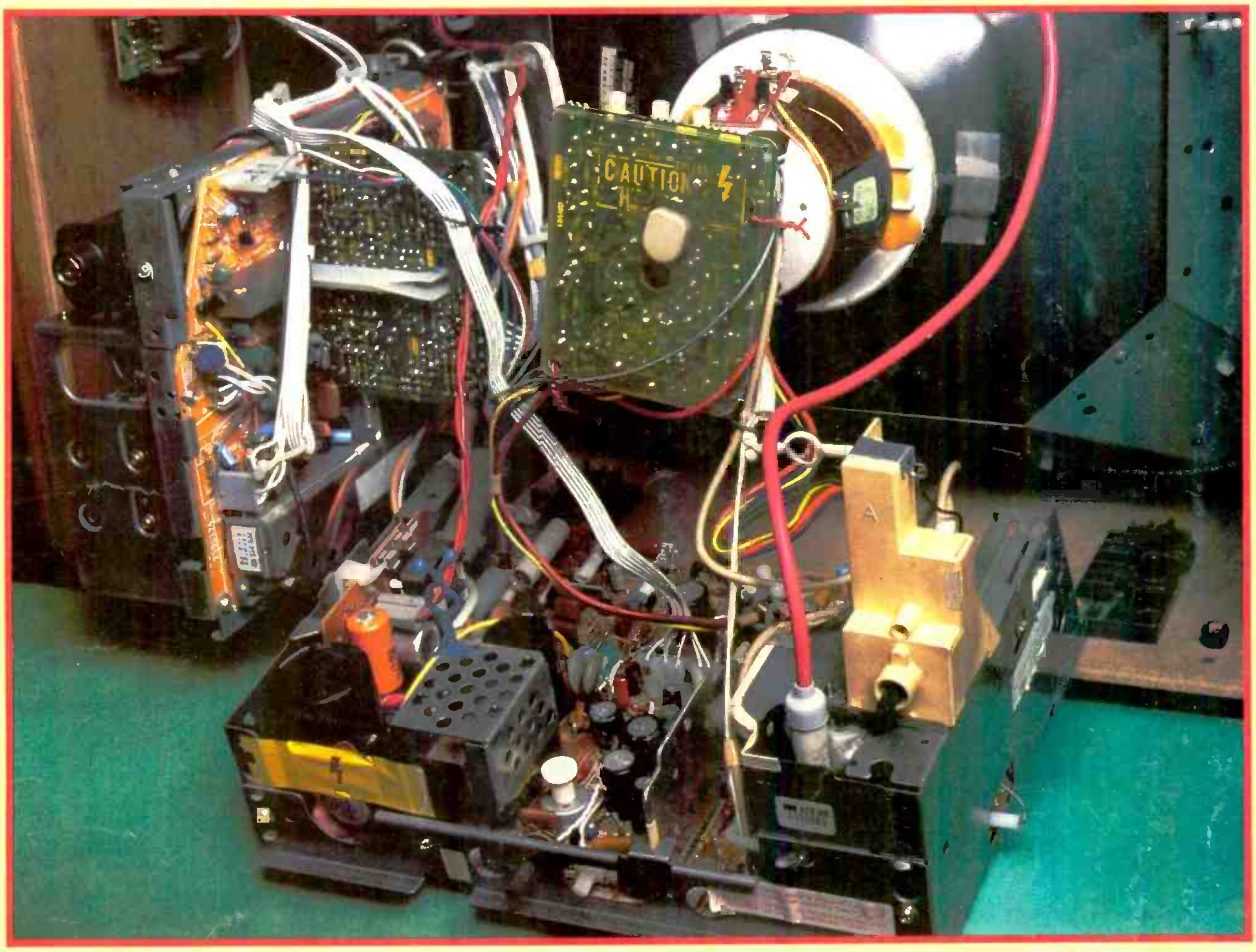
7

MARCH 1986

Australia $2, New Zealand $2·50, Malaysia $5·75 **£1·20**

TELEVISION

SERVICING·PROJECTS·VIDEO·DEVELOPMENTS



Servicing the Hitachi NP6C Chassis

Long-play VCR Operation

Network Remote Control CTVs

Vintage TV • VCR Clinic

VHS the Philips Way

TV Fault Finding • DX-TV

TELEVISION

March 1986

Vol. 36, No. 5
Issue 425

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 £13 in the UK, £15 overseas (by surface mail). Send orders with payment to Quadrant Subscription Services Ltd., Oakfield House, Perrymount Road, Haywards Heath, Sussex, RH16 3DH.

BINDERS AND INDEXES
Send orders for binders (£4·50) and indexes (45p) 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 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").

this month

OUR NEXT ISSUE DATED APRIL WILL BE PUBLISHED ON MARCH 19

P. V. TUBES
HAVE MOVED

Just phone your order through, we do the rest.

Buy with ACCESS / BARCLAYCARD VISA

Telephone: Accrington (0254) 36521
Accrington (0254) 32611
Telex: 635562 Griffin G (For P.V.)

SUPPLIERS
OF TELEVISION COMPONENTS

104 ABBEY STREET, ACCRINGTON, LANCS BB5 1EE.

TRADE COUNTER OPEN MON-FRI 9 a.m.–5 p.m. SAT 9.30 a.m.–5 p.m. TRADE COUNTER CLOSED WEDNESDAY p.m.

VARICAP TUNERS

ELC1043-05	8.40
ELC1043-06	8.40
ELC2003	16.50
Philips G8/G9	10.50
Philips G11 (U321)	8.50
U322	7.20
U341	9.50
TX10 Tuner	8.75

PUSH BUTTON ASS.

Decca 4 way	7.93
6 way	9.17
GEC 2110 6 way	10.92
GEC Slim 6 way	10.29
GEC/ITT/PYE 7 way	16.67
Pye 4 way (713/15)	10.35
Pye 6 way (207/715)	18.40
Pye 697 repair kit	10.35
Pye 725-735	12.60
Pye 725-735 with tuning head	16.19
Philips G8 (early)	17.82
Philips G8 (late)	18.97
Rank A823	12.36
Rank T20A	11.21
Hitachi 4 way	12.36
Philips G11 unit	26.50
Philips KT3	16.67
Philips KT30	13.22
ITT CVC 8/9 (mod)	13.80
ITT 6 way with VCR	8.90
Thorn 9000 switchback	6.09
Decca 7 way piano key replacement kit	22.42

SWITCHES & ACCESS

On/off gen. purpose 4A	80
G8 on/off	1.38
G11 on/off	1.58
G11 on/off remote	1.58
Gen. purpose rotary	66
Thorn Tx 9/10	2.98
GEC 2040	98
Thorn 1591 push on/off	2.90
Rank tuner buttons (while stocks last) 1½"×½", 2"×½", 2"×⅜"	20
GEC 2110 tuner neons	20
Thorn 3500 A1 beam	86
GEC 2110 A1 cont. R/B/G	58
ITT CVC5 on/off	1.24
ITT mains switch + solenoid	4.50
Rank mains switch + solenoid	4.50
Rank T20 on-off switch	1.95

MIDGET CONTROLS

Insulated Spindle Length 44mm

Log or Lin Without Switch 5K-10K-25K-50K-100K-250K-500K-1M	54
With D.P.S.T. Switch Log: 5K-10K-25K-50K-100K 250K, 500K, 1M, 2M	1.26
Dual gang Controls	1.25
16mm Rotary Controls 10K, 22K, 10K, 100K, 1M	

THICK FILM RESISTOR NETWORK

THORN 3500 (5 pin connection)	1.98
PYE 731 (6 pin connection)	2.20
THORN 9000 (Circuit Ref. R704/7)	2.15

CONVERGENCE POTS

3W/5R-6R8-10R-15R-20R 50R-100R-200R-500R	60

METRIC CONVERGENCE POTS

PHILIPS G8 5R-10R-15R-20R-50R	60

SKELETON PRE-SET POTS

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

SLIDER POTENT

Lin or Log
470R-1K-2K2
10K-47K-470K 75p

MULTITURN POTS

100K	65
GEC TE	65
PHILIPS G8	
DECCA, RANK	65

THERMAL CUT OUT

THORN 3000 2A Metal	2.68
GEC 2040 Metal	2.50

LINE OUTPUT TRANS.

R.B.M. T20A	13.95
R.B.M. A774 Mono	11.74
R.B.M. Z179	15.00
R.B.M. Z718 22"	19.50
PHILIPS 320	8.70
PHILIPS 210/300 Mono	10.00
PHILIPS G8	8.75
PHILIPS G9	9.50
PHILIPS G11	15.00
PYE 697 (Printed)	14.50
PYE 713/731	10.00
PYE 725 90°	10.50
PYE 169	10.00
DECCA 80	8.58
DECCA 100	8.58
DECCA 1700	9.00
DECCA 1730	8.58
DECCA 2230	8.58
GEC 2110	16.75
GEC 2040	9.50
ITT CVC 1-9	10.85
ITT CVC 25/30/32	8.65
ITT CVC 20	8.60
THORN 3000 EHT	9.95
THORN 3000 SCAN	7.95
THORN 8000	17.50
THORN 8500	17.50
THORN 3000/3500 Mains	10.00
THORN 1591	8.68
THORN 1615	12.50
THORN 1691	9.68
THORN TX10	15.00
THORN TX9	23.85
THORN 1615	9.75
PHILIPS KT3	9.70
RANK BUSHRANGER Early T16A	£10.00
RANK BUSHRANGER Late T18A	£10.00
PYE 741	8.20
B+O (2000, 3000)	14.69
B+O (3000 EHT)	22.25
ITT CVC 45	9.50

RECTIFIER TRAYS

THORN 950 Mk II	4.25
THORN 1400 3 Stick	5.20
THORN 1500 3 Stick	5.20
THORN 1500 5 Stick	5.99
THORN 1600	6.50
THORN 3000/3500	7.98
THORN 8000	6.95
THORN 8500/8800	7.15
THORN 9000	8.70
DECCA 1730/1830	5.48
DECCA 30	6.76
DECCA 80	7.12
DECCA 100	7.50
UNIVERSAL ITT or REMO	6.00
GEC 2100	7.40
GEC 2200 (20AX)	6.50
GEC 2040/2028	6.60
GEC 2110 Pre Jan '77	7.00
GEC 2110 Post Jan '77	7.00
PHILIPS G8 Short Focus Lead	7.12
PHILIPS G8 Long Focus 550	7.12
PHILIPS G9	6.37
Pye/Philips K3 Tripler	10.65
PYE 691/3	7.58
PYE 713/4 Lead	8.79
PYE 713 Doubler 5 Lead	8.79
PYE 731/725	8.75
R.B.M. A823 (plug in) AV	8.75
KORTING (similar to Siemens TVK1)	7.32
ITT KB CVC5/9	7.50
ITT KB CVC20/25/30 (Mullard)	7.12
RRI T20	7.12
ITT CVC45	8.65
DECCA/TATUNG 120/130	6.50

RECTIFIER STICKS

TV11	90	TV18	1.10
TV13	1.26	TV20	1.43

REPLACEMENT ELECTROLYTICS

PYE 169 (200/200/100/32)	3.74
PHILIPS 320 (400/400/200V)	3.02
DECCA 30 (400/400/350V)	3.74
DECCA 80 (400/350V)	4.37
DECCA 100 (800/250V)	
PHILIPS G8 (600/300V)	2.53
PHILIPS G9 (600/300V)	2.44
PHILIPS G11 (470/250V)	3.19
PYE 691/7 (200/300/350V)	2.97
PYE 731 (600/300V)	2.55
RBM A823 (2500/2500/30V)	1.83
RBM A823 (600/300V)	3.12
RBM Z146 (300/300/350V)	3.91
RR1 T20A (220/400V)	2.20
ITT CVC5/9 (200/200/75/25)	3.28
ITT CVC 20 (220/400V)	2.20
GEC 2110 (600/250V)	2.14
GEC 2040 (1000/2000/35V)	1.31
GEC 2040 (300/300/150/100/50)	4.51
THORN 3500 (400/40V)	33
THORN 950 (100/300/100/16/275V)	2.02
THORN 1400 (150/100/100/100/150/320V)	3.07
THORN 1500 (150/150/100/300V)	2.42
THORN 1500 (12/300V)	35
THORN 3500 (175/100/100/400/350V)	3.06
THORN 3500 (1000/63V)	95
THORN 3500 (1000/70V)	95
THORN 8000/8500 (2500/2500/63V)	3.72
THORN 8000/8500 (700/250V)	2.55
THORN 8000/8500 (400/350V)	2.82
THORN 9000 (400/400V)	3.61
GEC (200/200/150/50)	2.91
PHILIPS 69 2200/63V	1.38
THORN 4700 P/C 25V	1.32
THORN 1591/1691 4700/25V	1.32
G11 Capacitor 7N5 1500V	1.48

MAINS DROPPERS

DECCA 20	2.48
DECCA 27R/47R	1.40
DECCA 56R/6R8	1.40
R.B.M. A823 56R/68R	94
R.B.M. 161	82
GEC 2000/2018	70
GEC 27840	64
PYE 725/31 3R0/56R/27R	1.84
PYE 725 56R/27R	1.04
PHILIPS 210/5050 30R/125R/2k85	1.75
PHILIPS 210/5051 -/118R/148R	1.93
PHILIPS G8/5081 47R Section	50
PHILIPS G8/5083 2R2/68R	95
THORN 1400	1.52
THORN 1500	1.47
THORN 1600	1.77
THORN 3500	1.20
THORN 8000	1.24
THORN 8500	1.36
THORN 9800	1.30
DECCA 2R5	96
DECCA 3R9 Modulohm	60

WIREWOUND RESISTORS*

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

(Preferred values)*

CARBON RESISTORS*

¼W 3R3-8M2	30
½W 3R3-8M2	30
1W 10R-10M	46
2W 10R-10M	72

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

NEW VALVES

30FL2	1.70
DY802	98
DY86/7	66
ECC81	1.08
ECC82	98
ECC83	1.07
ECC84	80
ECC85	98
ECC88	1.35
ECF80	1.30
ECF82	88
ECH81	1.60
ECH84	1.66
ECL80	84
ECL82	1.30
ECL86	1.99
EF80	95
EF86	2.20
EF183	99
EF184	1.09
EH90	1.02
EL34	3.50
EL84	1.05
EY86/7	68
EY500A	2.25
EZ80/1	56
GY501	1.45
GZ34	3.50
KT66	8.50
KT77	8.50
KT88	12.00
PC92	3.00
PC97	1.65
PCC85	85
PCC805	1.40
PCF80	1.00
PCF200	1.35
PCF800	1.38
PCF801	1.13
PCF802	1.12
PCF805	1.80
PCF806	1.30
PCF808	1.63
PCH200	1.45
PCL82	1.20
PCL84	1.20
PCL86	92
PCL805	1.09
PD500	2.93
PFL200	1.86
PL36	1.87
PL81	94
PL83	1.43
PL84	84
PL504	1.65
PL508	2.90
PL509/19	5.30
PY88	81
PY500A	2.30
PY800/1	69
UCH81	2.25
UCL83	1.82
UY85	1.35
PL802T	4.00
40KD6	5.30
21LU8	3.00
17DW4A	4.50
3AT2B	5.00
12BY7A	3.75
12HG7	3.20

FUSES

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

Please add VAT 15% to all prices including P&P chg. except when purchasing books OR for exports.

NEW FIDELITY Spares

Fly back trans. FCC2015BE	£10.74
FCC2215AE	£10.74

CAPACITORS

Volts	Mfd	Price	63V	
6V3	33	9	1	12
10V	22	10	2.2	12
	47	10	4.7	12
	100	10	10	11
	220	15	15	12
	470	20	22	13
16V	33	11	47	19
	68	11	100	23
	220	16	220	41
	1000	27	470	56
	3300	53	1000	85
25V	10	11	2200	1.10
	22	13	**100V** 10	13
	47	15	22	15
	100	15	47	20
	220	29	100	36
	470	30	220	70
	1000	55	**450** 1	33
	2200	59	4.7	30
	4700	98	10	43
40V	10	10	22	80
	22	10	33	94
	400	48	**500** 10	32
			600 0.1	41

SPECIAL PRICES FLOPPY DISCS PLEASE ASK FOR PRICES

SERVICE MANUALS

Please check for availability

DECCA 80	5.35
70/90	3.90
100	4.80
PHILIPS G9	4.20
K30	3.90
KT3	3.90

See also SONY range. Zero VAT on Manuals

WE INVITE YOU TO COME AND SEE US! We make good tea.

T.T.L. 74LS SERIES

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

'4000 B' SERIES CMOS

		4025B	21	4068B	22	4510B	76	4538B	1.04		
		4027B	39	4069B	22	4511B	76	4539B	77		
		4028B	64	4070B	22	4512B	72	4541B	96		
4001B	21	4029B	90	4071B	40	4513B	1.68	4543B	1.12		
4002B	21	4032B	1.04	4072B	22	4514B	1.88	4551B	96		
4008B	72	4035B	80	4073B	22	4515B	1.88	4553B	2.40		
4011B	31	4038B	99	4075B	22	4516B	76	4554B	1.20		
4012B	21	4040B	72	4076B	80	4518B	76	4556B	48		
4013B	30	4042B	58	4077B	22	4519B	64	4560B	1.76		
4014B	74	4043B	71	4078B	22	4520B	76	4561B	74		
4015B	76	4044B	71	4081B	22	4521B	1.68	4566B	1.20		
4016B	42	4046B	96	4093B	49	4522B	88	4580B	3.60		
4017B	66	4047B	70	4094B	1.56	4526B	88	4581B	1.84		
4018B	72	4049UB	32	4099B	1.20	4527B	1.20	4582B	80		
4010B	70	4050B	32	4160B	72	4528B	88	4583B	1.00		
4020B	76	4051B	72	4161B	72	4529B	1.04	4584B	40		
4021B	70	4052B	72	4162B	72	4530B	62	4585B	88		
4022B	70	4053B	72	4163B	72	4531B	72	4597B	1.84		
4023B	21	4060B	96	4502B	72	4532B	1.00	4598B	2.40		
4024B	50	4066B	43	4505B	1.88	4536B	2.64	4599B	2.00		

Volts D.C.

250V	0.1mF	38p	1250V	0.1mF	59
	0.91mF	1.92	1500V	0.0047mF	32
400V	0.22mF	29		0.022mF	30
600V	0.1mF	38		0.033mF	62
1000V	0.01mF	24	2000V	0.0052mF	1.20
	0.047mF	46	2500V	0.0022mF	50
	0.033mF	33			
	0.1mF	35			
	0.22mF	66			
	0.47mF	98			

TANTALUM

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

POLYESTER

250V	0.01mF	13p
	0.1mF	16p
	0.22mF	16p
400V	0.01mF	14p
	0.1mF	17p
	0.22mF	17p

We are now stocking a range of Thorn New Life tubes. Please ring for prices and carriage costs.

DISC CERAMIC CAPS

8kV (12kV) 200pF, 150pF, 220pF, 180pF, 250pF	40p
63V/100V	12p

A range of pref. values 22pF-4700pF

Sheila says THANKS to her many valued customers and hopes the new additions are useful.

NEW MONO TUBES

MULL. A31/510 110° 12"	22.00
MULL. A34/510 110° 14"	26.50
A50/120WR 110° 20"	18.50
A61/120WR 110° 24"	20.50
VEGA 12" 90° (Jap Types)	15.00

NEW TUBES

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

REBUILT COLOUR TUBES

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

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

P.I.L. TUBES – we can rebuild your own glass – please ring for quotes. Carriage cost on tubes £10 + VAT

WE WILL ONLY SUPPLY TOP QUALITY, BRANDED COMPONENTS. REPUTATION COUNTS WITH US

G.G.L.COMPONENTS

108 SCOTLAND ROAD, CARLISLE, CUMBRIA CA3 9EY
PHONE (0228) 20358/39693

BUY WITH

INTEGRATED CIRCUITS

TYPE	PRICE (£)
AN214	1.95
AN301	3.45
AN303	3.45
AN305	3.50
AN7110	1.93
AN7114E	2.33
AN7115	2.37
AN7116	2.35
AN7145	3.25
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
HA1366 W/WR	1.95
HA1370	2.75
HA1374	2.45
HA1377	3.80
HA1388	4.20
HA1397	3.90
LA1201	1.75
LA1230	2.30
LA1365	2.45
LA3350	1.65
LA4031	2.45
LA4032	2.30
LA4101	1.50
LA4102	1.95
LA4400	2.50
LA4430	2.45
LA4440	3.55
LA4460	2.95
LA4461	2.95
MB3712	2.30
MB3713	2.25
ML231B	2.35
ML232B	2.55
ML237B	2.50
SAA1124	3.45
SAA1125	4.70
SAA1250	3.85
SAA1251	4.95
SAA5010	5.10
SAA5012	5.70
SAF1032P	3.25
SAF1039P	4.55
SAS560S	1.95

TYPE	PRICE (£)
SAS570S	1.95
SAS580S	2.40
SAS590S	2.40
SL1430	1.95
SL1432	1.75
STK0039	6.45
STK0040	5.95
STK0050	7.50
STK077	7.25
STK078	7.45
STK082	9.75
STK415	9.66
STK430	7.75
STK433	6.50
STK435	6.75
STK437	7.25
STK439	7.55
STK441	8.50
STK459	7.35
STK461	7.95
STK463	9.30
STK465	9.95
TA7193P	4.30
TA7202	2.25
TA7203P	2.25
TA7204P	1.90
TA7205AP	1.40
TA7208P	1.95
TA7222AP	1.85
TA7223P	2.85
TA7227P	2.95
TA7310	1.55
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
TBA800	.80
TBA810	1.35
TBA820	1.40
TBA890	2.95
TBA920	1.50
TBA950	2.65
TCA270	1.55
TCA800	5.45
TCA940	1.55

TYPE	PRICE (£)
TDA440	3.25
TDA1002	1.50
TDA1003	2.80
TDA1006A	2.95
TDA1035T	2.75
TDA1037	1.95
TDA1044	3.10
TDA1170	1.80
TDA1270	2.20
TDA1470	3.65
TDA2002	1.85
TDA2003	2.33
TDA2004	3.15
TDA2006	2.25
TDA2020	2.95
TDA2190M	4.95
TDA2522	1.80
TDA2523	2.25
TDA2530	2.10
TDA2532	2.20
TDA2540	1.95
TDA2560	1.80
TDA2578A	3.25
TDA2581	2.15
TDA2582	2.20
TDA2591	2.30
TDA2593	2.30
TDA2594	2.95
TDA2600	5.95
TDA2611A	1.50
TDA2640	2.40
TDA3560	5.10
TDA3561A	5.35
TDA3562A	5.50
TDA4500	5.85
TDA4600	2.85
TDA4600-16PIN	3.95
TDA9503	2.35
UPC555C	.70
UPC566C	2.10
UPC585C	1.40
UPC1031H	2.95
UPC1032H	.95
UPC1156H	2.45
UPC1181H	2.20
UPC1182H	2.20
UPC1185H	3.30
UPC1230H	3.95
UPC1238H	2.35
UPC1350C	4.50
UPC1353C	2.60
UPC1365C	5.05
UPC2002H	1.85

TRANSISTORS

TYPE	PRICE
BC107	14
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
BD124M	1.05
BD131	33
BD132	33
BD201	80
BD202	70
BD203	70
BD204	83
BD222	50
BD225	55
BD235	32
BD236	43
BD237	40
BD238	39
BD410	50
BD434	50
BD437	70
BD438	78

TYPE	PRICE
BD439	70
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	1.80
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
2N3055	50
2N3773	3.45
15/80H	2.25
15/85R	2.25
2SA 771	2.35
2SA 835	1.55
2SB 618	2.45
2SC 867A	3.25
2SC 1034	4.85
2SC 1061	1.15
2SC 1114	4.75
2SC 1124	97
2SC 1316	3.20
2SC 1413A	3.95
2SC 1739	2.45
2SC 1942	2.95
2SC 1962	1.65
2SC 1969	1.95
2SC 2078	1.55
2SC 2335 (Kit)	7.55
2SC 2369	3.25
2SC 257	2.45
2SD 588A	1.97
2SD 725	7.95
2SD 870	5.95

LINE O/P TR.

