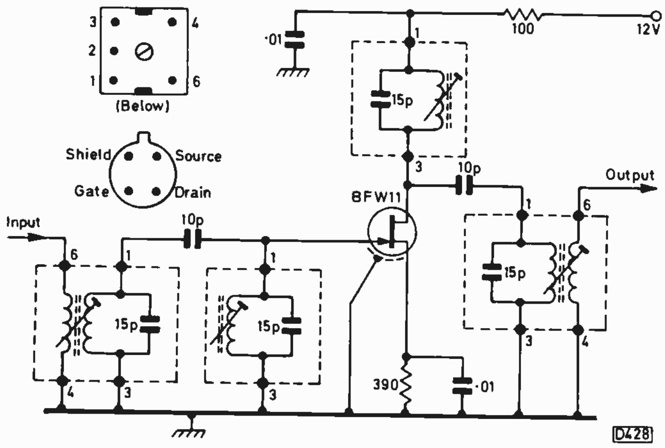


Fig. 1: Narrow-band i.f. amplifier circuit suggested by Paul Barton. All coils Toko type KANK3335R – available from Cirkit, order no. 35-33350.

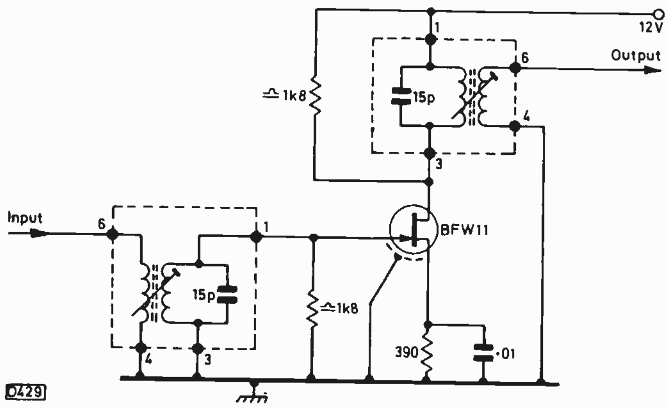


Fig. 2: Wideband version of the circuit.

available – mainly four Toko coils that can be obtained ex-stock from Cirkit. A pair of tuned circuits apply the input to the gate of a BFW11 f.e.t.: the output is taken from a second pair of tuned circuits of the same type. Construction is simple but lead lengths should be kept short. Alignment is also simple. Connect the circuit immediately after the tuner's i.f. output, tune in a weak but steady signal, then peak the four coils for minimum noise on the screen – start from the output.

It would in practice be better to build two such stages with one operated in the standard wideband mode. Fig. 2 shows a wideband circuit: damping resistors of about 1·8kΩ are required. Connect the two stages in parallel with switch selection at the input and output for wide/narrow bandpass operation. Our thanks to Paul for providing details of these circuits.

European Test Pattern Book

An excellent publication has recently been published in W. Germany, "TV-Bildkatalog", a collection of test cards/patterns etc. at present in use by various broadcasters in the European area. The 176-page book is in A5 size format and is bound with a thick gloss card cover: the reproduction is clear and sharp – noise is present on some of the pictures since they are off-air photos taken under DX conditions. The book covers Europe, the Mediterranean including Cyprus/Turkey and, to the east, the USSR. Unfortunately it doesn't cover the Middle East and North Africa. In addition to the photos there's a two-language (German and English) text describing the broadcasting activities in each country. This highly recommended book is available from Aerial Techniques (T), 11 Kent Road, Parkstone, Poole, Dorset BH12 2EH at £5.95 including post and packing.

Cordless Phones

The DTI plans to introduce new legislation that will make it illegal to import, sell, manufacture or own non-approved cordless phones. This would make the at present commonly used 49 and 70MHz systems illegal. A New Malden company is now marketing an upmarket radiophone system operating in these bands. It's known as the Shuttle Ace System and has a basic range of 12km. Improved base aerials increase the range to 20km while a linear amplifier gives 100km.

Publications

Dave Shirley and Tim Anderson are distributing a DX-TV newsletter called *Screen Europe*. It aims to provide news and information on basic DX-TV techniques for all those interested in alternative TV reception. The first newsletter contains quite a lot of information on the French TV5 and TV6 networks, with valuable updated transmitter listings, and a page of test cards. For further information, a sample copy and details of "club subscription" write to Dave Shirley at 93 Alfred Road, Hastings, E. Sussex TN35 5HZ enclosing three 12p stamps and a foolscap s.a.e.