DECCA 80	7.95
DECCA 100	8.50
ITT CVC 20	7.75
ITT CVC 25/30/32	8.00
ITT CVC 45	8.45
PHILIPS G8	8.75
PHILIPS G11	13.50
PHILIPS KT3	9.95
PHILIPS K30	16.50
RBM T20A	11.50
THORN 1615	12.35
THORN 1690/1	9.65

THORN/SONY

LARGE RANGE OF SPARES FOR ABOVE MAKES OF TV/ VIDEOS INCLUDING INSTRUCTION AND SERVICE MANUALS. PHONE OR WRITE FOR NEW LISTS. WE CAN ALSO SOURCE & SUPPLY OVER THREE THOUSAND I/Cs & SEMI CONDUCTORS.

SONY SPARES

C5/C7 Rewind Kit	4.65
C5/C7 Belt Kit	3.50
C6 Rewind Kit	4.35
C7 Pinch Roller	4.85
SG 613/6533	8.95
CX 143A	6.95
TDA 3652	4.35

Large range of Sony spares available

VALVES

PCF802	1.09
PCL82	97
PCL85	1.03
PCL86	1.07
PL504	1.59
PL508	2.99
PL509/519	5.99
PY500A	2.25

E.H.T. TRAYS

DECCA 80	7.20
DECCA 100	7.35
ITT CVC 20/30.	6.85
PHILIPS G8-550	7.90
PHILIPS KT3	9.75
RBM T20/T22A	7.35
THORN 8500/8800	7.60
THORN 9000	8.70
Universal	5.95

DIODES

TYPE	PRICE
BY127	.10
BY133	.15
BY164	.40
BY179	.65
BY210/800	.30
BY223	.86
BY227M	.23
BY229/600	.87
BY298/400	.24
BY299/800	.25
BYX10	.20
BYX55/600	.26
BYX71/600	.93
SKE4F2/06	.80
SKE5F3/10	1.45
W005	.55
1N4001-7	.07
1N5401-8	.16

HITACHI I/Cs

STR 441	8.95
STR 451	8.95
STR 6020	7.90

SUNDRIES

G8 TRANSDUCTOR	2.25
G8 ON/OFF SW.	1.40
G11 E/W Coil	1.65
G11 Lin Coil.	1.80
G11 Bridge Coil	1.35
G11 EHT Lead	2.25
PYE IF Gain MOD	7.85
ITT On/Off SW	1.10
THORN On/Off SW.	1.00
CUT OUT 2A	1.95
TX10 FOCUS UNIT	8.95
VCR Pilot Bulb	.70

TV ELECTROLYTICS

DECCA 30(400/400)350V	3.99
DECCA 80-80/100(400)350V (800)250V	3.99
PHILIPS G8(600)300V	2.65
PHILIPS G9(2200)63V	1.45
PHILIPS G11(470)250V	2.20
RBM A823(2500/2500)30V	1.65
RBM T20A(220)400V	2.35
THORN1690/1(4700)25V	.94
THORN3500(1000)70V	.99
THORN9000(400)400V	3.10

PUSH BUTTONS/ NEW TUNERS

DECCA/ITT 6 way	7.95
PHILIPS G8 S/L	14.90
PHILIPS G8 S/Q	12.00
PYE-G11 P/B	8.50
HITACHI 4 way	8.95
ITT CVC5 7 Button	10.40
ITT CVC8/9	12.80
1043/05	8.95
U321	8.35
U322	7.40

Available also a range of 2SA/B/C/D Transistors. Phone or write for lists.

ORDERING

Please Add 50p For P/P U.K. Add 15% VAT To This Total. Export Orders — Cost. DELIVERY BY RETURN ON ALL STOCK ITEMS.

THE DOMESTIC VIDEORECORDER SERVICING BOOK

THE ENGINEERS BIBLE

UPDATED SECOND EDITION IS NOW OUT WITH NEW CHAPTER ON HI FI, DIGITAL SERVOS, LUMINANCE AND CHROMINANCE SIGNAL CIRCUITS, FAULT GUIDES AND CONNECTION DATA

A MUST FOR ALL VIDEO REPAIRERS AND STUDENTS. THE COMPLETE REFERENCE TO VIDEORECORDER CIRCUITS

ORDER YOUR COPY NOW FOR ONLY £16.95 inc P&P FROM:

NEWARK VIDEO CENTRE

(0636 71475)

OR DIRECT FROM:

GROVE FARM, LONG LANE, BARNBY IN THE WILLOWS, NEWARK, NOTTS. NG24 2SG.

Cheques and PO's payable to D. BEECHING.

MAKE YOUR INTERESTS PAY!!

Train at home for one of these Career Opportunities

More than 8 million students throughout the world have found it worth their while! An ICS home-study course can help you get a better job, make more money and have more fun out of life! ICS has over 90 years experience in home-study courses and is the largest correspondence school in the world. You learn at your own pace, when and where you want under the guidance of expert 'personal' tutors. Find out how we can help YOU. Post or phone today for your **FREE INFORMATION PACK** on the course of your choice. (Tick one box only!)

Electronics ☐	Radio, Audio & TV Servicing ☐
Basic Electronic Engineering (City & Guilds) ☐	Radio Amateur Licence Exam (City & Guilds) ☐
Electrical Engineering ☐	Car Mechanics ☐
Elec. Contracting/ Installation ☐	Computer Programming ☐
GCE over 40 'O' & 'A' level subjects ☐	

Name: ____________________

Address: ____________________

P. Code

ICS International Correspondence Schools, Dept. EGS36, 312/314 High St., Sutton, Surrey SM1 1PR. Tel: 01-643 9568 or 041-221 2926 (both 24 hours).

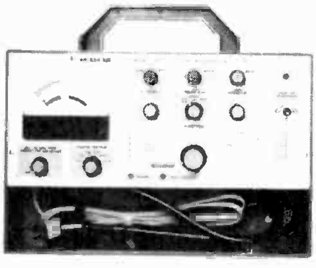
INCREASE YOUR PROFITS IMPROVE YOUR SERVICE WITH RELIABLE COST EFFECTIVE TEST EQUIPMENT

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

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

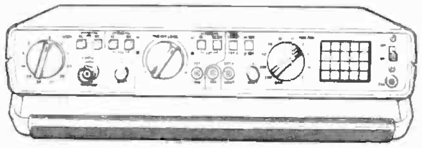
* Tests for shorts and leakage between electrodes.
* Tests cathode emission characteristics.
* Separately checks condition of guns.
* Removal of shorts and leakage between electrodes.
* Checks heater warm-up characteristics.
* Rejuvenation of low emission cathodes with automatic timing.
* Super rejuvenation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

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



PRICE £260 + £39 VAT

THE VERY LATEST SC110A LOW POWER, FULLY PORTABLE OSCILLOSCOPE.



The new Thandar SC110A represents a break-through in oscilloscope development. The SC110A is ONLY TWO INCHES thick and weighs under two pounds, yet retains the standard features and controls of a bench oscilloscope. **FITS IN A BRIEFCASE**

Full Sized Performance

* 10 MHz bandwidth. * 10 mV per division sensitivity.
* Full trigger facilities are provided including TV frame, or TV filtering.
* Runs on 4 to 10V DC via disposable batteries, re-chargeable cells, or AC adaptor.
* Size 255mm × 148mm × 50mm.

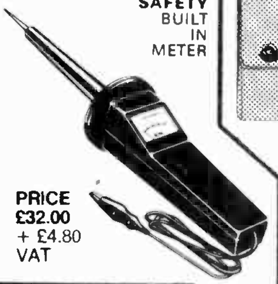
PRICE £165.00 + £24.75 VAT

Accessories: Carry Case **£5.95** + £0.89 V.A.T.
× 1 Probe **£7.50** + £1.13 V.A.T.
× 10 Probe **£8.50** + £1.28 V.A.T.
× 1/× 10 Switched Probe **£10.50** + £1.58 V.A.T.
AC Adaptor **£6.95** + £1.04 V.A.T.

ALSO AVAILABLE
Analogue Multimeters
Digital Multimeters
Oscilloscopes
Signal Generators
Digital Frequency Meters
Pattern Generators
CRT Tester/Rejuvenator
T.V. Field Strength Meter
Digital Capacitance Meter
LARGE S.A.E.
FOR COMPLETE LIST.

LEADER HIGH VOLTAGE METER EHT PROBE

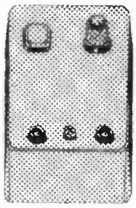
Measures up to 40 K.V. D.C. with **SAFETY** BUILT IN METER



PRICE £32.00 + £4.80 VAT

✱ FULLY GUARANTEED

LOPT TESTER



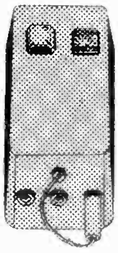
BK's REVOLUTIONARY DYNAMIC 'LOPT' TESTER
Revolutionary L.O.P.T. tester. Operates in dynamic mode which actually tests the L.O.P.T. under high voltage conditions without de-soldering or removal.
Size 75×100×40 mm. Supply 240V AC

PRICE £25.99 + £3.90 VAT

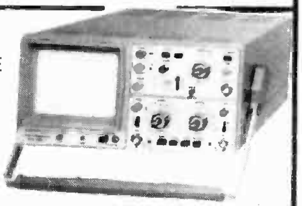
CRT TESTER-REJUVENATOR

BK's C.R.T. TESTER-REJUVENATOR
Tests and rejuvenates blue, green & red guns separately. Fitted with delta and P.I.L. sockets. Compact size 120×65×60 mm. Supply 240V AC

PRICE £32.00 + £4.80VAT



HAMEG HM 203-5 20MHz DUAL TRACE OSCILLOSCOPE:



SPECIFICATION:
* BANDWIDTH DC-20MHz
* SENSITIVITY CH1, CH2 2mV-50V/DIV
* TIMEBASE 40nS to 0.2S CM
* TRIGGER DC-40MHz Auto-Normal-TV
* CALIBRATION OUTPUT
* CH1 ADD AND INVERT FACILITY
* ALT/CHOP SWITCH
* LARGE RECTANGULAR SCREEN 8 × 10 cms.
* BUILT IN SEMICONDUCTOR COMP. TESTER
* SIZE 285mm × 145mm × 380mm.
* SUPPLY 110-125-220-240V AC 50-60Hz

2 YEAR WARRANTY

WITH COMPONENT TESTER

PRICE
£270.00 + £40.50 VAT
Optional probes as above

U.K. Post Paid, Export orders welcome, please deduct V.A.T. and enquire for Overseas carriage cost. Barclaycard/Access orders welcome, or Cheque, Bank Draft, etc., with order please. Large S.A.E. for technical leaflets of complete range. Delivery normally within 7 days.

B. K. ELECTRONICS Dept. 'T', UNIT 5, COMET WAY, SOUTHEND-ON-SEA, ESSEX. SS2 6TR TEL: 0702-527572

VISA

AN127Q	£1.75	CX143A	£7.50	HA11788	£4.50	M54543L	£2.75	TA7136P	£1.00	UPC1028H	£0.90	2SA899	£0.75	2SC1427	£0.30
AN203	£2.20	CX157	£3.95	HA11816NT	£6.50	M54548L	£6.75	TA7137P	£0.80	UPC1031H	£1.80	2SA940	£0.80	2SC1505	£0.70
AN210	£1.75	CX158	£3.50	HA11828NT	£9.50	MB3705	£1.60	TA7139P	£1.50	UPC1032H	£0.50	2SA952	£0.35	2SC1546	£0.30
AN211A	£2.25	CX160	£2.50	HA12035	£9.50	MB3712	£1.50	TA7145P	£1.80	UPC1035C	£1.20	2SA1015	£0.30	2SC1664	£2.50
AN214Q	£1.80	CX161A	£2.50	HA12413	£2.50	MB3730	£1.75	TA7146P	£2.50	UPC1037H	£0.75	2SA1102	£1.90	2SC1682	£0.30
AN217B	£2.20	CX162	£3.40	HA13402	£3.50	MB3731	£2.50	TA7150P	£1.80	UPC1043C	£1.20	2SA1103	£1.90	2SC1741	£0.30
AN228W	£2.75	CX170	£6.50	HA13403	£7.50	MB3756	£2.60	TA7152P	£1.70	UPC1156H	£1.40	2SA1104	£1.90	2SC1815	£0.25
AN236	£2.50	CX181	£8.50	HA13430A	£3.50	MB8719	£3.50	TA7173P	£1.60	UPC1158H	£0.60	2SA1105	£2.25	2SC1826	£0.60
AN239Q	£3.80	HA1124A	£2.75	LA1111P	£0.80	PLL01A	£2.30	TA7176P	£1.50	UPC1161C	£0.75	2SA1106	£2.50	2SC1849	£0.30
AN240P	£1.50	HA1125	£1.50	LA1201	£0.85	PLL03A	£4.95	TA7193P	£3.50	UPC1163H	£0.60	2SA1198	£0.35	2SC1945	£3.50
AN241P	£1.50	HA1137	£1.75	LA1222	£0.80	SI-1125H	£7.50	TA7200	£2.00	UPC1167C	£0.70	2SB22	£0.40	2SC1946A	£9.50
AN247P	£2.50	HA1149	£1.40	LA1230	£1.50	STK011	£3.75	TA7201	£2.00	UPC1168C	£0.90	2SB54	£0.70	2SC1957	£0.80
AN259	£2.75	HA1151	£2.50	LA1240	£1.75	STK013	£6.25	TA7202P	£2.00	UPC1170H	£0.75	2SB75	£0.60	2SC1969	£1.30
AN262	£1.50	HA1156	£1.10	LA1320	£1.50	STK014	£6.25	TA7203P	£1.80	UPC1171C	£1.50	2SB341V	£2.60	2SC2021	£0.30
AN271A	£2.50	HA1166	£1.60	LA1365	£1.20	STK015	£5.00	TA7204P	£1.10	UPC1176C	£1.20	2SB405	£0.80	2SC2026	£0.65
AN274	£2.50	HA1196	£3.75	LA1368	£2.20	STK016	£4.75	TA7205AP	£1.00	UPC1177H	£1.20	2SB426	£2.60	2SC2028	£0.75
AN295	£3.25	HA1197	£1.50	LA1460	£1.95	STK020	£4.50	TA7207P	£1.50	UPC1178C	£1.00	2SB471	£3/50	2SC2075	£0.25
AN303	£2.50	HA1199	£1.40	LA2200	£1.75	STK022	£5.25	TA7208P	£1.50	UPC1180C	£1.40	2SB492	£0.75	2SC2078	£0.75
AN313U	£2.75	HA1306W	£1.60	LA3101	£1.60	STK025	£6.75	TA7210P	£2.00	UPC1181H	£1.00	2SB509D	£1.70	2SC2091	£0.60
AN315	£2.00	HA1319	£2.00	LA3155	£0.95	STK041	£6.50	TA7214P	£2.50	UPC1182H	£1.00	2SB534	£0.60	2SC2092	£0.95
AN316	£3.50	HA1322C	£1.60	LA3160	£0.90	STK077	£5.95	TA7215P	£1.80	UPC1183H	£1.20	2SB536	£0.95	2SC2098	£0.95
AN318	£4.75	HA1339A	£1.60	LA3201	£0.95	STK078	£5.50	TA7217AP	£1.20	UPC1185H	£2.20	2SB546	£1.50	2SC2166	£0.95
AN331	£2.75	HA1342A	£1.70	LA3300	£1.40	STK080	£7.20	TA7220P	£1.75	UPC1186	£0.80	2SB561	£0.30	2SC2238	£0.65
AN360	£1.20	HA1366W	£1.50	LA3301	£1.20	STK082	£7.75	TA7222AP	£1.20	UPC1187V	£1.30	2SB698	£0.30	2SC2278	£0.70
AN362L	£1.30	HA1366WR	£1.50	LA3350	£1.20	STK086	£9.25	TA7223P	£1.95	UPC1190C	£0.95	2SB754	£0.95	2SC2335	£1.50
AN366P	£1.50	HA1367	£3.25	LA3361	£1.20	STK430	£4.75	TA7224P	£2.75	UPC1191V	£0.95	2SB755	£2.50	2SC2365	£4.25
AN610P	£1.75	HA1368	£1.60	LA4030P	£2.00	STK433	£4.50	TA7225P	£2.50	UPC1198H	£0.70	2SB7720	£0.90	2SC2540	£12.75
AN612	£1.75	HA1368R	£1.65	LA4031P	£1.40	STK435	£5.00	TA7226P	£2.20	UPC1200V	£0.80	2SC372	£0.30	2SC2570	£0.70
AN5722	£1.50	HA1370	£2.75	LA4032P	£1.40	STK436	£5.00	TA7227P	£1.50	UPC1208C	£0.95	2SC373	£0.30	2SC2577	£1.90
AN5730	£1.85	HA1374	£2.50	LA4051P	£1.50	STK437	£6.30	TA7229P	£3.00	UPC1211V	£1.90	2SC380A	£0.30	2SC2578	£2.20
AN5732	£1.85	HA1377A	£2.20	LA4100	£1.00	STK439	£5.50	TA7230P	£1.75	UPC1215V	£1.25	2SC458	£0.20	2SC2579	£2.20
AN5753	£1.95	HA1388	£2.35	LA4101	£1.00	STK441	£6.00	TA7232P	£2.75	UPC1216V	£0.95	2SC460	£0.30	2SC2580	£2.20
AN6250	£2.30	HA1389	£1.75	LA4102	£1.20	STK443	£6.95	TA7310P	£1.40	UPC1217G	£1.60	2SC461	£0.30	2SD24	£0.50
AN6344	£4.75	HA1389R	£1.40	LA4110	£1.40	STK457	£5.50	TA7312P	£1.30	UPC1218H	£1.40	2SC503Y	£0.70	2SD170	£0.60
AN7105	£2.20	HA1392	£2.30	LA4112	£1.30	STK459	£5.75	TA7313AP	£1.30	UPC1222C	£0.90	2SC536	£0.20	2SD187	£0.60
AN7110	£1.40	HA1394	£2.75	LA4120	£2.50	STK460	£7.50	TA7315AP	£1.75	UPC1223C	£1.75	2SC537	£0.25	2SD313	£0.95
AN7114E	£1.60	HA1397	£2.50	LA4125	£2.00	STK461	£6.50	TA7325P	£0.85	UPC1225H	£1.60	2SC620	£0.50	2SD325	£0.65
AN7115E	£1.60	HA1398	£2.40	LA4140	£0.70	STK463	£7.40	TA7328	£1.60	UPC1226C	£1.25	2SC632	£0.30	2SD348	£4.50
AN7120	£1.40	HA1457W	£0.90	LA4182	£2.00	STK465	£8.50	TA7607AP	£2.75	UPC1227V	£0.95	2SC681	£2.20	2SD352A	£0.50
AN7130	£1.50	HA11215A	£4.25	LA4192	£1.95	STK0025	£4.95	TA7608	£3.50	UPC1230H	£2.50	2SC681A	£2.30	2SD371	£1.30
AN7145M	£1.80	HA11221	£2.30	LA4200	£1.50	STK0029	£4.35	TA7609P	£2.30	UPC1238V	£0.85	2SC710	£0.30	2SD401	£1.50
AN7146M	£1.85	HA11223W	£3.80	LA4220	£1.20	STK0039	£4.25	TA7611	£2.75	UPC1245V	£1.00	2SC717	£0.50	2SD467B	£0.30
AN7154	£1.75	HA11225	£1.95	LA4230	£1.75	STK0040	£5.50	TA7658P	£1.50	UPC1277H	£2.75	2SC732	£0.30	2SD468B	£0.50
AN7156N	£2.40	HA11235	£2.00	LA4400	£1.90	STK0049	£5.75	UHIC001	£4.80	UPC1278H	£2.50	2SC733	£0.30	2SD718	£1.50
AN7158N	£3.25	HA11423	£4.75	LA4420	£1.40	STK0059	£6.00	UHIC004	£4.80	UPC1350C	£1.20	2SC792	£2.85	2SD734	£0.30
AN7168	£2.50	HA11701	£4.50	LA4422	£1.20	STK0080	£6.50	UPC16C	£1.30	UPC1353C	£1.75	2SC799	£1.75	2SD916	£0.95
AN7310	£0.80	HA11702	£4.90	LA4430	£1.30	STK2028	£6.50	UPC20C	£2.20	UPC1356C	£1.50	2SC828	£0.20	2SD1133	£1.75
AN7311	£1.00	HA11703	£4.50	LA4440	£2.20	STK2029	£3.75	UPC30C	£1.80	UPC1358H	£1.50	2SC840	£1.50	2SD1276	£1.50
BA301	£0.75	HA11704	£4.75	LA4460	£1.75	STK2230	£6.00	UPC41C	£2.00	UPC1360C	£1.60	2SC867	£2.75	2SJ49	£4.00
BA311	£0.95	HA11705	£6.50	LA4461	£1.75	STK2240	£9.75	UPC554C	£1.25	UPC1363C	£1.95	2SC900	£0.35	2SJ50	£4.00
BA313	£0.75	HA11706	£4.75	LA4500	£2.50	STK3042	£6.50	UPC555	£0.60	UPC1365C	£3.00	2SC929D	£0.35	2SK19	£0.50
BA318	£1.30	HA11710	£5.50	LA4505	£2.50	STK5211	£6.75	UPC561C	£2.00	UPC1366C	£1.50	2SC930D	£0.30	2SK38A	£2.70
BA402	£0.75	HA11711	£9.50	LA6458	£0.90	STK5421	£6.50	UPC566H	£0.60	UPC1367C	£1.50	2SC945	£0.35	2SK49	£0.60
BA511A	£1.80	HA11713	£6.00	LA7800	£2.50	STK5451	£6.75	UPC571	£1.95	UPC1368H	£1.75	2SC1034	£3.75	2SK120	£0.90
BA514	£1.75	HA11714	£5.75	LA7806	£2.50	STK5720	£6.80	UPC573C	£2.20	UPC1370C	£1.95	2SC1061	£0.95	2SK134	£4.00
BA521	£1.75	HA11715	£6.25	LC7120	£3.50	STK5730	£6.75	UPC574J	£0.35	UPC1373H	£0.75	2SC1096	£0.60	2SK135	£4.00
BA527	£1.50	HA11716	£6.25	LC7130	£3.50	TA7050P	£0.80	UPC575C	£1.00	UPC1378H	£1.95	2SC1114	£3.50	3SK22	£1.75
BA532	£1.50	HA11717	£6.25	LC7131	£3.75	TA7051P	£0.80	UPC576H	£1.75	UPC1382C	£0.75	2SC1115	£3.75	3SK45	£0.60
BA536	£2.25	HA11718	£4.75	LC7136	£2.75	TA7054	£1.70	UPC577	£0.70	UPC1384C	£2.50	2SC1124	£0.80	3SK88	£0.50
BA612	£1.80	HA11724	£18.25	LC7137	£2.75	TA7063	£0.80	UPC580	£2.75	UPC1458C	£0.90	2SC1162C	£0.80	TDA1515	£4.30
BA1310	£1.75	HA11725	£16.00	M5106P	£2.25	TA7066	£1.50	UPC585C	£0.95	UPD277	£4.50	2SC1170B	£2.95	TDA2002	£0.80
BA1320	£1.25	HA11726	£15.00	M5115P	£3.50	TA7070P	£1.40	UPC592	£0.95	2SA103	£0.60	2SC1172	£2.75	TDA2003	£0.90
BA1330	£1.75	HA11727	£9.50	M5134P	£2.75	TA7073	£2.25	UPC595C	£1.70	2SA350	£0.60	2SC1307	£1.25	TDA2004	£2.20
BA6304	£2.20	HA11736	£16.00	M5135P	£2.30	TA7074P	£1.95	UPC596	£1.50	2SA495	£0.35	2SC1308	£2.70	TDA2005	£2.75
CX0642	£8.50	HA11745	£9.00	M5155	£1.50	TA7104P	£1.35	UPC1001H	£2.00	2SA539	£0.30	2SC1316	£2.95	TDA2006	£1.20
CX065B	£2.50	HA11747	£9.50	M51513L	£1.50	TA7108	£1.50	UPC1009C	£1.20	2SA562	£0.30	2SC1317	£0.30	TDA2020	£1.40
CX075B	£2.20	HA11747ANT	£9.50	M51514AL	£1.75	TA7109	£2.30	UPC1017G	£1.30	2SA634	£0.60	2SC1342	£0.75	TDA2030	£1.40
CX095C	£2.80	HA11749	£4.50	M51515BL	£2.50	TA7119	£1.75	UPC1018C	£0.95	2SA643	£0.65	2SC1364	£0.40		
CX100D	£5.75	HA11750	£5.00	M51516L	£2.50	TA7120P	£0.50	UPC1020	£1.75	2SA673	£0.35	2SC1417	£0.30		
CX101G	£7.50	HA11753NT	£8.50	M51517L	£2.50	TA7130P	£1.00	UPC1023H	£0.60	2SA684	£0.70	2SC1419B	£0.75		
CX130	£4.50	HA11758NT	£8.50	M51518L	£1.75			UPC1025H	£2.30	2SA699A	£0.85				
CX136	£5.50	HA11768	£4.50	M51521AL	£1.75			UPC1026C	£1.00	2SA762	£1.95				