The German monthly magazine *Tele-Audiovision* has expanded from being a TV/FM DXing publication to a high-quality magazine covering TV/FM and in particular satellite reception. The latest issue runs to some 50 A4 pages. It contains much material for the satellite enthusiast and is perhaps the only European magazine that provides regularly updated technical details on this subject. Recommended, albeit in German. A single copy costs DM8 in Europe, annual subscription DM90. Write to *Tele-Audiovision*, Postfach 801965, D-8000 Munchen 80, W. Germany (telephone 089 448 03 28 from the UK). The first large edition (May/June 1986) is no. 36: it includes reviews of satellite downlinks and receivers, information on developments and general news on TV, radio and cable activity.

A Tribute

A correspondent well known in the DX-TV field passed away very suddenly on May 22nd. Reg Roper of Torpoint, Cornwall was in his 78th year and had been TV-DXing for over two decades. He was a true enthusiast who made most of the equipment he used, from aerials to amplifiers and receivers. Some years back he wrote for this magazine an article giving constructional details of a short backfire u.h.f. array – an aerial of this type subsequently became available commercially for a while.

Reg's finest hour came with reception of 860MHz signals from the ATS-6 satellite, broadcasting to India at 35°E, in 1976 using entirely home-constructed equipment. Reg introduced many enthusiasts in the Plymouth area to DX-TV, and on the night before his death had been planning a portable DX-TV expedition with several friends. He was also an active CB enthusiast and had experimented considerably with "hidden" aerials for 27MHz. He wrote to us only a few days before his death, giving details of SpE reception during early May – active to the end. Our sympathy goes to his immediate family in their sad loss. We will miss you Reg, rest in peace. Roger B.

Service Bureau

Requests for advice in dealing with servicing problems must be accompanied by a £1·50 cheque or postal order (made out to IPC Magazines Ltd.), the query coupon 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.

MITSUBISHI CT202B

The picture is good apart from the presence of Hanover bars. An attempt to adjust the decoder has produced only a marginal improvement. Any hints on likely component failure would be welcome.

Associated with the chroma delay line are a potentiometer marked "level adjust" or "amplitude adjust" and a miniature coil which is directly connected to the pins of the delay line. Clean the potentiometer thoroughly with switch cleaner/lubricant, scrubbing the slider to and fro to clean the track, then carefully adjust the potentiometer and coil to remove the Hanover bar effect. If the bars cannot be eliminated it's likely that the delay line itself is faulty.

TOSHIBA V31B

Peak white parts of the display have a sideways wobble to the right, especially captions and teletext (Ceefax in vision etc.). There's also spaghetti though this is not as noticeable as the wobble which is sometimes severe, making the picture unwatchable. The f.m. deviation and sync tip frequency controls have been set up correctly. Turning down the deviation reduces the wobble but gives a duller picture. One or two voltages around IC201 (TA7693P) are slightly out. Could this be the cause of the trouble?

While IC201 could be faulty it's unlikely – we would expect greater voltage changes if it was defective. From our experience of this machine we feel that the problem lies in the head itself. Before condemning the disc, try thoroughly cleaning it. We've found that rotating the head tips against a stiff card, e.g. a visiting card, held against the cylinder sometimes does the trick.

GRUNDIG 6010

This set suffers from an intermittently over bright raster with flyback lines and foldover. I've replaced the components in the line scan thyristor's gate circuit – they showed signs of previous damage – and have also gone over the joints in the line timebase area. The first anode presets and their feed resistor R546 have been replaced – they had also suffered some damage – but the problem persists.

The field foldover is an important clue, suggesting that the supply to the field timebase is falling when the fault is present. Assuming that pin E of the line output transformer is firmly earthed, this may well be due to a heavy load on the e.h.t. supply and the line output stage during the fault condition. Check the c.r.t. base voltages when the fault is present. If the grid voltages rise, suspect control Ab which sets the bias applied to the colour-difference output transistors, and the colour-difference panel. If the cathode voltages vary, check the continuity of the 279V supply to pin 13 of the luminance panel then suspect the BF459G output transistor and IC365 (TBA970) in that order. If the first anode voltages rise, check R545 on the "earthy" side of the presets.

ITT CVC1112 CHASSIS

At switch on there's no sound or colour. The brightness and contrast appear to be normal but the customer contrast control has no effect. No commands from the remote control handset alter the settings. The standby LED is lit all the time and after several minutes the set goes off. Operating the on/off switch restores the initial conditions, the fault sequence being repeated.