VIDEO BELT KITS

AKAI VS-2EG/5EG (5)	£1.50
AKAI VS 9700EG (6)	£1.75
FISHER VBS 7000 (6)	£2.20
FISHER VBS 9000 (3)	£1.00
HITACHI VT5000 (7)	£1.70
JVC HR3300/3600 (9)	£2.00
JVC HR3360/3660 (7)	£2.00
JVC HR7700 (3)	£1.20
PANASONIC NV333 (5)	£1.40
PANASONIC NV2000 (5)	£1.40
PANASONIC NV7000 (5)	£1.25
PANASONIC NV8600 (7)	£1.75
SANYO VTC5500 (3)	£1.00
SANYO VTC9300 (4)	£2.25
SHARP VC6300 (5)	£1.75
SHARP VC7300/7700 (5)	£1.30
SHARP VC8300 (5)	£1.50
SHARP VC9300	£1.30
SONY SLT7ME/T7 (6)	£1.60
SONY SLC7/J7 (6)	£1.70
SONY SL800/8080 (6)	£2.00
TOSHIBA V547 (6)	£1.70
TOSHIBA V7540 (5)	£1.75
TOSHIBA V8600 (6)	£1.30

LATE EXTRA

AN5033	£5.25
AN5620X	£6.25
AN6387	£5.63
HA11440A	£3.75
HA12001W	£6.50
HA12038	£6.75
LA1140	£1.75
LA3370	£2.80
LA4126	£2.50
LA4507	£4.85
LA7016	£2.50
LA7215	£2.75
LA7521	£4.50
LA7751	£4.75
LA7755	£2.95
LA7801	£2.95
LA7808	£2.50
LA7910	£1.95
LC4066B	£2.50
M51102L	£4.95
TA7140P	£1.75
UPC1387C	£2.50
UPC1391H	£2.50

VIDEO HEADS

8000/9000 VT11/14/33/5000/5500	£33.50
17/19/7 State model	£44.00
4 HSs	£28.75
RSV 3B	£32.00
DSR 10R	£32.00

Also available: Motors/Pressure Rollers etc.

CASSETTE MOTORS
6-9-12-13 2 Volts £2.50

CASSETTE HEADS

Mono	£1.50
Stereo	£2.50
Auto Reverse	£2.75
Mini/Stereo	£2.75

TV CERAMIC SOUND FILTERS 3 LEAD TYPE

SFE 4.5MB	£0.25
SFE 5.5MB	£0.25
SFE 6.0MB	£0.25
SFE 6.5MB	£0.25
CDA 6.0MC	£0.30
CDA 6.5MC	£0.30

HIGH SELECTIVITY 4 LEAD TYPE
SFT 6.0MA £0.75

Enquiries invited for any Japanese 1.6s. As we have imported for over 10 years.
Please add 60p post and packing and then add 15% to total.
Callers by appointment: opening times 10am-5pm, Mon-Fri, 9-12 Sats.

VISA/ACCESS ACCEPTED · MIN. TELEPHONE ORDER £5.00

T. POWELL,
16 PADDINGTON GREEN, LONDON W2 1LG
Tel: 01-723 9246 (Answerphone)
ITEMS DESPATCHED WITHIN 48 HOURS

BARCLAYCARD VISA

EAST CORNWALL COMPONENTS

Access

NEW 1986 CATALOGUE is now available – range of components greatly increased – over 136 pages fully illustrated. Price £1.00 per copy (free upon request with orders over £15). Includes 50p Credit Note, Special Offer Sheets, Order Form and Pre-Paid Envelope. Order your copy now – will be sent within 7 days.

VALVES

Type	Price (£)
DY802	0.95
DY86/87	0.66
ECC81	1.00
ECC82	0.92
ECC83	1.00
ECC84	0.80
ECC85	0.95
ECC88	1.25
ECF80	1.20
ECH81	1.40
ECH84	1.50
ECL82	1.10
ECL86	1.75
EF80	0.75
EF86	1.80
EF183	0.90
EF184	1.00
EH90	0.98
KT66(G.E.C.)	16.00
KT88(G.E.C.)	19.00
EL34	3.25
EL84	1.00
EL509	7.85
EM87	2.55
EY86/87	0.67
EY500A	2.50
PCC84	0.60
PCC85	1.75
PCC89	0.75
PCC189	0.85
PCF80	0.95
PCF86	1.25
PCF200	1.95
PCF801	1.05
PCF802	1.05
PCF806	1.20
PCL82	1.00
PCL83	2.50
PCL84	1.00
PCL86	0.90
PCL805/85	1.05
PD500	2.90
PFL200	1.85
PL33	1.50
PL36	1.75
PL81	0.85
PL82	0.75
PL83	1.20
PL84	0.75
PL95	2.00
PL504	1.40
PL508	2.70
PL509/519	5.25
PY88	1.80
PY500A	2.20
U26	1.90
UCH81	2.00
UCL82	1.80
30FL12	1.60

TRANSISTORS + DIODES

Type	Price (£)
AC127	0.28
AC128	0.30
AC128K	0.34
AC141	0.58
AC141K	0.38
AC142	0.56
AC142K	0.38
AC151	0.45
AC152	0.45
AC153	0.57
AC153K	0.46
AC176	0.30
AC176K	0.38
AC187	0.28
AC187K	0.38
AC188	0.28
AC188K	0.38
ACY22	1.50
AD142	0.88
AD143	1.10
AD149	0.72
AD161/162	1.20
AD162	0.52
AF114	1.20
AF115	2.10
AF116	2.10
AF121	0.56
AF124	2.10
AF125	0.58
AF126	0.58
AF127	0.38
AF139	0.40
AF178	2.28
AF239	0.50
AF279S	1.40
AL100	5.40
AL102	4.40
ASY80	5.20
ASZ17	2.20
AU110	2.80
AY102	4.40
B40C200	1.03
BA110	0.68
BA115	0.14
BA121	0.40
BA129	0.38
BA148	0.16
BA155	0.12
BA157	0.28
BB105B	0.30
BB105G	0.42
BB110B	0.42
BC107	0.10
A or B	0.12
BC108	0.10
A,B or C	0.13
BC109	0.10
A,B or C	0.14
BC113	0.42
BC115	0.12
BC116	0.12

Type	Price (£)
BC117	0.22
BC118	0.16
BC119	0.28
BC125	14
BC140	0.27
BC141	0.24
BC142	0.24
BC143	0.26
BC147	0.18
BC147B	0.14
BC148	0.10
BC148B	0.12
BC149	0.10
BC149C	0.14
BC157	0.10
BC158	0.12
BC159	0.12
B/C	0.14
BC160	0.30
BC161	0.30
BC168B	0.20
BC169C	0.12
BC170	0.16
A B or C	0.16
BC171	0.10
A or B	0.10
BC172	0.12
B or C	0.12
BC177	0.24
A B or C	0.12
BC182	0.10
A,B or C	0.10
BC182L	0.12
LA LD LC	0.10
BC183	0.10
A B or C	0.10
BC183L	0.10
LA LB LC	0.10
BC184	0.10
A B CL LC LB	0.10
BC207	0.15
BC212	0.10
A B or C	0.10
BC212L	0.09
LA LB	0.10
BC213	0.10
A B or C	0.10
BC213L	0.10
LA LB LC	0.10
BC237	0.11
BC238	0.12
BC251	0.14
A B	0.14
BC262	0.20
A B	0.28
BC301	0.30
BC302	0.30
BC303	0.30
BC307A	0.18
BC317A	0.12
BC323	0.90

Type	Price (£)
BC327	0.16
BC328	0.16
BC337	0.12
BC338	0.16
BC350A	0.24
BC351	0.16
BC440	0.36
BC441	0.40
BC461	0.58
BC478	0.24
BC516	0.48
BC547	0.12
A or B	0.12
BC548	0.12
A B or C	0.10
BC549	0.10
A or B	0.10
BC550	0.10
A or B	0.10
BC557	0.10
BC558A	0.10
BCY70	0.16
BCZ10	3.21
BCZ11	2.60
BD124P	0.70
BD129	0.90
BD130Y	0.68
BD131	0.36
BD132	0.36
BD135	0.26
BD136	0.26
BD137	0.28
BD138	0.30
BD139	0.30
BD140	0.28
BD142	1.26
BD145	1.82
BD150A	0.72
BD160	1.58
BD165	0.65
BD183	0.70
BD201	0.52
BD202	0.57
BD204	0.50
BD222	0.80
BD225	0.40
BD232	0.45
BD234	0.40
BD235	0.36
BD236	0.38
BD237	0.38
BD410	0.76
BD434	0.58
BD438	0.58
BD439	0.85
BD441	1.00
BD507	1.05
BD520	1.20
BD687	0.88
BD707	0.88
BDX18	1.00
BDX32	1.48
BF115	0.32

Type	Price (£)
BF117	0.50
BF119	0.82
BF120	0.38
BF125	0.42
BF127	0.41
BF154	0.14
BF157	0.46
BF158	0.30
BF160	0.23
BF167	0.32
BF177	0.42
BF178	0.26
BF180	0.27
BF181	0.27
BF182	0.32
BF183	0.32
BF184	0.30
BF185	0.28
BF194A	0.15
BF195	0.12
BF200	0.30
BF222	0.38
BF224	0.16
BF224J	0.20
BF240	0.30
BF241	0.30
BF244	0.34
BF244A	0.30
BF257	0.22
BF258	0.26
BF259	0.30
BF262	0.34
BF263	0.38
BF270	0.30
BF271	0.28
BF273	0.22
BF274	0.34
BF294	0.46
BF336	0.32
BF337	0.28
BF338	0.28
BF355	0.37
BF363	0.35
BF367	0.24
BF371	0.27
BF422	0.20
BF450	0.38
BF457	0.30
BF458	0.37
BF459	0.35
BFR51	0.36
BFR61	0.32
BFR90	0.86
BFT41	0.68
BFT43	0.86
BFW11	0.84
BFW44	0.88
BFX29	0.22
BFX48	0.78
BFX80	6.46
BFZ85	0.35
BFY50	0.22
BFY51	0.22

Type	Price (£)
BFY52	0.22
BFY90	0.80
BFY90S	1.34
BR100	0.25
BR101	0.40
BR103	0.50
BR303	2.75
BRY39	0.50
BRY56	0.42
BSX19	0.32
BSX20	0.30
BSX59	0.78
BSX76	0.65
BSY52	0.35
BSY95A	0.25
BT100A/02	0.90
BT101/300	2.75
BT101/500	3.25
BT102/300	3.60
BT106	1.15
BT108	1.25
BT109	1.15
BT116	1.20
BT119	3.30
BT120	3.50
BT121	2.99
BT138/600	1.30
BT151/560R	0.90
BTY79/400R	2.80
BU100A	2.30
BU104	1.80
BU105	1.20
BU105/02	1.55
BU108	1.75
BU124AE	0.98
BU126	1.40
BU133	1.90
BU204	1.30
BU205	1.30
BU206	1.50
BU208	1.40
BU208A	1.40
BU208/02	2.05
BU326S	1.75
BU407	1.10
BUX80	3.70
BUY20	2.75
BUY69A	2.60
BUY69B	1.98
BY100	0.80
BY103	0.50
BY122	0.60
BY126	0.10
BY127	0.10
BY133	0.06
BY135	0.35
BY164	0.45
BY179	0.56
BY182	0.80
BY184	0.30
BY187	0.65
BY189	6.75
BY198	0.64

Type	Price (£)
BY199	0.72
BY206	0.14
BY207	0.16
BY210/400	0.21
BY210/600	0.24
BY210/800	0.28
BY227	0.22
BY228	0.46
BY238	0.65
BYX10	0.20
BYX36/150	0.40
BYX36/600	0.48
BYX48/300	0.70
BYX55/600	0.30
BYX71/600	1.18
BYZ12	0.78
C106D (400V)	0.48
C106F (50V)	0.36
D40C1	1.08
D40N1	1.12
E1222	0.30
E5024	0.30
GET872	0.60
GET881	1.70
GET882	1.90
ITT2001	0.18
ITT2003	0.34
MCR106/5	1.20
ME0413	0.70
ME6002	0.26
MEU21	0.62
MJ400	0.45
MJ2955	1.00
MJ3000	1.80
MJE340	0.46
MJE520	0.44
MJE2955	1.60
MJE3055	1.40
MPSA05	0.30
MPSA12	0.30
MPSLO1	0.34
MPSUO5	1.05
MPSUO6	1.18
MR502	0.40
MR854	0.88
OA91	0.30
OA210	0.66
OC26	2.65
OC35	4.75
OC36	1.75
OC44	0.72
OC72	0.70
OC81	0.68
ORP12	0.85
R2008B	1.20
R2010B	1.20
R2540	2.71
TIC45	0.45
TIC47	0.70
TIC29	0.30
TIP30A	0.32
TIP31C	0.39
TIP32	0.35

Type	Price (£)
TIP33A	0.55
TIP34A	0.70
TIP41C	0.42
TIP42	0.44
TIP47	0.42
TIP121	0.63
TIP2955	0.70
TIP3055	0.58
TIS43	0.88
TIS88	0.50
TIS90	0.27
TIS20	2.45
Y728	0.14
Y969	2.80
ZE75	0.60
ZTX107	0.14
ZTX502	0.22
IN4001	0.04
IN4003	0.05
IN4004	0.05
IN4006	0.07
IN4007	0.07
IN4148	0.04
IN5400	0.12
IN5402	0.13
IN5405	0.16
IN5406	0.17
IN5408	0.19
IS44	0.06
IS920	0.07
2N1306	1.42
2N2122A	0.34
2N2222	0.30
2N2904A	0.48
2N2926G	0.14
2N3053	0.30
2N3054	0.60
2N3055	0.65
2N3703	0.10
2N3773	2.80
2N3904	0.20
2N3906	0.20
2N5294	0.80
2N6107	0.80
2SB337	1.80
2SC1098	0.84
2SC1172Y	1.70
2SC1173Y	0.88
2SC1279	0.50
2SC1306	0.92
2SC1307	1.50
2SC1413A	2.70
2AC1449	0.60
2SC1507	0.60
2SC1678	1.00
2SC1758	0.68
2SC1909	1.20
2SC1923	0.30
2SC1945	2.88
2SC21953	0.70
2SC1957	0.70
2SC1969	2.80
2SC2028	0.73

Type	Price (£)
2SC2029	2.70
2SC2078	1.05
2SC2091	0.70
2SC2098	2.90
2SC122A	3.20
2SC2314	0.80
2SC2335	1.50
2SK135	3.80
3N211	3.52
3SK88	0.60
3SK88L	0.80
40636	1.65
40673	1.80

74LS

Type	Price (£)
74LS00	0.24
74LS01	0.24
74LS02	0.24
74LS03	0.24
74LS04	0.24
74LS05	0.24
74LS08	0.24
74LS09	0.24
74LS10	0.24
74LS11	0.24
74LS12	0.24
74LS13	0.33
74LS14	0.48
74LS15	0.24
74LS19	0.44
74LS20	0.24
74LS21	0.24
74LS22	0.24
74LS24	0.28
74LS26	0.24
74LS27	0.24
74LS28	0.24
74LS30	0.24
74LS32	0.24
74LS33	0.24
74LS37	0.24
74LS38	0.24
74LS40	0.24
74LS42	0.50
74LS47	0.79
74LS48	0.85
74LS51	0.24
74LS55	0.24
74LS73	0.30
74LS74	0.33
74LS75	0.44
74LS76	0.38
74LS83	0.88
74LS85	0.82
74LS86	0.35
74LS90	0.48
74LS91	0.90
74LS92	0.54
74LS93	0.54
74LS95	0.60
74LS96	1.20
74LS107	0.40
74LS109	0.44

Type	Price (£)
74LS112	0.44
74LS113	0.40
74LS114	0.39
74LS122	0.68
74LS123	1.00
74LS124	1.15
74LS126	0.50
74LS132	0.60
74LS135	0.26
74LS136	0.42
74LS138	0.44
74LS139	0.58
74LS145	0.93
74LS147	1.64
74LS148	1.28
74LS151	0.70
74LS153	0.70
74LS155	0.55
74LS157	0.45
74LS158	0.58
74LS160	0.62
74LS161	0.68
74LS162	0.70
74LS163	0.68
74LS164	0.74
74LS165	1.10
74LS166	1.50
74LS168	1.48
74LS170	1.40
74LS173	0.98
74LS174	0.75
74LS175	0.70
74LS190	0.82
74LS192	0.98
74LS193	0.98
74LS194	0.75
74LS195	0.74
74LS196	0.84
74LS197	0.96
74LS221	0.85
74LS240	0.80
74LS241	0.80
74LS242	0.94
74LS243	0.94
74LS244	0.80
74LS245	1.20
74LS247	1.00
74LS251	0.75
74LS257	0.73
74LS258	0.75
74LS259	1.20
74LS266	0.55
74LS237	1.20
74LS279	0.70
74LS283	0.80
74LS353	1.10
74LS365	0.50
74LS366	0.50
74LS367	0.50
74LS368	0.50
74LS373	1.00
74LS374	1.00
74LS375	0.70

CHART RECORDER SPECIAL

Brand new 3 channel pen recorders complete with charts. Full spec. upon request. Once only price **£40 + £10 p&p + VAT.**

ORYX PORTASOL PORTABLE GAS SOLDERING IRON

Powered by ordinary lighter fuel. 60 mins. cont. use, adj. temp. 10/60W. Price £13.90

Fuseholders

20mm Panel Mounting	0.28
20mm Chassis Carline 1¼" holder	0.10

SOLDERING SECTION

Soldering Station complete with 30W or 40W Iron (state which)	67.95
XS25 W Iron kit/ complete with steel & plug attached	10.00
CS 18W, as above	9.90
Antex 15W Iron	5.25
Antex 18W Iron	5.50
Antex 25W Iron	5.75
Antex elements	2.75
Antex bits	0.90
Antex stands	2.10
Soldersucker	4.50
Spare nozzles for Soldersucker	0.65

CAPACITORS

Metallised Paper

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

SPECIAL OFFER – APRIL ONLY

¼W Resistor Kit 10 each value 10R – 1M each value individually packed and marked. Total 710 Resistors. PRICE **£4.75**

Available with each order valued £10.00 & over. Look for our SPECIAL OFFER each month.