A very common cause of these symptoms is failure of the 18V regulator IC1401. If replacing this three-legged chip doesn't cure the problems the SAA1251 remote control receiver chip is suspect.

HITACHI VT8300

The machine unlaces about five-six seconds after selecting the play mode. All the motors turn but the pinch roller doesn't engage. The solenoid has been replaced with no effect.

It seems that loading is not being completed. The most likely cause of this is a stretched loading belt, in which case replacement will cure the problem. If not, check at pin 29 of IC901. This should change state at the end of the loading sequence. If it doesn't, check the loading switches under the loading motor and replace or adjust as necessary. If you still have problems there's a mechanical fault as the pinch roller is mechanically engaged by the loading motor, the solenoids being merely for the operation of the various brakes. Try loading the machine by hand, turning the loading motor with the machine unplugged: examine the mechanical operation carefully.

DECCA 80 CHASSIS

The original fault was low, distorted audio. I've changed the i.c.s that handle the sound signal and have checked thoroughly for dry-joints. There don't seem to be any obviously leaky capacitors. The sound is now good, after adjusting the appropriate coils, but is still of low amplitude.

First ensure that the shunt regulator controlling the supply to the audio amplifier chip is working correctly: there should be 25V at pin 1 of the TBA800 audio chip – this voltage should vary little with load. If necessary disconnect PIC4 on the i.f. panel. If this increases the volume pin 5 of the TBA120S intercarrier sound chip is being incorrectly biased. If there's no change check the speaker coupling capacitors C146/7 (both 220μF) before suspecting the speaker itself.

RANK T16A CHASSIS

The problem with this monochrome portable is excessive height. Extensive checks in the field timebase have failed to reveal anything at fault.

Excessive height usually suggests lack of negative feedback. We suggest you check R43 (1Ω), C34 (47μF), R41 (33Ω) and R39 (220Ω). Leakage in D5 (1N4148) could also increase the scan amplitude by supplementing the height control network.

TEST CASE

284

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

The Philips K30 chassis was designed for use with the 30AX tube and produces a good picture. It's difficult for us to assess its reliability since we've never sold any of these sets (we're not Philips agents). The odd one or two that come our way will have moved into this area with their owners or been sold by other dealers in the district. Unfamiliarity is no excuse however for the ninth-rate diagnostic procedure to be described. . . .

The owner staggered into our service department carrying the set in his arms. Between panting and puffing he managed to get out that the problem was no colour. The set went on to the bench in due course: it produced a very good black-and-white picture without a trace of colour. Just as the man said. With the set tuned to the workshop colour-bar generator's output a subcarrier dot pattern was seen, indicating that the chroma signal was being correctly received. An oscilloscope check at the chroma channel input coil L3195 then proved that adequate chroma signal was being applied to the TDA2560Q luminance/chroma chip IC3192 – the set had the earlier two-chip decoder.

The next check carried out with the scope probe was for the presence of the reference signal at crystal X3233. The signal was present but the scope wouldn't lock to it in the usual way. The excitement died down when it was realised that the crystal is an 8·86MHz one, as is usual with more recent sets.

To override the colour-killer on this decoder panel you earth pin 16 of the TDA2523/4Q reference signal generator/demodulator/matrix chip IC3223. This was done but it had no effect on the monochrome picture. Back to the scope. A check at pins 5 and 6 of IC3223, where the output signals from the delay line circuit should be present, revealed that the colour signals were not reaching this point. They weren't present at the input to the delay line or at the output pins of the TDA2560Q i.c. either. There was a perfectly good burst signal however, and this disappeared into noise when the colour-bar generator was switched off. Well!

The presence of the burst signal in the delay line circuit, followed by a long gap where the colour-bar chroma signal should have been, convinced our man (who shall remain nameless) that something very strange was happening in the TDA2560Q i.c. He scoped pin 5 of the decoder panel and after some deliberation pronounced that the sandcastle pulse was present and correct with respect to amplitude and shape. He then confirmed that it was reaching pin 3 of the TDA2560Q unscathed. A further check at pins 1 and 2 of the i.c. (balanced chroma input) confirmed that the complete chrominance signal was present here. It seemed safe to assume that the TDA2560Q chip was faulty, so a new one was ordered from our friendly supplier. While he awaited its arrival however our man was beset by doubts as to whether the replacement would cure the fault.

And it didn't! Of course not! The new chip produced exactly the same results, with the same burst only output at pin 6. The problem was really down to lack of knowledge on the part of the man with his oscilloscope. He would have done better in fact with a test meter! A read of the circuit description might also have helped, but wouldn't have been essential.