SONY T.V. & VIDEO SPARES

Idler Kit SLC5.SLC7 (Rewind Kit)	A-670-634-8A	£4.80
SLC6 (Rewind Kit)	A-670-639-1A	£3.06
Video Head SLC9UB	A-676-208-8A	£45.05
SLC5/C6/C7	A-676-212-9A	£43.05
Motor Kit MT General	X-354-931-41	£14.44
Limiter Assembly SLC7UB	X-365-331-00	£2.45
Power Switch KV General	1-554-820-11	£5.50

Diodes ICs Thyristors Belts Transistors Switches Remote Controls Instruction & Service Manuals

POTENTIOMETERS

Carbon Track Rotary 0.25W Log & 1 in values. All ¼in Spindle 20ml body dia Shaft 2" long

4K7.2M2 Single Gang Log	.40	10/3.50
1K — 2M2 Single Gang Lin	.30	10/3.50
5K — 2M2 Single Gang DP Switch Log	1.05	10/9.50
5K — 2M2 Double Gang Log & Lin	1.25	10/10.50

INTEGRATED CIRCUITS (£) EACH

709	0.35	ML23713	2.30	TDA560C	1.50
741	0.25	NE555	0.25	TDA800	0.80
747	0.70	SAA1025	4.00	TBA810S	1.20
AN214Q	3.80	SAS560	2.50	TBA950/2A	3.05
AN240P	3.42	SAS570	1.85	TCA270SA	4.02
BTT6218	1.98	SAS580	2.85	TDA1003A	5.50
CA301AT	2.88	SN76131N	1.99	TDA1006A	2.45
CA358	0.66	SN76226DN	1.70	TDA1035S	2.20
CA801CM	1.20	SN76227N	1.10	TDA1170S	1.99
CA3020	2.10	SN7666ON	0.75	TDA1352A	1.80
CA3065	1.60	SN76666NO	1.40	TDA2002	1.80
CA3080E	0.68	STK015	6.20	TDA2020	4.00
CA3140	0.45	TA7146P	4.60	TDA2030	1.90
HA1366W	1.59	TA7203P	2.76	TDA2140	2.90
LA4422	3.20	TA7204P	1.50	TDA2160	2.50
LC7131	4.90	TA7205AP	1.30	TDA2522	2.75
LC7137	5.40	TA7222P	2.32	TDA2530	2.20
LM324N	0.48	TAA550	0.50	TDA2532	2.80
LM380N8-P	1.15	TAA611A12	3.50	TDA2560	3.20
LM380N14-P	1.80	TAD100	2.90	TDA2561	4.65
LM1011N	3.20	TDA120A	0.80	UPC57562	1.48
LM1488N	0.98	AS/S/SB/T/U	0.80	UPC741G	0.92
LM3900N	0.85	TDA120B	1.30	UPC1156H	2.75
M51513L	3.18	SA/SQ/UQ	1.30	UPC1182H	2.75
M51515L	3.18	TBA520	1.50	UPC1218H	1.80
MC1307P	1.99	TBA530	1.20	UPC1370C2	2.50
MC1327P	1.50	TBA540	1.64	UPC2002H	2.78
MC1330P	1.60			UPC2002V	2.78
ML23213	2.10				

CMOS

4000	0.19	4096	0.98
4001	0.24	4097	2.65
4002	0.24	4098	0.78
4006	0.68	4099	0.75
4007	0.24	4161	0.96
4008	0.59	4162	0.96
4009	0.44	4163	0.96
4010	0.39	4174	0.96
4011	0.23	4175	1.00
4012	0.24	4195	0.99
4013	0.35	4501	0.38
4014	0.58	4502	0.58
4015	0.58	4503	0.38
4016	0.38	4507	0.45
4017	0.54	4508	1.28
4018	0.59	4510	0.54
4019	0.59	4511	0.54
4020	0.78	4512	0.54
4021	0.58	4514	1.10
4022	0.68	4515	1.20
4023	0.30	4516	0.60
4024	0.49	4517	2.70
4025	0.24	4518	0.48
4026	0.89	4520	0.05
4027	0.44	4521	1.10
4028	0.44	4522	1.20
4029	0.73	4526	0.58
4030	0.33	4527	0.64
4031	1.28	4528	0.68
4033	1.25	4531	1.20
4034	1.40	4532	0.64
4035	0.68	4536	2.50
4036	2.48		
4038	0.73		
4039A	2.70		
4040	0.58		
4042	0.48		
4043	0.42		
4044	0.48		
4049	0.38		
4050	0.34		
4051	0.68		
4052	0.58		
4053	0.58		
4066	0.44		
4068	0.24		
4069	0.24		
4070	0.24		
4071	0.24		
4072	0.24		
4073	0.24		
4075	0.24		
4076	0.68		
4077	0.24		
4078	0.24		
4081	0.24		
4082	0.24		
4085	0.58		
4086	0.58		
4089	1.22		
4093	0.37		
4094	0.70		
4095	0.93		

SERVICE AIDS

Switch Cleaner	1.24
Circuit Freezer	1.40
Foam Cleanser	1.22
Aero Klene	1.14
Plastic Seal	1.34
Excel Polish	1.16
Antistat Spray	1.24
Aero Duster	1.48
Super 40	1.86
Video Head Cleaner	1.10
Fire Extinguisher	3.28
Silicone Grease Aero	1.50
Ditto Tube	1.66
Heat Sink Compound	1.10
Solda Mop 0.12mm	0.74
Ditto 0.06mm	0.76
Industrial Reel 0.12mm length 10m	£2.90

TERMINAL BLOCKS

2 amp 12 way	0.22
5 amp 12 way	0.24
15 amp 12 way	0.42
32 amp 12 way	0.88

RESISTORS – CARBON FILM 5%

¼W 1RO to 10M (E12 Range)	2p each. 15p/10. 75p/100
½W 2R2 to 10M (E24 Range)	2p each. 15p/10. 75p/100
1W 10R to 2M2 (E12 Range)	7p each. 65p/10. 6.00/100
2W 10R to 2M2 (E6 Range)	8p each. 70p/10. 6.00/100

RESISTOR KITS – each value individually packed

¼W pack 10 each value E12 – 10R to 1M 610 pieces	5.75
¼W pack 5 each value E12 – 10R to 1M 305 pieces	3.35
½W pack 10 each value E12 – 2R2 to 2M2 730 pieces	7.95
½W pack 5 each value E12 – 2R2 to 2M2 365 pieces	4.75
1W pack 5 each value E12 – 10R to 1M 353 pieces	15.00
2W pack 5 each value E6 – 10R to 2M2 317 pieces	18.50

RESISTORS – WIREWOUND. Generally 5%

2.5W – 0.22 to 270R – Available in preferred values	0.15
4W – 1R0 to 10K – Available in preferred values	0.18
7W – 0.47R to 22K – Available in preferred values	0.15
11W – 1R0 to 22K – Available in preferred values	0.18
17W –1R0 to 22K – Available in preferred values	0.24

ZENER DIODES

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

*Only available while stocks last

HV Disc Ceramic (1)

1kV 1.5nF 18p

8kV 10, 47, 56, 82, 100, 120, 150, 180 30p

ZENER DIODE PACK

400mW – 5 each value – 11 values – individually marked and packed – 55 Zener Diodes. Price £3.50 each.

All prices are subject to change without notice

TELEPHONE SPECIAL

BT App Telephone Plug + 3m Lead	£1.25
BT App Master Socket inc Wiring instrns	£2.85
BT App Secondary Socket	£1.95
4-way plug	30p each
BT 4-Core Cable per metre	15p/m £12.00/100m
Cable clips for above	100/75p

NI-CAD CHARGER

Universal Ni-Cad charger, charges PP3, AA, C, D. Price £5.17

Rechargeable Batteries

AA (HP7)	95p	10/ 85p each
C (HP11)	£2.14	10/£1.98 each
D (HP2)	£2.30	10/£2.10 each
PP3	£3.75	10/£3.65 each

Dry Cell Batteries – Button type for Multimeters – set of 3 £1.50

MULTISECTION ELECTROLYTICS

THORN	850 100+300+100+16/300V	1.80
	1400 150+100+100+100+150/320V	2.70
	1500 150+150+100/300V	2.00
	3000 1000/63V	0.74
	3500 175/400V+100+100/350V	2.56
	8000 400/350V	2.10
	8000/8500 2500+2500/63V	1.99
	8000 700/250V	2.15
	1000/70V	0.80
	9000 400/400V	3.00
Timer Amp	4700/25V	0.95
DECCA 10/30	400+400/350V	3.20
	1700 200+200+400/350V	3.75
GEC	2047 2048 2083 2084 2104 200+200+150+50/300V	2.50
	600/250V	1.85
ITT/KB	200+200+75+25/350V	2.90
	220/100V	1.95
PHILIPS	G8 600/300V	2.20
	G8 G9 600/300V	2.10
	G11 470/250V	1.80
	G9 2200/63V	1.25
EKCO	T148 125+200+100+32/275V	2.65
	691 Series 200+300/350V	2.50
	600/300V	2.20
RANK	300+300/300V	1.75
	A823 2500+2500/30V	1.50
	220/400V	1.85
	600/300V	2.25

FUSES Prices per 10

20mm Quick Blow. 100, 125, 160, 200, 250, 315, 400, 500, 630, 800mA, 1, 1.25, 1.6, 2, 2.5, 3.15, 4, 5, 6.3A. **40p. 20mm Time Delay.** 100, 125, 160, 200mA **£1.80.** 250, 315, 400, 500, 630, 800mA. **£1.00.** 1, 1.25, 1.6, 2, 2.5, 3.15, 4, 5, 6.3A **85p. 1" Mains.** 2, 3, 5, 7, 10, 13A **85p.**

REPLACEMENT TV MAINS DROPPERS

GEC2010	8R + 15R + 17R + 70R + 63R + 188R	0.95
GEC 2018	10R + 15R + 19R + 70R + 188R	1.15
Philips G8	2.2R + 68 R	0.80
Philips 70	6R + 124R + 84R	0.68
Philips 300	118R + 148R (with link)	0.85
RRI A640	250R + 14R + 156R 50W	1.05
RRI A816	302R + 70R + 6.2R	0.78
Thorn 1500	350R + 20R + 148R + 1.5K + 317R	1.34
Thorn 3000/3500	6R + 1R + 100R Fused	0.93
Thorn 8000	56R + 1K + 47R + 12R	0.95
Thorn 8500	1K5 + 40R + 50R	1.28

Plus Many More. Please enquire.

EAST CORNWALL COMPONENTS
119 HIGH STREET
WEM
SHROPSHIRE SY4 5TT TEL: 0939 32689
TELEX: 35565

ORDERING: All components are brand new and to full specification. Please add 65p postage/packing (unless otherwise specified) to all orders and then add 15% VAT to the total. Minimum order £5.00. Either send cheque/cash/postal order or send/telephone your Access or Visa number. Official orders from schools, universities, colleges etc most welcome. (Do not forget to send for our 1986 catalogue – only £1.00 per copy). Delivery by return on ex-stock items.
NEW RETAIL 1000 sq ft shop now open Mon-Fri 9.00-5.00. Sat 9-12.00.

TELEVISION

EDITOR
John A. Reddihough

ADVERTISEMENT MANAGER
Roy Smith
01-261 6671

CLASSIFIED ADVERTISEMENTS
Pat Bunce
01-261 5942

Please note that the telephone numbers above are for contact with the advertisement departments only. Editorial enquiries should be sent to the editor at the address given on page 281.

COVER PHOTO
This month's cover photo shows a set fitted with the Hitachi NP6C chassis. See article on page 294.

CORRECTIONS
The line output valve used in the Thorn 1500 chassis was given as a PL509 in our February issue (page 176). This should of course have been type PL504.

A couple of modifications to the Sharp VC9700 were mentioned in VCR Clinic last month (page 255). The recommended value for R693 should have been given as 10kΩ, not 10Ω.

Two corrections to the Spectrum 48K colour bar program on page 241 last month appear in a letter on page 319 this month.

ADDRESSES ETC.
Several readers wrote to provide us with the address for Nikkai colour sets. These are distributed by Nikkai Imports, Nikkai House, Unit 3, Ashley Industrial Estate, Sackville Street, Leeds LS7 2BS (0532 622 404). Our thanks for this help.

Does anyone know the spares agents for the Sonar 77 portable? The set was made in Taiwan.

Cable Standstill
In November 1983 eleven broadband cable TV franchises were awarded. It was to be the beginning of a great new era, with groups of five franchises being advertised by the Cable Authority at four monthly intervals – remember all that talk about "recabling" the UK? To date one such group of franchises has been awarded and a second, after the Authority delayed its last advertising exercise, is about to be announced, extending the new style services to Camden, Cardiff, Edinburgh, Preston and Southampton. It's hardly been a dynamic start to the new era, and in practice there's a huge difference between being awarded a franchise and actually starting a service. This difference is caused by the problem of raising the finance required once a franchise has been obtained: it's been estimated that current franchise holders are at present seeking around £250 million of risk capital. They are finding it far from easy – it can't help that one of the original eleven franchise companies, Shaw Cable (Wandworth), went into receivership before laying any cable at all. Just four of the original franchise holders have started to provide services, in Swindon, Aberdeen, Coventry and Croydon. One of the problems in obtaining finance is the length of time required to show any profit – an estimate of ten years "at the earliest" has been made. And that of course is pure guesswork since no one is likely to make a profit from the new style networks for a good few years to come. It has often been said that the City is slow to provide finance for new ventures, especially where new technology is concerned, and that it should be prepared to invest with a view to a longer profitability time scale. That might be reasonable with real high technology, but ten years seems a fair enough time scale for an activity like a cable franchise.

How are current cable operations faring? During 1985 the number of homes connected to a cable TV service declined by three per cent. Not a large drop, but on the other hand one would expect a reasonable increase if the new services are making any impact. The drop occurred despite the fact that the number of homes with cable TV available increased by over 41 per cent last year. For the record, at the end of December there were 126,262 cable TV subscribers in the UK while cable services were available to 976,671 homes. Just 12·9 per cent of those who could take a cable TV service chose to do so.

A distinction has to be made between the newer broadband services and the older networks originally set up to provide services in areas where off-air reception was poor. Some of the latter have been updated to provide extra channels, and you might think that this would help keep them going. In fact the drop in the number of cable TV subscribers is due to disconnections from the older networks. By far the largest provider of these older type services is Robert Maxwell's British Cable Services, which took over the Rediffusion networks a while back. British Cable Services has some 75,000 subscribers in over forty towns and recently announced that active selling in 24 of these areas is to stop. The sales force is being reduced from 130 to 100 and will concentrate on the sixteen areas considered to have the best long-term potential. Without a detailed knowledge of local conditions it's hard to see why Bristol, Hastings, Oxford, Reading and Southampton should be considered good prospects while Exeter, Hartlepool, Newcastle and Plymouth are to be put on ice, though the areas selected for continued sales effort are in the more prosperous parts of the country.

This last point leads to what could be regarded as a serious criticism of cable TV as a broadcasting medium. Traditionally in the UK the aim has been to make broadcasting available to all. The BBC and the IBA have gone to great lengths to maximise the coverage provided by their transmitter networks – the cost per viewer of providing services soars in the more remote parts of the country. Even when enthusiasm for cable as an exciting new medium was at its height during the ill fated Information Technology Year it was never envisaged that cable TV would serve more than half the country – those viewers who could be reached at a reasonable cost. It now seems that the potential cable TV network will be much more severely restricted. For a cable service to be viable the area it serves will have to be compact, reasonably homogeneous and relatively prosperous. It's sensible to start off in areas that provide the best economic prospects, but it all seems a far cry from the idea of broadcasting as a public service.

While optimism is still being expressed by some of those in the cable TV industry the omens are at present not very reassuring. Thorn EMI, a company that was expected to become a major operator of the new style broadband services, has decided to reduce its involvement in both programme and network provision: talks have taken place on the sale of its operations in Swindon, Coventry and Belfast. There has already been cost cutting at Swindon, where the local news service has been closed down. This employed nine people to provide two bulletins a day and three fifteen-minute programmes a week for the network's 12,000 subscribers, which was hardly an economic proposition. Raising finance and getting subscribers is proving far harder than was once envisaged – it's a sort of chicken and egg situation of course. Relief has been expressed by the Cable Authority that applications for franchises are still being made. But each franchise recently advertised has attracted only one applicant, which is a bit different from the original idea that the Authority would be responsible for making a careful selection between competing groups of prospective cable TV operators.

Servicing the Hitachi NP6C Chassis

John Coombes

The NP6C chassis was used in a number of Hitachi models that were on sale from late 1976 to 1980, including the CWP132, CRP143, CTP203, CTP213, CTP215, CTP216 and CTP217. Tube sizes range from 13 to 20in. and some models have an ultrasonic remote control system for channel selection, volume and standby. The chassis is in two main sections, the power supply and deflection circuits being on a large horizontal panel at the base of the cabinet while the signal stages are on a vertically mounted panel at the left-hand side – the chroma panel, which includes some but not all of the decoder circuitry, is mounted on this. The RGB output stages are on the c.r.t. base panel. Our front cover photograph shows the general arrangement.

The circuitry is mostly in discrete component form. Early sets have just two i.c.s, an HA11580A (IC501) in the decoder and an HA1124D (IC401) as the intercarrier sound/audio preamplifier channel. In later sets an HA1126DW (IC001) a.f.c. chip appeared while a μPC1351C (IC502) took over most of the decoder circuitry not contained in IC501. There's a transistor line output stage with diode-split transformer and a chopper power supply. The latter includes a multivibrator start-up arrangement. Two thick-film voltage divider/reference voltage modules (CP901, CP902, type HM9102) are used in the power supply. They are none too reliable. Another thick-film module is used for the field driver and output stages (M601, type HM6231) – faulty connections can give problems here.

Poor Soldered Joints

Poor soldered joints are in fact a common problem with these sets – dry-joints on the chopper (T902), chopper driver (T901) and line output (T703) transformers are often responsible for intermittent operation. Dry-joints also tend to occur on the resistors mounted above the board in the power supply – R918, R924, R928, R933 and R935. R937 is another resistor in this area whose connections are worth checking. Suspect joints should be cleaned and fluxed before resoldering.

Power Supply Circuitry

As with most modern TV receivers the chopper power supply is the heart of the set. The circuit is shown in Fig. 1 and to assist with fault-finding it's helpful to appreciate how this works. Mains bridge rectifier CR901-4 produces across C909 a d.c. supply which is fed to the collector of the chopper transistor TR906 via the primary winding of the chopper transformer T902. CR908 rectifies the pulses developed across the secondary winding, producing a stabilised 110V h.t. supply across C925. Stabilisation is achieved by adjusting the mark-space ratio of the drive to the chopper transistor, i.e. its on/off times.

TR905 is the chopper driver transistor while TR904 is responsible for adjusting the mark-space ratio of the drive. Pulses from the line output transformer are integrated by R910 and C915 to produce a sawtooth at the base of TR903. This transistor acts as an inverting amplifier whose output is coupled to the base of TR904 via C916. The point at which TR904 conducts during the sawtooth at its base is set by TR907, which is controlled by the thick-film unit CP901. The latter produces a reference voltage for the emitter of TR907 and a feedback sample for its base, derived from the h.t. line via a divider. The use of this thick-film unit enables precise control of the h.t. to be achieved without the need for any adjustment.

During normal operation the circuit depends on the presence of pulses from the line output transformer, so a start-up system is required. For this purpose R908/R935/R909/CR906 provide a supply for TR904 and TR905 while the multivibrator TR901/2 provides a squarewave to drive TR904. At switch on C910 begins to charge via R902, enabling TR901/2 to operate. Once C901 has charged TR901/2 can no longer function. When the h.t. line has been established TR904 and TR905 are supplied via CR907.

Overload protection is provided by TR908/9, CP902, CR709, CR712, CR713 and the associated components. CR709 rectifies pulses from the line output transformer, producing across C753 a d.c. supply which is divided down in CP902 and applied to the internal zener diode (via pins 3/2). In normal operation the voltage is insufficient for the zener diode to conduct. Excessive voltages in the line output stage will result in the zener diode conducting, producing a voltage across R931 to bring TR908/9 into conduction. These transistors latch on, shorting the supply to TR904's emitter so that the chopper drive is removed. CR712 is linked to the earthy end of the e.h.t. rectifier system in the line output transformer. CR713 senses the voltage developed across R726 (20Ω, 10W) which is in series with the emitter of the line output transistor TR704. In the event of a leaky or short-circuit line output transistor CR713 will conduct to bring the protection circuit into operation.

The 12V supply for the small-signal stages in the set is derived from a winding on the line output transformer. CR705 (V09C) is the rectifier diode and C735 (1,000μF, 16V) the reservoir capacitor. Smoothing is provided by L705 and C736 (2,200μF, 16V). The 1Ω fusible resistor R733 provides protection/surge limiting.

If it's necessary to replace any of the following components only Hitachi supplied/approved types should be used: CP901, CP902, TR907, TR908, TR909, CR705, CR709, R928, R931, R932, R934, C753, C932 and T703 (line output transformer).

No Results

The most common fault with these sets is no sound or raster. The first thing to do is to check for dry-joints around the higher-wattage resistors in the power supply. Next check the voltage at the collector of the chopper transistor TR906. If there's no reading, F903 is probably open-circuit – check TR906 before replacing this. If F903 is all right check the mains fuse F901. If this has blown check the mains bridge rectifier diodes CR901-4. If both fuses are o.k. check TR906 by replacement and check the

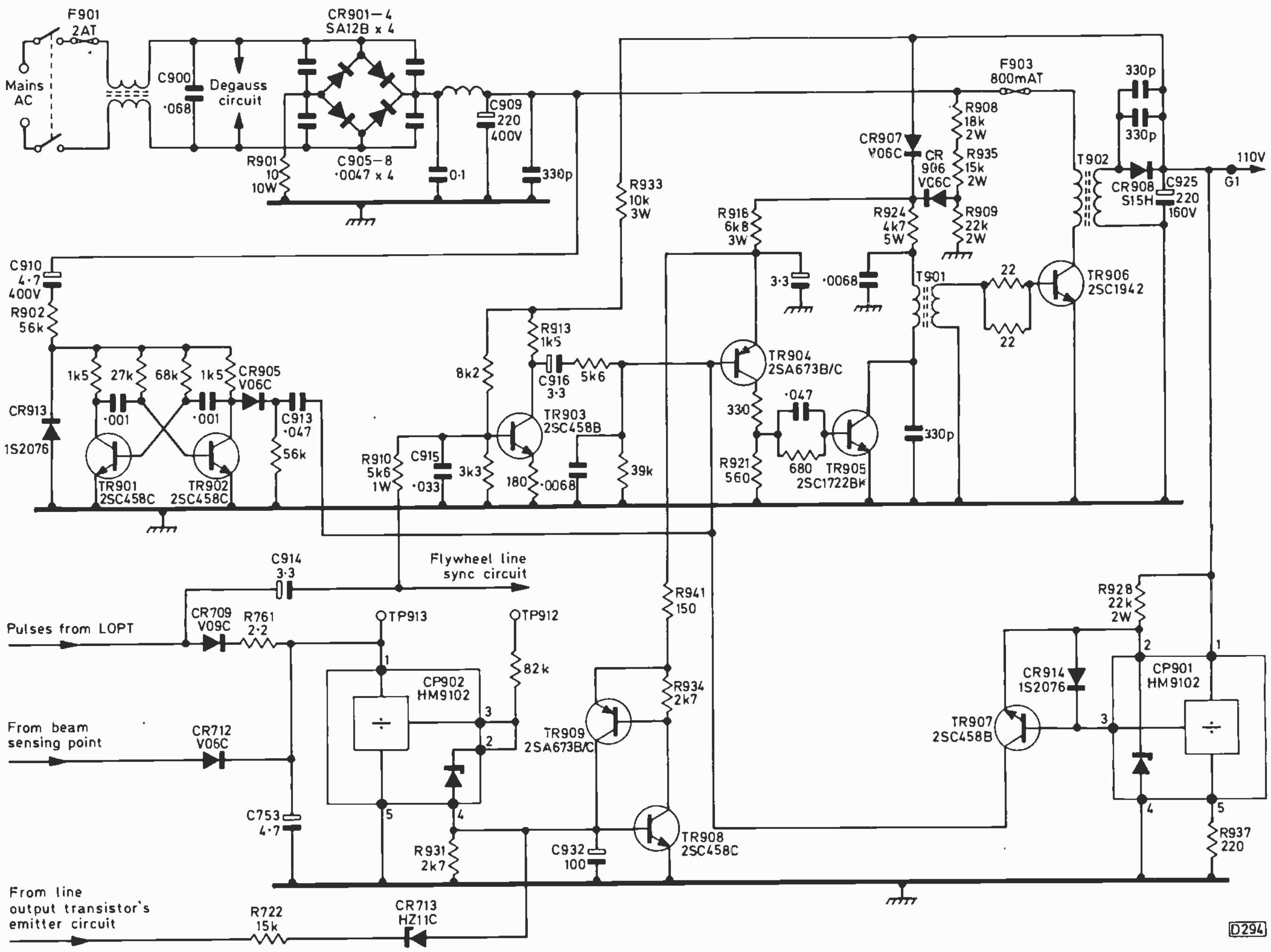


Fig. 1: The switch-mode power supply circuit used in the Hitachi NP6C chassis.

continuity of the chopper transformer's primary winding.

If the voltage at the collector of TR906 is correct – something between 230V and 360V should be recorded – check whether CR908 is open-circuit. If CR908 is all right but there's no voltage at its cathode, remove R941 and try again. If you now get a reading of 110V and the line sync is normal check TR908 and TR909 by replacement, then CP902. If there's still no voltage at the cathode of CR908 replace R941 and short out C910 briefly. If this fails to restore the voltage at CR908's cathode check TR901 and TR902 by replacement. If necessary go on to check TR904, TR905 and TR907, then both CP901 and CP902 by replacement.

If shorting out C910 produces a reading of about 60V at the cathode of CR908 check the 12V line at terminal B1. If there's no voltage here check CR705 and R733. If the reading is 5V or so check TR903 by replacement.

In our experience the line driver and output stages are remarkably trouble free.

Field Faults

In the event of field collapse, check that the 110V line is correct then check the temperature fuse TF601. If this is open-circuit, check whether the decoupling capacitor C610 (22μF) is short-circuit, then check the thick-film module M601 by replacement. If TF601 is all right check the voltage at pin 1 of M601. If the voltage here is less than 70V check the preamplifier transistor TR602 (2SA673B/C) for being short-circuit: if the voltage is more than 70V check the field oscillator transistor TR601 (2SC458B/C) by replacement – if necessary check capacitors C601 (0·068μF), C602 (1μF), C603 (0·01μF), C604 (1,000μF) and C605 (470μF) by replacement.

The field output thick-film module can usually be repaired on an outside call – look for dry-joints around the field output transistors. You may get intermittent or permanent field collapse, lack of height, bottom cramp, top foldover or picture jitter. It's best to replace the module however.

If the sync and height are not correct though the 110V line is o.k. check the setting of the hold control R605 and the height control R607. If still confronted with poor sync and excessive height check C602 (1μF) and C611 (0·1μF) by replacement. For poor sync and lack of height check C601 (0·068μF), C604 (1,000μF), C607 (100μF) and C611 (0.1μF) by replacement. For top foldover check C606 (10μF) and C610 (22μF) by replacement.

Sync Faults

For loss of field sync first try adjusting R605 then check C602 (1μF) and R601 (6·8kΩ) for being open-circuit and C601 (0·068μF) by replacement.

For incorrect line lock try adjusting T701 then check TR701 (2SC458B/C) and TR702 (2SA844D/E) by replacement. If necessary check the flywheel line sync discriminator diodes CR701/2 (1N34A) which can be leaky, then go on to check the other components associated with

Chase Manhattan Bank Citibank 4½% first year United Overseas Bank UOB Credit POSB Straits Times

TR701/2. Note that TR701 handles both the line and field sync pulses.

If there's complete loss of sync short out diode CR253. If this restores sync check CR253 (1S2076) and the noise-canceller transistor TR251 (2SC458E/C) by replacement. If shorting out CR253 makes no difference check the voltage at the collector of the sync separator transistor TR252 (2SA673B/C/D). If there's no voltage check TR252: if the reading is normal (0·7V) check whether TR701 (2SC458B/C) is open-circuit. If necessary check whether R701 (15kΩ), R702 (1·5kΩ) or R703 (430Ω) is open-circuit. The voltage at the base of TR252 should be about 8·8V. If this is incorrect check the a.g.c. transistors TR254 (2SC458B/C) and TR253 (2SA836/2SA844D/E). If the picture is dark check the first two i.f. transistors TR201 and TR202 (both 2SC1855).

Brightness Faults

If the sound is all right but the brightness cannot be adjusted check TR304 (2SA836/2SA844D/E) and TR305 (2SA673C/D) either of which can go open-circuit. If there's no raster check the setting of the brightness control R328 then the voltage at the collector of TR304. If the voltage is high at around 10V check TR304. If the voltage is slightly high at around 7-8V check TR305. If the voltage is correct at about 6·5V check TR305 and IC501 (HA11580A). If a raster still cannot be obtained, the line output transformer T703 could be defective – if the c.r.t. heaters are out check fuse F701 (630mAT).

Colour Faults

In the event of no colour or floating colours connect a 20kΩ resistor from pin 21 of IC501 (HA11580A) to chassis. If there's still no colour check for about 0·2V p-p of chroma at pins 19, 2 and 3 of the i.c. If any of these waveforms are absent, replace the i.c. If adding the 20kΩ resistor produces unlocked colour check for a 1·8V p-p reference oscillator signal at pin 8. If the waveform is correct, check the adjustment of the phase control R525 and if necessary the associated circuitry around pins 9 and 10 of the i.c. If no faults can be found here replace the i.c. If the waveform at pin 8 is incorrect check the 4·43MHz crystal X501 and associated components as necessary.

For Hanover blinds first check the setting of the gain balance control R564 and the adjustment of coil L551. If necessary check the chroma delay line DL551 by replacement. Other things worth checking are T551, TR551 (2SC458B/C) and the condition of R564's track.

Sound Faults

In the event of no sound make a hum check at terminal F3 on the signals panel – apply a screwdriver with finger on the blade. If hum is present check the intercarrier sound i.c. (IC401, HA1124A). If there's no hum check the voltages around the audio output transistors TR401 and TR402 (both either 2SD478C/D or 2SD401K/H) and the coupling capacitor C415 (10μF). There should be 110V at the collector of TR401, 40V at its emitter and at TR402's collector. If these voltages are missing, check R422 (100Ω, 1W), the temperature fuse TF401 and the transistors. If everything is in order check the continuity of the speaker – a reading of 8Ω should be obtained across terminals D1 and D2. C415 can be responsible for poor/distorted sound.

POST A PART ELECTRONICS

6 CHAPMAN COURT, CHARFLEETS ROAD, CANVEY ISLAND, ESSEX SS8 0PQ.
Telephone 0268 690868
Telex 99305

BARCLAYCARD VISA

TRADE COUNTER OPEN

ORDERS DESPATCHED SAME DAY
ADD 75p P&P, THEN 15% VAT.
ADD POSTAGE FOR OVERSEAS ORDERS.
ORDERS WITH AEROSOLS, PLEASE ADD 25p PER CAN.

Thorn 10Ω 20W (3500) R751 Safety Resistor	75p
Pye 713 Speaker 5" × 3" 70Ω	1.00
Pye 713 Complete Tube Base Panel with Focus Slider & Leads	2.75
Pye 725 Complete Tube Base Panel	1.25
TX9 Complete Tube Base Panel	2.75
TX10 Complete Tube Base Panel	3.75
TX90 Complete Tube Base Panel	4.75
Pye 713 Control Knobs	4 for 50p
Tube Base Socket ITT CVC32	45p
Tube Base Socket Thorn 3000/8000 etc	50p
IC Inserter 16 Pin	50p
Large IC Extractor	50p
Crystal 4.43MHz	65p
EHT Lead & Cap for Split Diode Lopt	90p
Anode Cap	47p
Sanyo Anode Cap Assy + Lead. 12TCD-CT-1G	65p
Degause VDR E299D/HP230 3000/8000	25p
Degause Thermister C8-ROH (TX90)	1.80
Control Knob Thorn TX90	4 for 2.00
On/Off Knob Thorn TX90	65p
Push Button Assy Thorn TX90	9.80
Tube Neck Correction Assy. 20AX AT1081	5.00
EHT Cable	Metre 25p
BF259 with Heatsink	14p
TIP110 with Heatsink	40p
L129/130/131 Coil	10p
6MHz Ceramic Filter	25p
DL700 (Philips) Chroma Delay Line	1.00
DL50 Chroma Delay Line	1.00
T9006A Lum Delay Line	1.00
8K5/9K Lum. Delay Line	65p
Plastic Cover for 3K5 SP8385	5p
TX9 Back Ground Control 10K	15p
TX9 Gain Control 100R	15p
Thorn 2000 Focus Pot	1.00
Thorn 9000 Focus Pot	3.75
Thorn 9600 Focus Pot	2.00
Thorn 8K5 Focus Pot	2.40
Thorn 4000 Focus Pot	2.75
Thorn TX10 Focus Pot (New Type)	9.00

SERVICE AIDS

Ambersil MS4 Silicone Grease	12oz	2.15
Ambersil Freezer	12oz	1.99
Ambersil Amberlube	6oz	1.89
Ambersil Ambertron	16oz	2.25
Ambersil Anti-Static Screen Cleaner	7oz	1.95
Ambersil 40+ Protective Lubricant	14.1oz	2.15
Ambersil Amberclens Foaming Cleaner	13oz	1.26
Ambersil Circuit Lacquer	14oz	2.15

THICK FILM RESISTOR UNITS

3500 Thorn (5 Pin Connection) video	1.70
4000 Thorn (4 Pin Connection)	1.90
725/731 Pye (6 Pin Connection)	2.20
713 Pye (6 Pin Connection)	2.20

FUSES

20mm		1¼"	
50MA	10 for 70p	250MA	10 for 65p
250MA	10 for 50p	750MA	10 for 65p
315MA	10 for 50p	7A	10 for 50p
500MA	10 for 50p	10A	10 for 50p
2.5A	10 for 1.00	20A	10 for 50p
3.15A	10 for 1.00	50A	10 for 50p

Thorn Mains TX 3000/3500	7.50
Thorn Mains TX 8000/8500	10.00
Thorn Mains TX 9000 (T701)	10.00
Thorn Mains TX 9600 (T512)	10.00
Thorn S.O.P.T 8000/8500	3.50
Thorn Scan TX 3000/3500	6.00
Thorn EHT TX 3000/3500	6.00
Thorn LOPT 9000	10.00
Thorn LOPT 9600	12.00
Thorn LOPT 1590/91	7.25
Thorn LOPT 1690/91	7.25
Thorn LOPT 8000	9.80
Thorn LOPT 8500	9.80
Thorn LOPT TX9	9.85
Thorn LOPT TX10	19.00
Thorn LOPT TX90	13.75
Pye LOPT 713	10.00
Pye LOPT 725	9.85
Pye LOPT 731	10.18
Philips LOPT G9	8.80
Philips LOPT G11	13.75
GEC LOPT 3113	7.40
Diode Split LOPT AT2076/35	14.75
Sanyo LOPT AM-WM-21	6.75
Sanyo LOPT AM-WM-4	7.30
Philips LOPT G8	7.80
Sanyo LOPT (CW21) 4-2751-44700	5.00
ITT LOPT CVC5-9	9.60
ITT LOPT CVC30	8.75
ITT LOPT CVC45	9.75
Baird 8750	10.25
Baird 8752	10.25
Thorn Line Drive TX. TX9 (T2)	3.00
Thorn Line Drive TX. 8K etc. (T402)	1.85
Thorn Line Drive TX. 9K (T705)	2.00
Thorn Switch Mode TX. 9K6 (T511)	3.75
Thorn Input Choke TX9 (L64)	4.00
Thorn Choke TX90 (L120)	2.95

300 Mixed Resistors	1.50
300 Mixed Capacitors	1.50
150 Mixed Electrolytics	2.00
100 W/W Resistors	1.00
20 Mixed Conv Pots	1.00
40 Mixed Pots	1.50
20 Mixed Sliders	1.00
40 Mixed Presets	60p
20 Mixed VDR & Thermistors	1.00
100 Mixed Ceramic Discs	1.00
20 Mixed Valve Bases	1.00
10 Spark Gaps	1.00
10–16 pin Quil IC Socket	90p
20 Assorted TV Knobs	1.00
10–16 pin Quil to Dil IC Socket	90p
100 Mixed Diodes	1.00
50 Mixed Mica Washers	65p
300 Mixed Resistors & Capacitors	1.50
10–16 pin Dil to Dil IC Socket	1.00
50 Electrolytics & 50 Capacitors	1.00
50 Mixed Poly Capacitors	1.00
20 Mixed Valve Bases	1.00

						BF154	25	BFR52	31	NKT276	20
						BF167	24	BFR62	28	NKT453	1.65
AC128	39	BC174B	23	BCX33	22	BF173	29	BFR81	29	OT112	1.92
AC131	40	BC177	24	BCX34	11	BF179	32	BFR87	25	OT121	2.08
AC138	40	BC182LB	12	BD115	49	BF180	33	BFR90	1.74	R1038	80
AC141K	39	BC183L	12	BD131	30	BF181	30	BFR91	2.08	R1039	80
AC142K	38	BC184L	13	BD132	46	BF184	30	BFT42	30	R2008B	1.40
AC153	39	BC187	24	BD133	59	BF185	30	BFT43	30	R2010B	1.10
AC176	33	BC204	15	BD139	36	BF194	16	BFX38	40	R2030	70
AC176K/		BC208	9	BD140	38	BF195	16	BFY50	30	R2265	1.30
AC128K	93	BC212L	9	BD144	1.70	BF196	16	BFY51	34	R2305	80
AC188	38	BC213L	12	BD150	50	BF197	15	BFY52	34	R2322	50
AD142	1.18	BC237	12	BD163	98	BF198	19	BRC116	1.50	R2443	25
AD143	1.08	BC238B	8	BD201	74	BF199	15	BRC1693	1.43	RCA16446	30
AD149	98	BC238L	8	BD203	78	BF223	18	BU105	1.00	RCA16599	1.25
AD161	32	BC250A	15	BD204	99	BF224	19	BU126	1.10	RCA16600	1.40
AD162	32	BC251	8	BD222	48	BF238	20	BU207	1.05	RCA16799	1.13
AD263	1.05	BC252A	20	BD225	52	BF240	9	BU208	1.15	RCA16800	1.42
AF127	45	BC294	37	BD232	50	BF241	21	BU208A	1.15	RCA16802	1.38
AF139	38	BC301	32	BD233	60	BF255	10	BU326A	1.30	RCA16815	1.20
AF239	41	BC303	31	BD234	60	BF256LB	38	BU407	1.70	SP8385	2.65
BC107	15	BC307	10	BD237	55	BF256S	20	BU408	2.76	S1299	2.25
BC108	15	BC308	8	BD238	65	BF257	28	BU500	2.30	S28000	1.25
BC109	15	BC309	14	BD241	59	BF259	28	BU526	2.46	T6050V	1.30
BC115	16	BC327	18	BD244	85	BF271	25	BU806	1.80	T6052V	1.30
BC117	21	BC328	18	BD278A	81	BF274	11	BU807	2.94	T9003V	1.25
BC125	26	BC337	17	BD386	68	BF337	29	C1129	9	T9010V	1.45
BC126	23	BC338	17	BD433	71	BF338	34	C1172B	9	T9053V	1.30
BC139	27	BC347	8	BD437	83	BF355	40	E5386	54	T9054V	1.00
BC141	34	BC394	8	BD592	1.20	BF362	50	E9003	28	T9039V	1.10
BC142	30	BC454	8	BD589	1.20	BF391	21	E9005	25	TIC45X	50
BC143	31	BC455	8	BD677G	1.35	BF394	16	ME0404	10	TIC46	48
BC147	12	BC456	10	BD679	1.42	BF422	47	ME0412	10	TIC106C	40
BC148	12	BC460	40	BD701	1.04	BF423	53	ME6002	10	TIP29	42
BC149	12	BC463	22	BD702	1.12	BF450	43	MJ2501	2.36	TIP30	42
BC153	16	BC546	8	BD707	95	BF453	53	MJ3001	2.21	TIP31	35
BC1540R	16	BC547	12	BD708	95	BF458	37	MJE340	50	TIP32	43
BC154YL	16	BC548	12	BD839	1.30	BF459	40	MJE520	50	TIP33	61
BC157	12	BC549	8	BDX10	93	BF461	59	MJE2955	1.40	TIP41	42
BC158	12	BC557	10	BDY20	1.09	BF556B	35	MJE3055	1.50	TIP42	45
BC159	15	BC558	10	BDY82	99	BF596	15	NKT241W	8	TIP110	61
BC171	9	BC559	8	BF137	20	BF694	16	NKT241G	8	TIS91	25
BC172	9	BC595	8	BF153	20	BF757	62	NKT241Y	8	ZTX550	30

INTEGRATED CIRCUITS

				TBA530	1.26	TDA2030	2.10
BRC1330	1.40	SN76013ND	1.80	TBA540	1.00	TDA2522	2.10
BRC3064	1.00	SN76023N	1.80	TBA550Q	1.82	TDA2530	2.61
BRC/M/200	1.00	SN76033N	2.00	TBA560C	1.50	TDA2540	3.50
BRC/M/300	1.00	SN76115	2.00	TBA641	2.05	TDA2560	3.50
CA3060	1.58	SN76131N	1.58	TBA651	2.50	TDA2581	3.00
LM1303P	1.48	SN76226N	1.25	TBA720A	2.49	TDA2591	1.96
ML231B	2.20	SN76227N	1.00	TBA750	2.20	TDA2611A	1.95
ML237B	2.00	SN76530P	1.30	TBA800	1.62	TDA2640	2.90
ML239B	2.86	SN76622N	1.00	TBA810S	1.00	TDA2690A	1.50
MC1327AP	1.25	SN76650N	80p	TBA810AS	1.00	TDA3560	6.00
MC1358P	1.30	SN76666N	75p	TBA920	2.08	TDA4500	5.40
MC1455P	18p	SN76744	1.92	TBA950	2.54	TDA9503	2.90
MC14516BCP	60p	SY153A	2.50	TBA1440	1.92	TCEP100	3.48
SAA1025	7.20	TA7117P	1.00	TCA270SA	1.05	TEA1009	1.95
SAA1124	4.50	TA7109AP	2.80	TCA270C	1.05	MC14426P	4.80
SAA5010	6.00	TAA611	1.40	TCA270CQ	1.05	MC14429P	4.50
SL432A	1.80	TBA120B	1.20	TDA1035T	3.50	MC14514	5.00
SL1430	2.50	TBA120C	1.20	TDA1037	2.72	UA758PC	2.50
SL1432	2.50	TBA120CQ	70p	TDA1170	2.15	UAA1008A	2.66
SN15846N	60p	TBA120S	70p	TDA1170S	1.76	ULN2165	1.30
SN74123N	65p	TBA120U	1.00	TDA1200	2.42	ULN2216A	1.25
SN74154N	1.40	TBA395	1.00	TDA1270	2.76	UPC1365C	5.75
SN76001N	1.40	TBA480Q	1.40	TDA1327	2.53	SC9488P	1.40
SN76110N	1.14	TBA510	1.90	TDA2002	2.80	SC9511P	1.40
						SW153	2.50

Thorn 8/8K5 ex equip panels untested

PSU	2.88
FTB	3.75
Decoder	4.00

Thorn 9K ex equip panels untested

PSU	12.00
Decoder	5.00

Thorn 9K6 ex equip panel untested

Decoder	5.75

Thorn 3/3K5 ex equip panels untested

PSU	3.75
LTB	3.75
Video	2.50
Chroma	2.00
FTB	2.75
IF	1.75
Conv. 3K	3.00
Conv. 3K5	3.75
Autovox Decoder FG/01 new boxed	5.00

Thorn 4000 Convergence panel ex-factory	3.75
Thorn 4000 PSU panel ex-factory	2.50
Thorn 3K5 beam limiter board new	1.75
Thorn 3/3K5. EHT & scan TX + R2008B on alum chassis ex-equip	1.80
Thorn 8/8K5 damaged FTB for spares	1.25
Thorn 8/8K5 damaged decoder for spares	2.25

UHF TV Aerial for portable	50p
Indoor Aerial With Reflector to Help Combat Ghosting Problems	2.50
Line Connectors	38p
Coax Plugs	10 for 1.65
Band Change Switch Assy, Pye 725	40p
Coax Cable Low Loss	per Metre 22p
Switched Flush Fitting Aerial Outlet	1.00

Pye 78+161	50p
Pye 147+260	50p
Thorn 56+1K+47+12	1.24
Thorn 50+40+1K5	60p
Thorn 128+16+1K7+116+462+126	50p
Thorn 120+72+300	50p
RBM 250+14+58 (TV161)	63p
Pye 3R5+15+45 (713)	90p
Philips 2R2+682	90p
Philips 47R	52p
Thorn 6+1+100	92p
Thermal Cut-Out Thorn 3000 Metal	1.45
Thorn 8/8500 Plastic	1.45

EHT TRAYS

Thorn 3000	5.50
Thorn 8000	4.50
Thorn 8500	6.00
Thorn 9000	7.90
Thorn 9600	6.00
Thorn 900/950	1.50
Thorn 1500 3 stick	2.40
Pye 713 4 lead	5.83
Pye 713 5 lead	5.97
Pye 725	6.35
Decca Bradford	5.00
Baird 8750	7.10
Korting AZ9100	7.10
Philips G8 (520)	6.50
Philips G8 (550)	6.50
Universal	5.00

MULTISECTION CAPACITORS

220+47 350V	65p
200+150+50 350V	60p
200+200+100 325V	54p
32+32+16 275V	52p
200+200+100+32 350V	70p
100+50+150 350V	58p
400+400 200V	72p
32+32+16 350V	52p
200+32+300+100 350V	70p
225+25 350V	50p
200+200+100 350V	70p
200+100 325V	65p
200+100+100+50 350V	60p
200+200+100 350V	55p
200+200+75+25 350V	60p
50+50+8 300V	55p
100+50+100 350V	55p
100+150+50 350V	55p
2500+2500 (Thorn 8K) 63V	1.20
150+150+100 300V	1.80
200+47 250V	65p
500+500 175V Thorn TX9	1.00
175+100+100 350V Thorn 3K5	2.25
400 400V Thorn 9K	2.50
470 250V Weldel Type Philips G11	1.71

CAN TYPES

0.2MF 250V	50p	1250MF 40V	50p
2MF 250V	50p	1250MF 50V	50p
22MF 275V	50p	1500MF 100V	1.05
50MF 275V	50p	2000MF 30V	50p
100MF 150V	65p	2200MF 40V Thorn 4K	95p
100MF 250V	70p	2200MF 63V Philips G9	1.25
220MF 450V Thorn 4K	1.30	2500MF 35V	65p
400MF 350V Thorn 8K	1.00	2500MF 40V	65p
400MF 400V Thorn 9K	2.95	3000MF 30V	65p
800MF 250V	70p	3300MF 16V	50p
1000MF 100V Thorn TX90	2.90	3300MF 25V	60p
		4700MF 16V	72p
		4700MF 40V	75p

Thorn/Decca/GEC On/Off Switch. Push to make	75p
Philips G11 On/Off Switch. Push to make	75p
ITT CVC9 On/Off Switch + Relay	90p
Philips G8 On/Off Switch	75p
Thorn 3/3500 A1 Switch	50p
Thorn 4000 A1 Switch	50p
Korting Shift Pot 50Ω	65p
2.5A Push to make on/off switch	15p
Thorn TX90 On/Off Switch	1.85
10K Lin Pot. TX9/TX90	75p

DIODES

AA112	8p	IN4003	4p
AA119	8p	IN4004	5p
AA143	8p	IN4005	5p
BA115	8p	IN4006	5p
BA154	8p	IN4007	6p
BB103	8p	IN4148	2p
BB105B	30	IN4149	6p
BR103	52p	IN4742A	8p
BT106	1.50	IN5254B	8p
BT116	1.00	IN5349	14p
BT119	2.56	IN5400	12p
BT120	2.82	IN5401	12p
BT151 650	1.00	IN5402	14p
BY127	12p	IN5404	12p
BY188	16p	IN5406	16p
BY204	26p	IN5408	16p
BY206	16p	IS025	8p
BY207	16p	IS131	8p
BY208/800	38p	IS1658	8p
BY223	95p	MR854	35p
BY225	1.20	SKE1/02	20p
BY227	28p	MCR106/1	1.00
BY298	22p	MCR406	35p
BYX22/400	30p	2N4444	1.50
BYX55/600	30p	Y827	80p
BYX71/350	80p	Y969	75p
BZV15 C12R	1.16	ZX150	12p
BZV15 C24R	1.16	OA91	5p
IN60	8p	MCR106/7	1.00
IN2070	8p	MCR106/8	1.50
IN4001	4p	BY255	30p
IN4002	4p		

You won't believe me

Les Lawry-Johns

Last month I commented on the fact that TV sets can do some strange things. Here's another case, this time involving a Thorn TX9 chassis.