What did our man miss? Why was the burst signal coming through the delay line without the chroma signal? One voltmeter reading would have revealed the root of the problem, as we'll see next month.

ANSWER TO TEST CASE 283
– page 596 last month —

Last month we followed the progress of an Hitachi Model CBP220 (NP8CQ chassis) through field and workshop diagnosis of two faults. The first was simply solved on site but the second, intermittent problem was something of a puzzler. In spite of reasonably correct cathode and first anode voltages the raster would sometimes, especially from cold, be of vastly increased brightness with flyback lines. The tube itself could have been responsible, but this seemed unlikely in the circumstances (fault clearing as tube heated).

The only logical conclusion in view of the symptoms and test results was that the common grid pin was "floating", and so it proved to be. The tube's grid pin was firmly in contact with its base socket: the problem lay on the c.r.t. base panel. On this panel the printed lands for the electrode connections have a narrow neck connected to a printed earthing ring: during manufacture the neck is broken by a machined slot to provide a spark gap. In the case of the earthed control grid land print the copper neck is made wide to give continuity around the ends of the short slot – the print pattern can just be discerned at about seven o'clock on the base panel in the photo on the front cover of the June 1985 issue. In our set a hairline crack had spread sideways from each end of the machined slot . . .

QUERY COUPON

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TELEVISION AUGUST 1986

Published on approximately the 22nd of each month by IPC Magazines Limited, King's Reach Tower, Stamford Street, London SE1 9LS. Filmsetting by Trutape Setting Systems, 220-228 Northdown Road, Margate, Kent. Printed in England by the The Riverside Press Ltd., Thanet Way Whitstable, Kent. Sole Agents for Australia and New Zealand – Gordon and Gotch (A/sia) Ltd.; South Africa – Central News Agency Ltd. Subscriptions: Inland £14, overseas (surface mail) £17 per annum, payable to Quadrant Subscription Services Ltd., Oakfield House, Perrymount Road, Haywards Heath, Sussex RH16 3DH. "Television" is sold subject to the following conditions, namely that it shall not, without the written consent of the Publishers first having been given, be lent, resold, hired out or otherwise disposed by way of Trade at more than the recommended selling price shown on the cover, excluding Eire where the selling price is subject to currency exchange fluctuations and VAT, and that it shall not be lent, resold, hired out or otherwise disposed of in a mutilated condition or in any unauthorised cover by way of Trade or affixed to or as part of any publication or advertising, literary or pictorial matter whatsoever. ISSN 0032-647X.

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AA119	9p
AAY32	9p
AC107	28p
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AC128	15p
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BZX61 Range	
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MB3756	260p
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SN76023N	140p
SN76033N	150p
SN76110N	70p
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TBA820	75p
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TBA950	100p
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TDA2690	100p
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UPC-577H	64p
UPC-592H2	96p
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UPC-1025H	230p
UPC-1026C	105p
UPC-1028H	90p
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UPC-1156H	140p
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74S11	17p
74S12	17p
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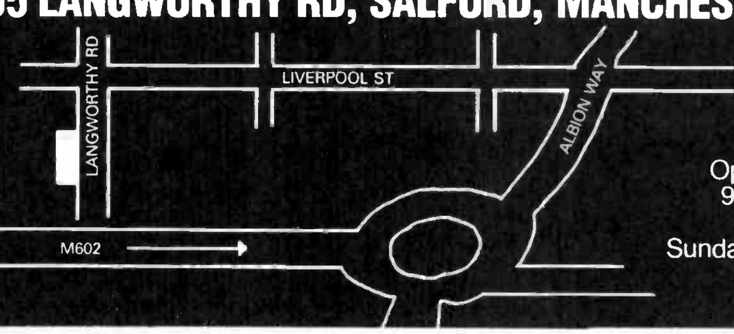

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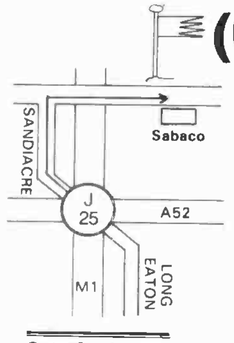

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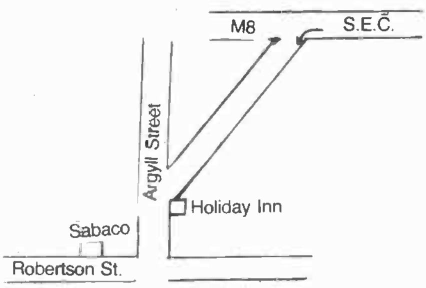

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