The TX9

A chap brought the set in and put it on the bench. I was busily engaged on a portable but he asked me to do a quick job, at the same time looking anxiously at the clock. So I put the portable to one side and whipped the back off the TX9. The 1·6A mains fuse had shattered and a light shone on the board revealed that the bridge rectifier diodes were in a sorry condition. I removed them and the red cover and wired the replacement diodes underneath for a quick test. After fitting a new fuse I switched the set on. The e.h.t. rustled up, a picture appeared and a look of profound relief showed on the chap's face. The picture then suddenly disappeared and a bright blank screen took its place. Very bright, as you get on certain GEC sets (PIL/20AX chassis) when the 82kΩ resistor in the RGB output stage clamp circuit goes open-circuit. Before I could take any action the 1·6A fuse failed again, with a pop. This time a check on the bridge rectifier diodes revealed that they were innocent, and no shorts could be recorded. I fitted another fuse and tried again. The picture came on and seemed fine. Suddenly the blank screen appeared and while I was making some quick checks in the RGB output stages the fuse once more failed. Since the screen appeared blank white I reasoned that something was affecting all three RGB output stages, but why this should have blown the fuse puzzled me.

The chap became very agitated and said that if it was going to take any longer he'd rather return the set "to her". I didn't argue as I could see that he was upset, so I removed the bridge diodes to allow the red cover to be refitted and he took the set away.

Upon reflection, the strange thing was that the full h.t. was present at the collectors of the RGB output transistors, which are d.c. coupled to the tube's cathodes. I'd have thought that some 190V here would have blanked the tube instead of being accompanied by a bright, blank raster. The only conclusion I can come to is that C209 (0·1μF), which decouples the bias applied to the tube's grids, must have been going short-circuit intermittently. It's taken to the 190V line instead of to chassis to provide hum cancellation. But why should this have blown the fuse? I wish he hadn't been in such a hurry.

The Philips G6

You may recall the Philips G6 I mentioned a couple of months back – the one I sold many years ago when I could have sold my first G8. Well Mr. Furnace has since died but the set still carries on under the guidance of Mrs. Furnace. She phoned recently to say that the colour was now very slow to appear, so I went along to investigate. I was amazed at the clarity of the picture, though there was no colour. So I changed the EF183 and EF184 valves in turn. This made no difference, and the voltages all seemed about right. I then tried a cautious turn on the core of the reference oscillator's coil. "Colour" cried Mrs. Furnace. "Bingo" I replied.

So there it still is, working and giving a perfect picture – with a tripler in place of the previous e.h.t. overwinding etc. Supplied in 1970. How about that?!

Infra Red

Ray brought in this Fidelity handset and was moaning because it wouldn't work. I had a radio set on the bench at the time so I switched it to long wave, tuned it to 200 metres and directed the handset at it. Nothing. I replaced the battery (Alkaline MN1604) and again pointed it at the radio. There was a series of clicks as the buttons were pressed.

"Well I'm blowed" said Ray. "Is that all it was? It's three years since I bought that set from you and I never thought about it having a battery in it". I nipped upstairs and tried it on our CTV14S and it worked perfectly, as the radio set had said it would.

Thanks Denis

I'd like to thank those of you who offered me help with the Network colour portable whose start-up resistor would intermittently spring open. Special thanks are due to Network's service manager Denis Mott. I took down all you said Denis – about directing heat at the suspect components – and will follow this advice when the set comes back, as you all say it will.

Bounce, bounce, bounce

I was quite annoyed with a well known store that expressed doubt about taking my cheque (business account). Having identified myself, they accepted the cheque and overcharged me sixty three pounds. I got that put right and went away mumbling about their strange way of doing business.

Later that same day a nice man came into the shop and said he wanted a portable set for his daughter. He selected a nice black and white Pye and said he'd collect it later but would pay for it now. He presented me with a cheque for sixty nine pounds, on his business account, and wrote his address on the back. H.B. gift wrapped it and it looked splendid there waiting to be collected. He came back next day and expressed delight with H.B.'s efforts. He left in high spirits and we were pleased.

Next week we were not so pleased. The cheque had been returned as his account had been cancelled. I wrote a note to him at the address he'd given. This came back from the Post Office marked "gone away". Oh well, a small price for experience – it could have been a lot more.

Problems with Scotch

As I write this the festive season (Christmas through to the New Year) is at its peak. Here's a little story about a friend who's also a reader. He was at this party and had had a few beers. The host brought him a scotch (neat) which he was not used to drinking. So he topped up his glass from a nearby water jug. "Um, not bad" he thought. There was a repeat performance and after that he began to feel funny but quite happy. Before he passed out like a light he was vaguely aware of a young lady emptying her glass into the water. "Wassat?" he enquired. "Vodka" she replied, "I've been doing it all evening – can't stand the stuff but you can't very well say so".

Next day he was decidedly out of salts. Daft you may say, but it can happen – especially if you're basically a beer man.

While on the subject of Scotch, an apology. Some time ago I did a job which was a bit of a swine for Mr. Webb. He gave me a china bottle in the shape of a ship's bell. Now I drink a lot of that brand of whisky and I said the contents were nice but not that brand. A few days ago I was presented with an ordinary shaped bottle of the same brand, with a black label marked twelve years old. It was identical to the scotch in the china bottle. Sorry Mr. Webb, I'm so used to the cheaper stuff. I feel ashamed of myself . . .

Developments in VCRs

Part 2

Steve Beeching, T. Eng.

The first long-play VHS machines were introduced in 1983. For long-play operation the tape is run at half speed (11·7mm/sec). This has several implications. First the track width is reduced by half, from 49 to 25 microns: as this reduces the signal-to-noise figure new noise reduction techniques have been adopted. Secondly for stable playback in the long-play search modes special "jump" circuits have been designed. Further luminance signal correction is used to reduce h.f. noise.

LP Track Characteristics

The characteristics of the LP track are determined by the slower tape speed and the extra set of LP video heads fitted to the dead drum. In some early models the LP heads were mounted at an angle of 70° with respect to the standard-play heads, though in later models the two sets of heads are mounted on single assemblies as described in Part 1 last month.

With standard-play VHS operation the tracks are laid down side-by-side with a 1·5 TV line offset between the start of each track to ensure that lines with the same colour phase lie next to each other on adjacent tracks and that the line sync pulses on adjacent tracks line up. It's not possible to achieve this symmetry in the LP mode, due to the effects of tape speed and track angle. Fig. 1 shows the difference between the SP and LP tracks: you can see that with the LP tracks shown at (b) the 0·75 line offset (half the 1·5 line SP offset) results in the adjacent line patterns being displaced. The adjacent colour phasing is also displaced: whereas lines 2 and 316 in the SP mode carry the same PAL phasing the correlation between lines 2 and 316 is shifted by 0·75 of a line in the LP mode.

The standard colour crosstalk system used in VHS machines will cope with colour crosstalk in the LP mode but extra measures are required to eliminate the increased luminance crosstalk.

Picture Search

The main problems occur during picture search however, when due to the increased linear tape speed a video head will cross over a number (usually around five) of its own video tracks as it traverses the width of the tape. In the SP mode the line sync pulses replayed by a video head as it crosses the tracks it recorded occur in regular order – with drum speed correction – at 64μsec intervals. Picture search at the same speed will with LP tracks produce line sync pulses that are by no means at 64μsec intervals: without correction the result will be considerable picture skew (sideways pulling).

A section of recorded tape is shown in Fig. 2: the upper edge of the tape is to the right and the lower edge to the left (the slanting recorded tracks are shown horizontally to make things clearer). A ch. 1 head is shown scanning across the tracks in the forward picture search mode. The burst phase is 135° on lines shown as clear blocks and 225° on lines with diagonal-line shading. In this example the head crosses over four of its own recorded tracks.

The top line of the timing part of the diagram, line (1), shows the original signal – it's a reconstruction of the replayed lines and colour phases as the head crosses over its own ch. 1 recorded tracks, i.e. tracks 1, 2, 3 and 4. You

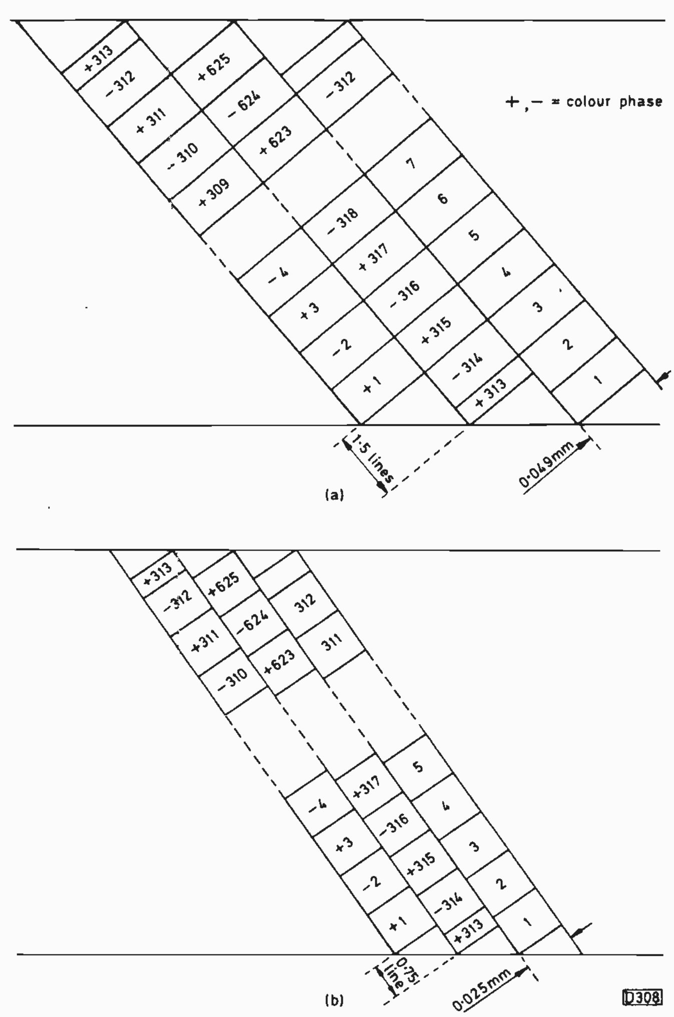


Fig. 1: SP (a) and LP (b) track characteristics.

can see that when demodulated the replayed TV lines do not occur at regular 64μsec intervals – the irregularities are in fact at half-line intervals, i.e. the small squares of original signal are half a line long. Line (3) shows how the line sync pulses are replayed. It should be clear then that without correction there will be severe line pulling in the LP cue and review modes, due to the half-line errors in the video signal.

Correction of the half-line error is done by producing a half-line (0·5H) jump pulse. A data signal is derived from a phase-locked oscillator working at twice line frequency: when the output from this oscillator is divided by two the signal shown in line (2), a symmetrical squarewave, is produced. This signal is compared with the replayed line sync pulses in a clocked bistable. If the data signal is low when the bistable is clocked by a line sync pulse the output is low: if the data signal is high when the clocking occurs the output is high. With a clocked bistable the input level appears at the output which remains in this state until the next clock pulse arrives. This arrangement provides the 0·5H jump pulse shown in line (4).

A half-line delay is included in the playback signal path. The 0·5H jump pulse controls a switch which selects direct or delayed signals alternately – with line sync pulses as shown in lines (3) and (5). After the switching a corrected output with the errors removed is obtained.

Two methods of obtaining an 0·5-line delay have been used. The earlier method was to f.m. modulate the video on to a 14MHz carrier, feed it through an 0·5-line delay line and then demodulate it. Fairly crude, but don't forget that we're in visual search! The second and more up-to-date method is to use a 423-bit CCD serial delay line, clocking the signal through this with a 13·3MHz clock signal. 13·3MHz is equivalent to a period of 0·075μsec: clocking 423 bits at 0·075μsec is 0·075 × 423 which is 31·8μsec or about half a line.

If the composite video signal is being switched by a half-line period clearly the colour phase must be inverted to compensate – otherwise the PAL signal will have half a line in one phase and the second half in the other phase. To prevent this happening and to synchronise the colour phase with the video signal switching a 1H jump pulse is produced by the jump pulse generator.

Fig. 2 also shows a simplified block diagram of the above arrangements. The jump pulse generator produces the half-line frequency jump pulses from the replayed line sync pulses and the 1H jump pulse from the 7·8kHz colour ripple signal. The circuitry is usually contained within one or two i.c.s.

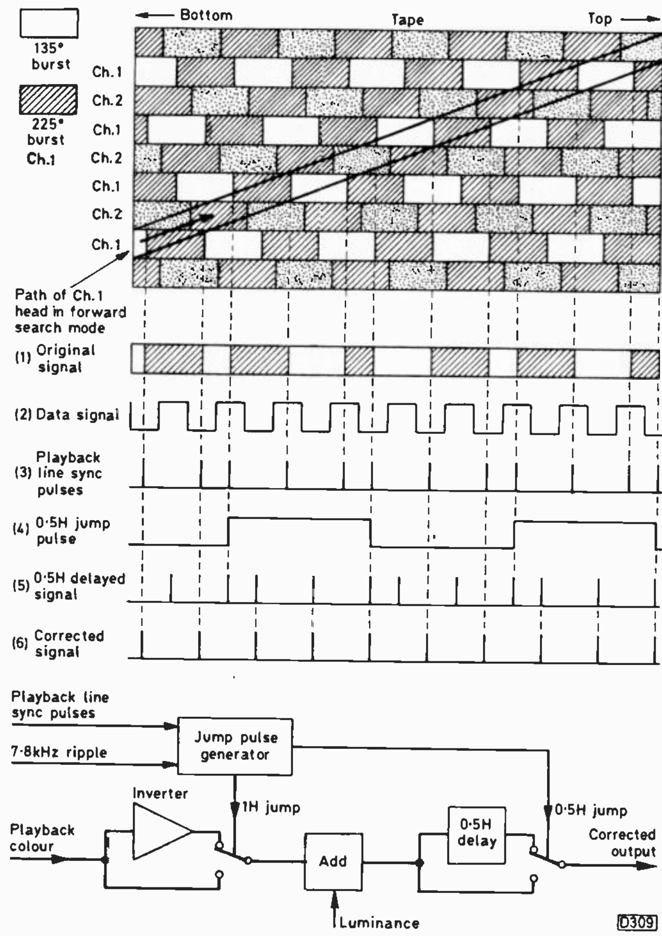


Fig. 2: Picture search in the LP mode.

Noise Reduction

A video noise reduction system is used to improve the signal-to-noise performance. The noise to be reduced is low-frequency f.m. crosstalk between tracks – frequencies in the range 1-2MHz, forming the lower sideband of the video f.m. carrier. The ±6° azimuth offset of the two video heads is used to reduce the pickup by one head of the other head's f.m. carrier, but the technique becomes less effective at the lower frequencies. Hence the need for the noise reduction system.

The technique used is to shift the f.m. carrier recorded by one head by 7·8kHz. The ch. 1 head records the normal 3·8-4·8MHz f.m. signal: the ch. 2 head records this with a 7·8kHz shift. Now when the ch. 1 head replays residual ch. 2 f.m. picked up from either side as crosstalk the crosstalk signal has a 7·8kHz shift – half line frequency. A signal at half line frequency will complete a cycle over a two-line period: it will have a positive polarity on one line and a negative polarity on the next, i.e. there's phase inversion on every line. The principle also holds for ch. 1 crosstalk picked up by the ch. 2 head. The point to remember is that introducing a half-line frequency shift into the recorded f.m. results in crosstalk noise that changes polarity at line rate.

One method used to apply the 0·5 line frequency shift is shown in Fig. 3. It affects the f.m. modulator in an HA11724 i.c. – you'll be able to identify the circuitry in various makes of machines. The video signal is clipped and clamped and fed to the f.m. modulator internally – though there's a test point at pin 12. The carrier frequency is set to 3·8MHz for the sync pulse tip by the 1kΩ potentiometer, the thermistor being included to provide

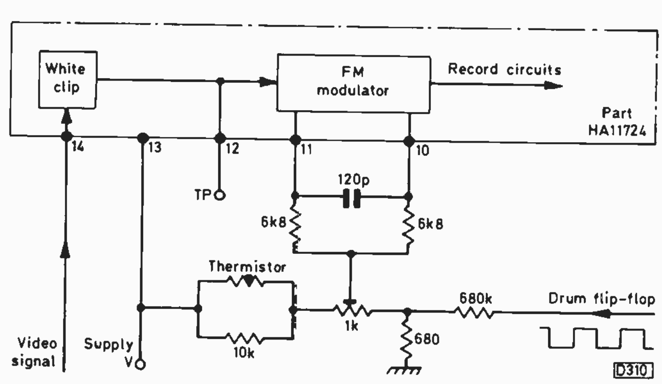


Fig. 3: One method of applying an 0·5 line frequency shift during recording for crosstalk noise reduction.

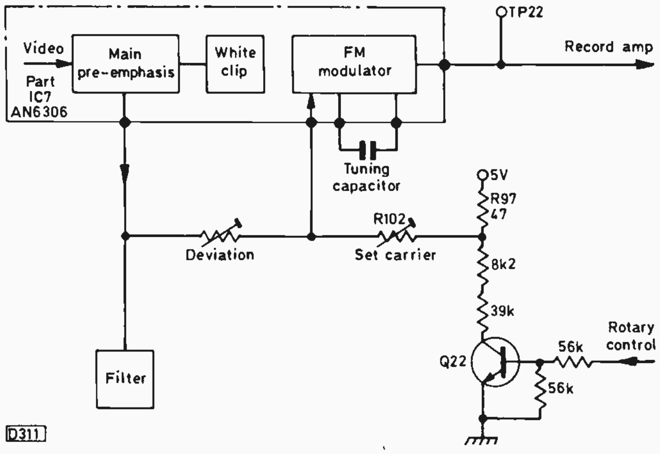


Fig. 4: The technique used in the JVC HRD725.

temperature compensation against drift. The drum flip-flop signal is applied to the circuit via a 1,000:1 potential divider, so its level at the f.m. modulator is very small. The result is that the f.m. oscillator is stepped up by 7·8kHz for the ch. 2 head and back down again to the standard frequency for the ch. 1 head. In some machines the level of the flip-flop signal is set by a potentiometer: don't touch this – setting up requires the use of a spectrum analyser.

The example shown in Fig. 4 is used in the JVC HRD725. This uses the rotary control signal, which is derived from the drum flip-flop (see Fig. 5 last month). It controls the colour phase selection, hence "rotary". Q22 is switched on and off at 25Hz, taking the junction of R97/R102 to chassis via 47·2kΩ, again a ratio of 1,000:1. The very small shift in the d.c. level of the signal applied to the f.m. modulator results in a 7·8kHz frequency change.

Fig. 5 shows a typical playback system in which the dropout compensation delay line is also used for noise cancelling. It's easier to understand the arrangement used in the HRD725 if we look at this one first. An a.g.c. system stabilises the signal which is then fed via the dropout switch to an f.m. equaliser – in later, dual-speed machines SP/LP compensation is provided at this point. The signal is then sent along two paths, to the direct demodulator and via the one-line delay line to the delayed demodulator. The output from the delay line goes to the dropout switch, for dropout compensation, as well as to the delayed demodulator.

The output from the direct demodulator, (a), is filtered and applied to a mixer. The output from the delayed demodulator, with 180° phase-shifted noise, is filtered and used as one input to a differential amplifier. This is waveform (b). The clean signal output from the mixer, (c), is the other input to the differential amplifier whose output is waveform (d), phase-shifted crosstalk noise. Adding (a) and (d) in the mixer gives us the noise-free signal (c). Prior to the limiter the output from the differential amplifier will contain large amounts of

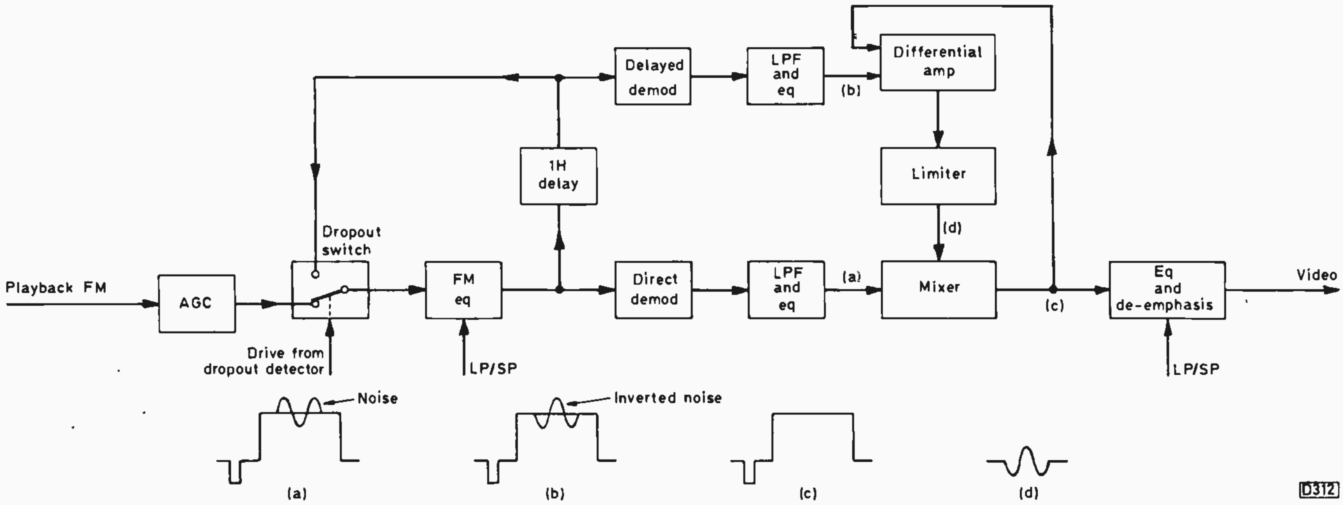


Fig. 5: Typical playback noise reduction system, with the dropout compensation delay line also used in the noise cancelling arrangement.

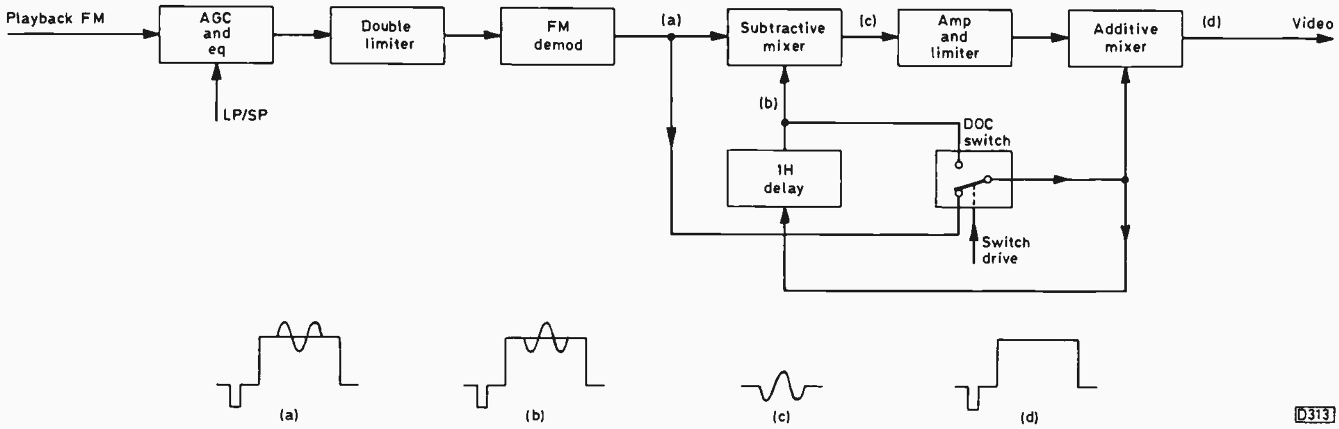


Fig. 6: Playback system used in the JVC HRD725.

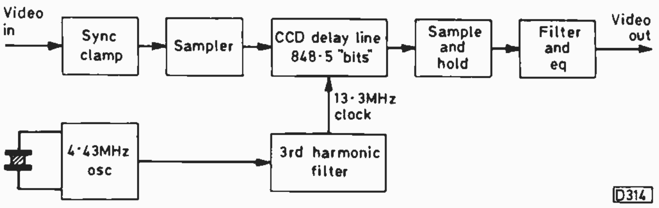


Fig. 7: Operation of the CCD delay line.

unwanted video in addition to the noise. If this was allowed through to the mixer without clipping the result would be impairment of the displayed picture.

Now to the HRD725 where other new concepts are introduced, see Fig. 6. It looks deceptively simple in block diagram form, but the circuitry used is actually very advanced. After a.g.c. and equalisation the f.m. signal passes through a double limiter and is then demodulated. In this case the delay line comes after demodulation – because a CCD (charge-coupled device) delay line is used instead of a glass delay line.

As a result of the action of the delay line the noise in signals (a) and (b) applied to the subtractive mixer is of opposite polarity. The subtractive mixer cancels the video component of the signal to leave just the noise signal (c). This is amplified and limited and applied to the additive mixer along with the direct signal (a). The mixing process this time gives noise instead of video signal cancellation, resulting in the clean signal (d). You will notice that one small licence has been taken. During a dropout the noise will be additive. This happens for only very brief periods however and is not visually perceptible.

The action of the CCD delay line is shown in Fig. 7. The analogue input is sampled and sent along the line as clocked "bits". At the output a sample-and-hold circuit restores the analogue signal. There are 848·5 "bits" within the delay line, clocked at 13·3MHz – this is conveniently obtained as the third harmonic of a 4·43MHz colour crystal oscillator. The clock period is 75nsec, the delay through the line being 63·8μsec (0·075μsec × 848·5). A further delay of 200nsec is gained in the equalisation and filtering circuit, giving 64μsec in all. The use of a delay line at baseband video improves the signal-to-noise performance by avoiding the losses inherent in a glass delay line at low carrier levels.

Fig. 8 shows the arrangement used in the HRD725 in greater detail. The playback luminance signal enters IC8, a T8004, at pin 7. It's first clamped and then sent along two paths. The main path is via the dropout (DOC) switch to the noise-canceller section, after which it emerges at pin 2. The other path is to the noise-detector, where one-line delayed video is subtracted. In the subtraction process the video components cancel and the noise components add. The amplified noise emerges at pin 3 and is fed back in at pin 1 where it's limited to reduce high-level video spikes to the level of the noise. The noise is then subtracted from the main path video in the noise-canceller circuit.

The horizontal correlation detector monitors the signal level at the output from the noise amplifier. If there's no horizontal correlation between tracks the noise amplifier's output rises and the detector mutes the noise limiter. The noise cancelling system cannot work without horizontal correlation because the noise component will not change polarity on each line. The system then breaks down – this happens in visual search when tracks are crossed, and in slow motion and still picture when only one field is replayed continuously.

The input to the CCD chip IC9 is taken from pin 4 of IC8. The circuitry around Q30 and Q31 filters out the 13·3MHz clock switching spikes as well as introducing a 200nsec delay. The delayed signal is fed back into IC8 at pin 6 and is then clamped to prevent d.c. drift and ensure that the black levels of the direct and delayed signals are the same. The DOC switch is driven by dropout pulses derived from the f.m. a.g.c. circuit – this is standard practice. It's a cyclic dropout compensator, so that if the dropout is longer than a line the switch stays over and the signal continues to circulate. I've not found the cyclic effect as noticeable as in Grundig machines, where a single line can be repeated down the screen giving a pattern of vertical, wiggly lines.

In the concluding instalment next month we'll look at further luminance signal processing – h.f. noise reduction and picture crispening.

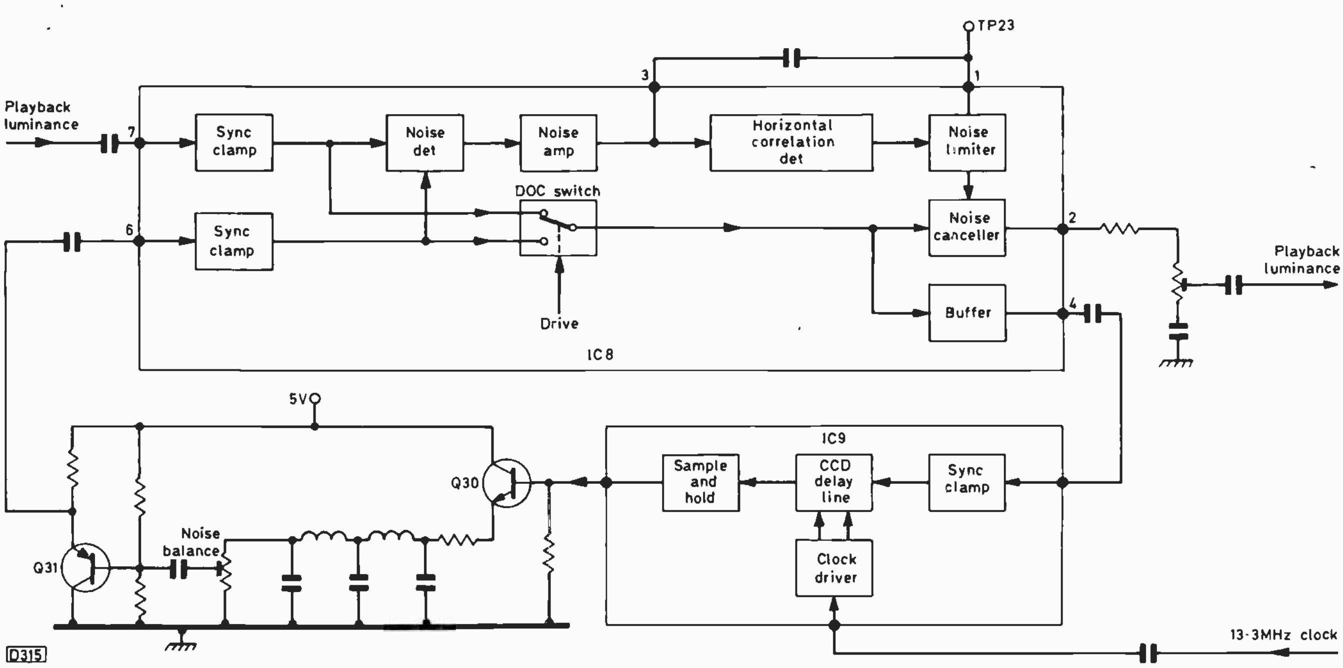


Fig. 8: Crosstalk noise cancelling system used in the JVC HRD725, shown in greater detail.

Teletopics

DBS LATEST

It's understood that the IBA's report to the Home Secretary on the prospects for UK DBS TV services is cautiously optimistic. An announcement from the government giving the IBA the go-ahead to advertise DBS franchises is expected by the end of February. One favourable factor is an assessment made by John Jackson, chairman of Celltech and a member of the British Technology Group, the holding company for the government's investments in new technology. Mr. Jackson believes that a project offering viewers three DBS channels on a subscription basis could be established by 1989 and that it could attract fifteen per cent of viewers within seven years of starting. The cost is estimated as being some £200 million, spread over several years.

A proposal for a joint UK-Irish satellite system has been put forward by James Stafford, chairman of Atlantic Satellites, the company chosen by the Irish government to start a DBS service. Ireland and the UK share the same satellite orbital allocation at 31°W. A six-channel system (three channels controlled by each country) has been suggested in talks between the Department of Trade and Industry and the Irish government – the proposal has also been formally submitted to the IBA.

An independent satellite TV news and information service has been established in London to offer the growing number of European private TV stations an alternative to EBU services. Independent Satellite Network expects to be able to provide between six and twelve hours of transmissions daily by April 1st.

It's understood that an agreement has been reached between Satellite Racing Development, a consortium of large bookmakers, and British Telecom to provide live coverage of horse and greyhound racing for betting shops, using an Intelsat satellite. The signals would be scrambled and the source would be video equipment already installed at racecourses for stewards' use.

Launch of the French TDF-1 DBS satellite has been put back from July to November – the delay is a result of schedule changes following an abortive Arianespace mission last September in which two satellites, including ECS-3, were lost and the failure of the French government to reach a final decision on the financing of the satellite. It's also understood that a final decision on the transmission standard has still to be made. This is delaying plans by European setmakers to start production of satellite TV receiving equipment. Arianespace is due to launch the Luxembourg SES satellite in May 1987.

REVISED DBS PLAN

A revised plan for DBS TV transmissions was approved by the 1985 World Administrative Radio Conference. Under the new plan the 500MHz band between 12·2 and 12·7GHz is to be used for 32 24MHz channels, with left- and right-hand circular polarisation to maximise band use (the previous plan approved at WARC 1977 was for 40 27 MHz channels in the band 11·7-12·5GHz). Satellite orbital position spacing varies from 1° to 11° under the new plan instead of being a regular 6°. The allocation of orbital positions to countries has been changed (several countries in addition to the USSR have been assigned more than one orbital position) and the previous five channel per country allocation has been dropped. The minimum power flux density at the outer edge of each satellite's service footprint has been reduced from -103dBW/m^2 to -107dBW/m^2.

SATELLITE TV RECEIVING EQUIPMENT

The latest issue of the Philips publication *Electronic Components and Applications* contains brief details of an indoor receiver unit designed by the company. A block diagram is shown in Fig. 1. Because of the high gain now achieved with head units the tuner has been designed for minimum intermodulation distortion rather than an optimum noise figure. Surface mounted components are used to minimise parastic inductance and capacitance and reduce the size of the unit – the prototype has a board area of only 70cm^2.

An input bandpass filter is used to suppress image frequencies and match the input from the head unit to a high-gain, broadband amplifier stage using a BFG67 transistor. This advanced device has a cut-off frequency of 7·5GHz. A filter between the broadband amplifier and the mixer is used to isolate the local oscillator signal from the input. It's tuned by two BBY39 varicap diodes – these devices have an extremely low capacitance. The high i.f. of 479·5MHz has been chosen to reduce the number of tuned circuits required and has the advantage that all image frequencies are outside the input from the head unit. The BFR92A transistor used in the local oscillator stage has very low feedback capacitance. A buffer stage is used to isolate the local oscillator from strong input signals.

Use of a BF990 dual-gate MOSFET in the i.f. amplifier makes it easy to apply a.g.c., which is necessary to prevent the SAWF driver stage being overloaded. The design of the PLL f.m. demodulator, which has excellent threshold performance, depends on the transmission standard used.

Prototype 60-90cm. parabolic dish aerials have been produced in W. Germany using Bayer's Novodur ABS engineering thermoplastic and have been subjected to exhaustive tests. Stability at wind speeds up to 100 m.p.h. has been established by tests carried out in a high-speed wind tunnel and the plastic has been found to have good rigidity, high heat resistance and good dimensional stability. The surface of the plastic dish is covered with a reflective metal layer. This can be done by placing aluminium foil or wire mesh in the injection mould or by applying a conductive coating, either by flame-spraying a metal alloy or by chemical electroplating. The result in an inexpensive dish that meets all design requirements.

AERIAL CATALOGUE

A new catalogue and price list is available from Aerial Techniques, 11 Kent Road, Parkstone, Poole, Dorset BH12 2EH (0202 738 232) for 65p inclusive of postage. The catalogue lists an impressively wide range of aerials and associated equipment, including amplifiers, splitters and combiners, converters, rotors etc.

VISIONHIRE REORGANISATION

The Electronic Rentals Group (Visionhire) has started a major reorganisation following its acquisition of Telefusion last October. The Telefusion headquarters at Blackpool is being closed down and about half the 200 outlets will be closed. Thirty former Telefusion shops are

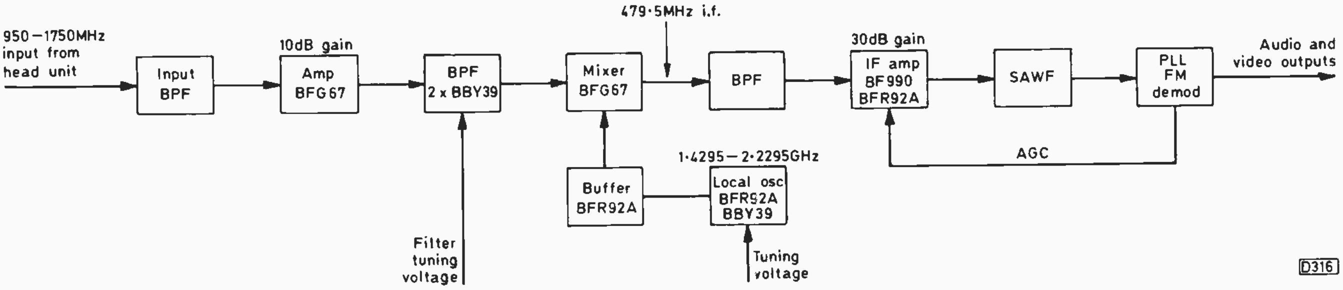


Fig. 1: Block diagram of the Philips indoor unit designed for satellite TV reception.

to become Visionhire outlets, bringing the total to 453. Some seventy former Telefusion Connect outlets will be relaunched. The two companies' cable TV interests are to be merged and run from the Telefusion Westhoughton centre.

ITT's SOPHISTICATED DIGITAL TV SET

The latest model in the ITT Digivision range, the Multicontrol, introduces some interesting features. The picture-in-picture facility enables a second picture to be displayed in a postcard sized area at the top right-hand side of the screen – a sixteenth of the total screen area. Freeze frame can be applied to this smaller picture area, which can also be used to monitor other parts of the house in conjunction with a video camera. The inset image can be interchanged with the main picture: a computer display can be seen on the main area of the screen while viewing a TV channel in the "window", or alternatively a video or TV channel can be monitored while the main screen area is used for teletext.

PERITELEVISION SWITCHING IC FROM MULLARD

The TDA8440 switching chip has been introduced by Mullard for use with a Peritel connector, offering flexibility and low-distortion performance. The i.c. enables signal sources to be selected under microcomputer control, eliminating the need for manual interchanging of cordsets at the rear of a display unit or TV set. The circuit can also be controlled by the d.c. level on the Peritel connector's function switching pin.

The TDA8440 can select one of two video channels together with their stereo/dual sound channels. An off position can also be selected, enabling the input signal to be taken from another TDA 8440. The device incorporates two three-state switches for the audio channels and one three-state video channel switch. A video amplifier with a selectable gain of one or two is incorporated and expansion with up to seven devices is possible. The minimum video switching crosstalk attenuation is 60dB and the total, maximum audio harmonic distortion 0·1 per cent. The chip operates from a supply voltage of 10-13·2V and requires a maximum unloaded supply current of 50mA. It's encapsulated in an 18-pin plastic DIL pack and has static short-circuit proof outputs.

VIDEO NEWS

According to a Keynote report the UK VCR market has now reached saturation level. Over 42 per cent of households now have a VCR and some 8·6 million machines are in use. Annual sales are now running at a level of around 1·5-1·7 million. An increase of some 200,000 is expected when the machines sold during the boom year come to be replaced but this is not likely to be before 1989/90. It's thought that only about 40 per cent of machines are now rented. The report is available from Keynote, 28-42 Banner Street, London EC1Y 8QE at £79.

Sanyo has introduced a range of three VHS machines (Models VHR1100E, VHR1300E and VHR1500E) in the UK – Sanyo manufactured VHS machines have been on sale under the Fisher brand name since 1982. The new Sanyo models will initially be imported from Japan but assembly at the Lowestoft plant is expected to start in the near future. Sanyo will continue to assemble Betamax machines at Lowestoft. The new VHS models will be promoted under the Proformance (professional performance) label, which is also to be used for TV sets.

BUSINESS NEWS

The latest half-yearly report from Thorn-EMI shows profit reduced from £40·2 million to £11.4m on turnover up from £1,436·9m to £1,533·6m. The Ferguson TV manufacturing operation is now back in profit: increased profits were recorded by the rental and retail sides of the business. Problems at Inmos have been the main cause of the profit shortfall.

Matsushita's profits for the year to November 20th, 1985 increased by ten per cent on turnover increased by five per cent. Sales of video equipment (VCRs and TV sets) increased by eight per cent, with the growth mainly in the US market, but there was a fall of five per cent in audio equipment sales. Virtually static profits are expected for the current year due to appreciation in the value of the Yen and reduced VCR sales.

VCR SOUND RECORDING INTERFACE

The VSR-1 sound recording interface module has been introduced by Video Interface Products Ltd., Charlton House, 32 Charlton Lane, Cheltenham, Gloucestershire GL53 9DX (0242 581 383). At present it's available by mail order only, at £49· 99 inclusive of VAT and postage. A free brochure is available.

The VSR-1 comes complete with leads and an instruction manual. Its advantage is that radio programmes (or audio material) can be recorded in the same way as TV programmes on a VCR. So you can make timed recordings running to several hours. The video part of the tape is blacked out and playback is through a TV set. It may be thought that this is rather wasteful of tape, but the point is that lengthy timed recordings can be made without fuss: if the material is to be kept it can be transferred to audio tape. The VST-1 is a compact unit measuring only 120 × 65 × 40mm and weighing 150g. Two further modules, an f.m. tuner with five preset stations and a preselector, are to be introduced. They will all bolt together.

Servicing Teletext Receivers

Part 3

Mike Phelan

This month we'll look at the TAC – text acquisition and control – i.e., type SAA5040 or SAA5040A (M914A in very early decoders), which is probably the most complicated of the chips in this decoder set. We'll also look at the row/column decoder system.

The TAC Chip

A block diagram of the TAC chip is shown in Fig. 1. The processed data from the VIP chip enters at pin 2 and goes to one of the inputs of an AND gate. The DEW (data entry window) gating signal goes to the other input, via pin 7. Serial data passes through the gate when the DEW signal goes high. The data is required in parallel, not serial, form however, so the next step is to feed the data into a shift register. If this holds eight data bits, the register will make one byte of teletext data available. As the data arrives at the rate of 6·93MHz the shift register must be clocked at this frequency. The clock signal from the VIP chip enters at pin 3.

Before any use can be made of the data checks on its integrity must be carried out. And before this can be done the electronics must be synchronised with the data, i.e. the electronics must know which is the first bit of each byte. The "framing code" – see Fig. 2 – is used for this purpose.

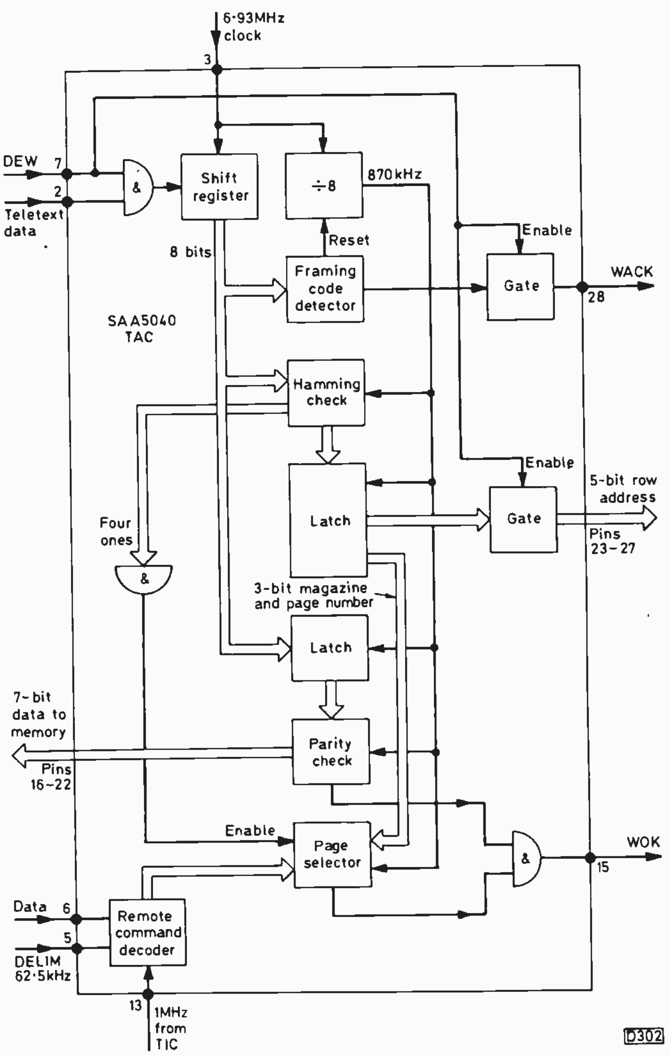


Fig. 1: Block diagram of the SAA5040 text acquisition control (TAC) chip.

When the framing code detector recognises the presence of the framing code (11100100 binary) it provides a reset pulse for the divide-by-eight section of the i.c. This section divides the 6·93MHz clock signal, which has already been synchronised with the data by the VIP chip, by eight, i.e. one "tick" per byte. The reset pulse ensures that the correct groups of eight bits are accepted as bytes. The 870kHz signal is used for various timing functions within the i.c.

There are two forms of error checking – a Hamming check and a parity check. The former, more elaborate, system is used to check the row address information, the latter the display data. Minor display errors are not too important but if the rows of information weren't presented correctly the display would be useless.

The eighth bit of each teletext data byte is a parity bit whose state is made such that the total number of one bits in the byte comes to an odd figure. If the total comes to an even figure there's an error in the byte which can thus be rejected instead of being fed into the page memory.

With the Hamming system four of the bits in each byte are parity bits, the other bits comprising the message: the message and parity bits are interleaved. Error checking consists basically of carrying out four sets of additions of the bits in each byte. If there's no signal corruption the result of each addition check is an odd number. The advantage of doing it this way is that the checks will indicate which bits are in error and the corrective action required. If more than one bit is wrong the byte is rejected. Otherwise correction consists of inverting the incorrect bit – this is accomplished within the TAC.

The display data emerges at pins 16-22 of the TAC – seven bits now instead of eight since the parity bit has been dropped.

Page Selection

The pages are transmitted in numerical sequence (more or less). If we were unable to select the page we required they would all flash before our eyes as transmitted. This would clearly be of no use at all. Page selection is done by keying the appropriate number into the remote handset. The remote control signals from the SAA5010 remote control receiver chip arrive at pins 5 and 6 of the TAC chip. The data at pin 6 is in the form of a serial code at a frequency of 62·5kHz. It's converted to seven bits of parallel code within the i.c., using another shift register. As with the serial teletext data, a clock signal is required to drive this. It comes in from the SAA5010 chip at pin 5 and is referred to as the DLIM (delimiter) signal. The seven data bits comprise two that specify TV/text/mix and five for the text functions, including page numbers.

A page is displayed when the transmitted page number (in the page header line) matches the selected page number. The four ones from the Hamming code parity

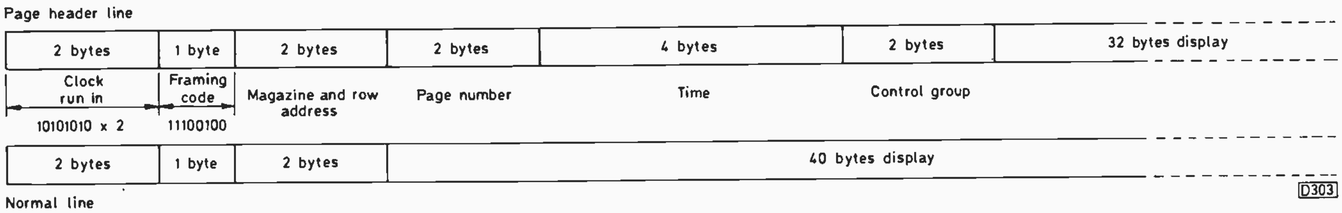


Fig. 2: Data composition of the page header and an ordinary display line.

check go to an AND gate: if all are o.k. the output goes high to enable the page selector. This carries out comparison between the page number in the header and the selected page: when they match the WOK (write OK) signal appears at pin 15. Note the second AND gate: the other input to this is high only when the parity check on each display byte is o.k. – thus corrupt bytes are rejected. The WOK output goes low to write data into the memory during the DEW period, also during the EDIL period (line 40) when status data is transmitted to show which channel is in use.

Addressing the Memory – Row and Column Decoding

We have display data leaving the TAC at the correct times then: where do we put it? We need some sort of clock to keep track of the locations in the memory. The RAM i.c.s used to store the display data have to be told whether to read or write data and the correct addresses.

The seven RAM i.c.s used have a capacity of 1Kbyte each (1,024 bytes). This is unfortunate since 960 bytes (40 columns by 24 rows) are required to store a page of text. The TAC provides a five-bit row address (counting 0-23) but there's no way in which this can be used to address a RAM. Consider for a moment why this should be. Each 1,024 byte RAM stores one bit of the seven-bit character display code. To address each location in the RAM we'd need a ten-bit address – to put it another way, to count up to 1,024 in binary we need ten bits – 1,024 is 1000000000 in binary. We can't use so many bits for rows and the rest for columns as 1,024 won't factorise into anything like 40 × 24. The nearest we can get is 32 × 32, which is of no use to us.

To get round this snag a clever bit of circuitry is used employing three TTL i.c.s (see Figs. 3 and 4). Two of these form a counter which counts up to 39, for which six bits are required. Each 74LS161 four-bit counter will count up to 15, so we pass a carry pulse from the first to the second and use only two bits from the latter. This gives us the six bits to count from 0 to 39.

After a byte from the TAC has been written into the RAMs, WACK (write address clock) sends a pulse to the counter i.c.s to prepare the next address. The GLR (general line reset) pulses reset the two counters at the end of each line. Note that during the display period, when the RAMs are being read, WACK is replaced by the RACK (read address clock) signal from the SAA5020 TIC chip.

We still have the 40 × 24 problem however. Back to the counters, which provide a count of 0-39 in six bits, from WACK or RACK which give one "tick" per byte. The TAC chip provides at pins 23-27 a five-bit row address to count up to 23 (during the display period a five-bit row address comes from pins 19-23 of the TIC i.c. – this was not shown in Fig. 1, Part 1). Note that the two sets of row addresses and the WACK and RACK outputs are directly connected between the i.c.s, so tri-state outputs are required with the outputs not being used switched to the high-impedance state.

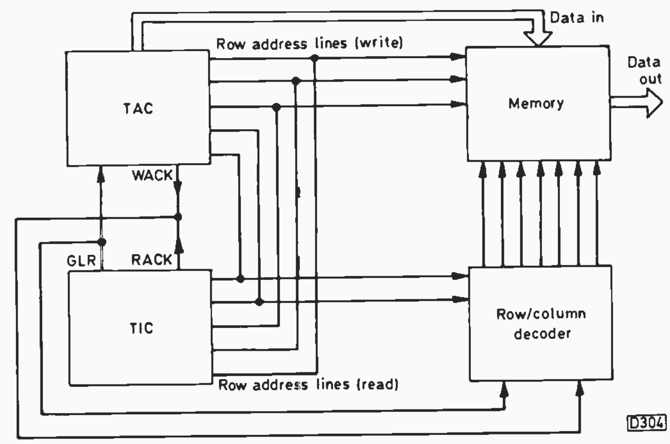


Fig. 3: Way in which the TAC and TIC i.c.s address the memory. This partially corrects Fig. 1 in Part 1.

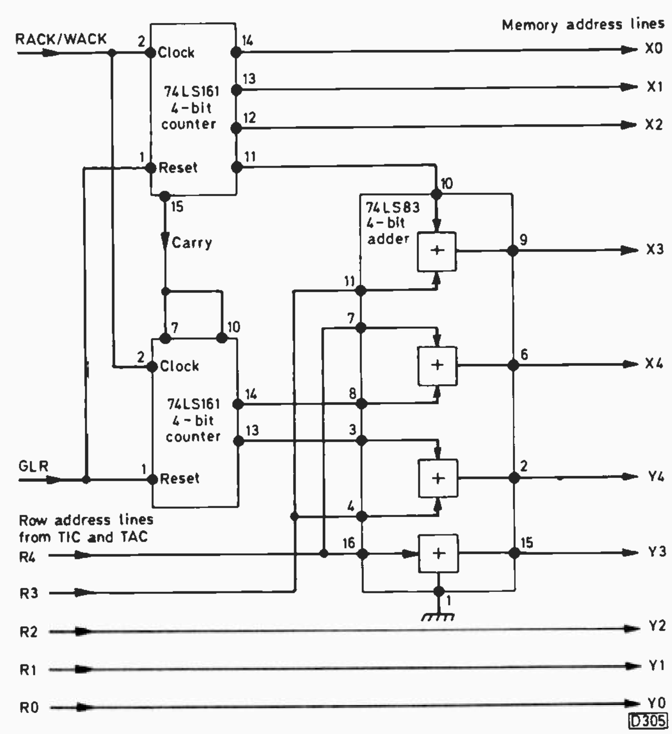


Fig. 4: The row/column decoder arrangement.

To convert from the six column and five row bits to the ten bits required to address the RAMs we use the lowest four row bits as they are – this counts up to 15. The first four column bits will also count to 15. We add the highest three column bits to the highest two row bits to give two row and two column bits respectively, thus converting the 24 × 40 matrix to 32 × 32 (1,024). X0-X4 and Y0-Y4 in Fig. 4 are the RAM address lines.

Next month we'll discuss the final chip in the decoder, the TROM, and servicing aspects of this decoder.

VCR Clinic

Reports from Steve Beeching, T. Eng., Les Harris, Philip Blundell, Eng. Tech., R.S. Narwan and William G. Lockitt

Sanyo VT9300

There was no servo lock on record, but it would play back known good tapes. A quick check through the servo soon showed a distinct lack of monostable output pulses at pins 17 and 19 of the control track record i.c. Q101. Separated field sync pulses were present at pin 15 but were of a suspect, low level. I had to cross check with another VT9300 that the 1·25V p-p field pulses were indeed correct. The faulty component was actually C108, which is part of the monostable timing for dividing the field syncs by two. **S.B.**

Hitachi VT11

This machine would thread up, run for a few seconds and then stop. The dealer who'd sent it in had already changed the capstan motor. The fault was caused by the threading motor not reaching the after loading position however. Changing this motor and the accompanying belts cured the trouble. **S.B.**

JVC HR2200/Ferguson 3V24

I was interested in E.T.'s report (December issue) on a problem caused by C11 (3·3F, 1·6V) whose sole purpose is to retain the counter memory when the machine isn't powered. In the case I had the leakage was to the remote control socket print. This brought about permanent rewind by raising the voltage level on control line B2. **S.B.**

Hitachi VT5500 – No Clock Display

This was difficult to solve, not because the problem was complex but because of Hitachi's aggravating production modifications not being shown in the service manual. The clock i.c. we found in the machine was an HD38845A-36. I thought at first that the dealer who'd sent it in had replaced it with the wrong type. We confirmed that the replacement was of the correct type, but it hadn't cured the fault. After lengthy tests and yet another HD38845A-36 I was getting nowhere fast. The chip just wouldn't run despite checking and double checking everything. One problem was that I was using a VT8500 service manual because the chips and circuits in the machine bore no relation to anything I could find in the VT5500 manual. It appears that there's an updated manual, reference no. 1311, so this was sent for.

It could be deduced from the VT8500 manual that the HD38630A-26 is an earlier equivalent of the HD38845A-36, then from the revised VT5500 manual that it could be an HD38630A-36 (or an HD38630A-06 or HD38630A-26, provided one, both or either sub or sub-2 PCBs are fitted). Confused? Yes, so was I.

Anyway, the i.c.'s internal clock was running but nothing else – no output strobe pulses anywhere. The −30V line was present – actually it was −45V, due to the machine being of NAFFI origin for a 220V mains supply. While I was playing around with the power supply I discovered that a 6V rail was missing, due to R954 being open-circuit. This was repaired – and the clock came on! Now this 6V line goes nowhere near the clock i.c. It just runs through the timer PCB to the programme selector panel. What's more it doesn't even exist on the VT8500 circuit. It didn't seem possible that the 6V line could affect the clock i.c. but it did, via the programme selector. Q703 in the programme selector circuit is normally off: with the 6V supply missing it turns on via the tuning supply. This held pin 35 of the clock i.c. at chassis potential, which is a permanent interrupt, holding the i.c. off. Unfortunately the service manual incorrectly shows pin 35 as being at 0V, which means that innocent souls fault-finding wouldn't think twice about it. **S.B.**

Grundig 2 × 4 Super

The problem with one of these machines was no modulator output. R25 (2·2kΩ) which feeds the −22V supply to zener diode Di27 within the modulator was open-circuit. Another fault on one of these machines was no E-to-E audio. The TBA120T chip on the i.f. panel was defective. **S.B.**

Mitsubishi HS330

The complaint with this machine was an intermittently snowy picture on long play. After much panel waggling we found that flexing the top PCB around the head amplifer section caused the fault to appear and a relay could be heard clicking in and out. The head amplifier screening can was shorting to the link by R20. **P.B.**

Ferguson 3V29

A loan machine would not record sound though there was playback sound from a prerecorded tape and in the E-E mode. The audio signal was present at the record amplifier output from IC1 (TP2) and the erase oscillator was working, but there was hardly any bias signal at TP3. We found that the voltage at the collector of Q11 in the control circuit was permanently low – it should go high in the record mode. Zener diode D7 in its base circuit was short-circuit. **P.B.**

Toshiba V8600

Poor pictures were obtained with both playback of a prerecorded tape and E-E operation – the pictures were "nasty", with flaring. A scope was used to check the video signal along the E-E path. Everything was o.k. up to the point where the path splits two ways – to the r.f. modulator and to the video output socket. As a quick check I fed the video output to the video input of another machine and obtained a perfect picture on the monitor. The supply to the r.f. modulator was then measured – only 4V. Switch transistor Q661 on the servo logic board was faulty. A meter check on this produced a base-emitter reading of 500Ω both ways – I've had Q661 open-circuit on several occasions but never before has it been half way! **L.H.**

Panasonic NV7200

There was no timer programming on this machine, which had been subject to liquid spillage at some time – the timer and operation boards were affected and had received a lot of attention. The clock worked so I decided to check the programme switch. It had 5V at one side but when pressed produced only 1·5V at the other side. A replacement programme switch cured the trouble. **R.S.N.**

Sony SLC9

The problem with this machine was no signal from the tuner, no clock and no programme numbers due to no 38V supply from the d.c.-to-d.c. converter module on board D (check for 38V at pin 3 of the module). **W.G.L.**

Panasonic NV366

The complaint was intermittently incorrect capstan speed. The machine was put on soak test and after half an hour the capstan speed increased. A scope was used to check the capstan FG signal at TP2007 – it was missing. We checked back to the motor and found that when this was gently tapped the speed corrected itself. A new motor restored normal results – the capstan FG generator is built into the motor. **R.S.N.**

Ferguson 3V31

This machine would work all right for a short time then the drum speed would increase. The trouble was traced to IC13 (μPC1458). **W.G.L.**

Sony SLC5

The head drum wouldn't rotate, though turning the drum by hand would get the machine to work until switched off. The fault was eventually traced to D1 (1S1555) on audio/servo board AS6 – it was short-circuit. As a check, pin 18 of the drum servo i.c. (IC1) should be at 10·8V at switch on: D1 short-circuit gives a low reading. **W.G.L.**

VHS the Philips Way

Harold Peters

When Philips took up the VHS format to improve their share of the VCR market they were reluctant to abandon some of the features of their V2000 system. The result has been something of a compromise: machines that are indisputably VHS but have the Philips philosophy applied to their operation and use. This can be a little confusing to someone who has just got one to replace an early Japanese machine, or to engineers who have to deal with a mixture of the two types. The instruction books don't help, being multilingual (or alingual!) and badly set out – with the exception of a limited edition for the VR6462, revised in the UK. Nor does the fact that their authors, following the practice of "positive thinking", don't tell you what the things won't do. Let's try to straighten matters out. We'll look first at the differences between the Japanese and Dutch approaches, then run through the range of Pye/Philips machines released up to the time of going to press.

Different Approaches

The Japanese philosophy, which up to now covers the majority of VHS/Beta machines and means that if you can operate one model you can get by on all the rest, is as follows:

(1) The user's on/off switch is used to turn the machine on: it remains on until you turn it off again.

(2) Timed recording programs, once entered, lock the machine so that it cannot subsequently be used or accidentally "dusted to error".

(3) Tracking errors are compensated by adjusting a control which must be reset after the mistracked tape has been played.

The Philips philosophy, based on the electronics of their V2000 system, is totally different:

(1) There's no on switch, only a standby button. To start the machine you merely press the button for the required function, e.g. play, wind or eject. If the machine is not used for a few minutes it automatically reverts to standby, i.e. only the clock and infra-red receiver are on.

(2) Personal use overrides timer settings. Dad can come in with a borrowed tape and watch it despite Mother having booked the VCR to record Coronation Street. At 7.30 Dad wonders why the display starts flashing.

(3) Tracking should be automatic. The V2000 format uses dynamic track following, with the video heads mounted on bendable arms. Compatibility precludes the use of this arrangement with the VHS system. Instead Philips use a tracking button: push it till the sparklies move out of the picture and it holds that setting while the tape is played, resetting itself at the end.

So much for the basic differences. Now let's see how they have been applied. As you'll see, only partially at first. We'll consider the machines in the order in which they were released: the model number in brackets is the Pye version, which differs only in style and presentation.

Philips VR6520 (65VR20)

To get Philips VHS off the ground the initial basic Models VR6520 (65VR20) were imported from Japan – they are in fact the Panasonic NV370 with restyled fronts. Naturally they conform fully to the Japanese philosophy, with on/off switches, locked timer programming and a tracking knob. They stay on till you turn them off. What you can't do is to watch a broadcast on its own channel while the machine is in the play mode. This is a Panasonic feature introduced to avoid beat patterning in areas where the lower u.h.f. channels are in use: it can be overcome by linking pins 5 and 6 of P1 on the modulator.

The VR6920

The VR6920 (no Pye version) was an adaptation of the Panasonic NV850 stereo hi-fi model. The use of helical audio recording gives sound quality comparable to that from a compact disc. It's "helical stereo only", the lateral sound track on the edge of the tape being mono only in both the record and playback modes. As with the VR6520 the broadcast channels are inhibited during playback, and since the VR6920 can be used purely as a sound recorder – in conjunction with a hi-fi – this feature prevents other members of the family watching TV while someone is using the machine as a sound recorder. If required the remedy is the same as with the VR6520: link pins 5 and 6 of P1 on the modulator.

The Japanese philosophy of on/off switching, timer lock and a tracking knob is maintained, but Philips replaced the infra-red remote control circuitry with their own RC5 board (see January *TV*), permitting remote control to be linked to TV handsets of the flat 53 series. The handset supplied, type AV5567, controls all the VCR functions and will also control a restricted range of functions on any Philips group TV set that uses the RC5 code. Two orange buttons on the right of the "calculator" part of the keypad give selection betwen VCR/TV control. A word of warning here. Although it doesn't say anything about it in the instruction leaflet, the act of inserting the batteries in a new handset puts it into the TV mode. The writer, unaware of this, unpacked three samples before a chance encounter with a teletext set in the showroom told him that he hadn't received a batch of duds.

Model VR6560 (65VR60)

The middle range Model VR6560 (65VR60), which is capable of programming up to five items in advance, was the first purely Philips machine. It's a top loader with the lift controlled by touch buttons. The temptation to push it down by hand should be resisted. Much of the cabinet and electronics are derived from the V2000 format Model VR2324 and the machine has the full Philips philosophy: it turns off after eight minutes of non-operation, personal use overrides the timer and tracking is by pushbutton. Setting the clock requires you to enter the date – day, month and year, even though it never asks questions about the latter.

Test Program

Due to its compact size this is not the easiest machine to service. It does however contain a comprehensive test program in its microcomputer, part of which is initiated every time the machine is plugged in. The rest is detailed in the manual, but we'll mention two useful sections.

The first is the ability to read off the number of hours the machine has been used. Press standby once then press store and, while holding it down, press search (not the other way round). If you ignore the decimal point the time display will then show the total number of hours of use, i.e. 2.35 indicates 235 hours' use. To clear, release store and search and press standby once again.

The other feature of the test program useful to the servicing fraternity is a life test mode. Make up a dummy DIN plug to fit the camera socket at the back of the machine, with a diode connected between pin 4 (anode) and pin 5 (cathode). Put a tape in, unplug the machine, fit the plug and reconnect the mains supply. The machine will now play the tape to the end, rewind, replay the tape again and so forth until the mains supply is disconnected. Should an intermittent fault occur the machine will stop and an error indication, which can be looked up in the manual, will appear on the display. This is also a useful feature for display purposes.

The VR6460 (64VR60)

The VR6460 (64VR60) was the first front loader with the Philips philosophy. This is considered to be a basic machine even though two programmes can be entered in the timer. A "one touch recording" counts as one of the two, i.e. filling both timer "blocks" will prevent a "one touch" recording being made. Manual operation overrides the timer and after eight minutes of idleness the machine automatically goes to standby.

The AV5561 plug-in infra-red unit gives remote control operation: it can be used with the AV5562 handset or with many of the current range of Philips TV handsets that employ the RC5 code (more on this later). There's a built-in test program similar to the one just described, but since the machine uses a Panasonic deck which is similar to that used in the VR6520 the two features specifically mentioned above are not available.

The VR6462 (D464)

The VR6462 (D464) is destined to be the basic model for the coming season and after. This two-program development of the VR6460 differs in having a Philips deck as well as Philips electronics and a built-in remote control receiver unit. This latter feature means that any user of a recently bought Philips TV set which employs the flat 53XX type handset can use this to control the majority of VCR operations. Further details will be given later. Again the full Philips philosophy applies: shutdown after eight minutes of non-operation, manual use overrides the timer and there's pushbutton controlled tracking. Also the "one touch" button requires an empty timer block to function.

A limited number of these machines came complete with an easy-to-read instruction manual printed in the UK. Its illustrations are in blue and black, so you can tell it from the "Euromanual" which is printed in red and black. Unhappily it doesn't have a code number, so if you send for a manual you'll get the Euro version. Neither manual mentions the fact that there are two versions of the machine – "swallowers" and "stoppers". If empty a swallower will accept a cassette, even if in standby, and lower it into the deck, staying in the on state. The stoppers go into the standby mode with the cassette lift down, thus preventing the insertion of a cassette until the machine has been turned on by pressing the eject button.

As with other models a comprehensive test program is built into the microcomputer chip. This is triggered on every POR (plug in) and gives fault indications that can be looked up in the manual. Its "life test" mode is similar to that of the VR6560 but you don't need a diode plug.

Model VR6660

The VR6660 is a full-specification front loader with the mechanics of the VR6462 and the electronics of the VR6560, plus extras. As the shutdown after eight minutes without use and the timer lock are optional the machines can be run following either philosophy.

The most noticeable feature is an alphanumeric display beneath the standard four digit time/counter figures. The function (play, record, wind, search, timer etc.) appears on this in large letters. The second thing you notice is that everything, including setting the timer, can be done from the remote control handset. There's also audio dub and, provided you've entered the type of cassette you're using, e.g. E180, a time remaining readout can replace the conventional counter display. Like the VR6560 the clock setting requires the date with year. Once you've set it, and the TV channels it is to monitor, these details remain in store for up to three months. So there's no need to reset after every power cut and more predelivery work can be done in the workshop.

You can override the eight minute turn off by selecting a broadcast channel during standby, turning the machine into a high-quality tuner. There's also a tamperproof lock: you open the store, enter any four digits and store them – all while the set is in standby – and the word "locked" appears on the display. Only by opening the store again, re-entering the same four digits and closing the store can the machine be unlocked. The machine cannot be used in the locked mode, but any programs booked into the timer before you locked the machine will be carried out. What if you forget the four-figure code? Hard luck! There's obviously a way to restore the machine to normal use but you'll be asked a lot of embarrassing questions (we hope) before anyone will come out and do it. If in normal use you override the timer when it should be recording a programme the machine will emit bleeps to warn you.

The POR test program is similar to the VR6560's, including a "life test" that requires the same diode plug.

VR6860 Matchline

The VR6860 is the Matchline version of the VR6660. It has hi-fi stereo sound recording facilities via helical tracks, as with the VR6920, and all the features mentioned above. It should be noted that the linear track is mono only and that audio dubbing can be carried out only on the linear track.

Remote Control

For the last eighteen months or so most remote control and teletext Pye/Philips TV sets have come with a flat handset that includes some VCR functions. They were originally designed for use with the later V2000 series VCRs but will also remotely control the VR6560, VR6462, VR6660 and the Pye equivalents for the following functions: play; record; forward search; reverse search; channel change; standby; stop; pause; and a few others depending on the combination of handset/TV. Three functions are available only via the remote control handset – triple forward speed playback, normal speed reverse playback and slow forward. The TV/VCR button at the side of the unit has to be held in when VCR functions are being selected. Fast wind and fast rewind are not available via remote control – due I've been told to no one asking the designer to include them. Finding this hard to believe, I dug a bit deeper. The more plausible explanation is that the system was designed for use with V2000 machines and in this respect doesn't require wind and rewind since all V2000 machines have a "go to" feature which is quicker and more effective.

Service

Hitherto Philips Service have held courses at various regional centres to train dealers' engineering staff on the servicing techniques required for new models. In the case of the VHS machines these courses have been replaced by packages of instructional material that amount to a tidier form of the notes you'd have taken had you gone on a course. In addition to the service manual each package includes a circuit description and fault-finding guide – the latter emanating, thank goodness, from Croydon itself and thus being in a language we all understand.

Issued so far are VR6920, code No. 727 17992; VR6460, code no. 722 17197; and VR6462, code no. 722 17202. Each package comes in a zip-up wallet and, at £25 a time, is a lot cheaper than sending a man on a two-day course.

The Network EMS System

Denis Mott

Network NWC1402 series colour receivers employ an electronic programme memory system (EMS). It's a voltage-synthesis tuning arrangement based on the SGS M193 i.c. Inevitably faults can occur and the service engineer then has to try to cope. The service manual will probably be consulted but it's seldom obvious from a circuit diagram how things are supposed to work. It's about this time that my phone goes . . .

The M193 incorporates a non-volatile memory, i.e. the memory retains the information stored in it when the power supply is interrupted – SGS quote the memory storage time as being ten years. With a volatile memory, i.e. one using RAMs as in the earlier Network NWC1401 series, a back-up battery is required to ensure that the stored information is not lost when the main power supply is switched off.

Fig. 1 shows a simplified block diagram of the M193. It's been simplified because some of the facilities incorporated in this i.c. are not used in the NWC1402 – data display control and band switching for example. The memory is organised as 17 bits of information, 12 to provide the varicap tuning voltage, three for fine tuning and two for band selection. A digital-to-analogue converter (DAC) provides the tuning output at pin 15: the output depends on the twelve bits of information obtained from the memory.

The four input lines PA-PD receive a binary-coded input to address the memory. Pulses are applied to pin 9 when a new programme is to be stored. The timing of these pulses depends on the store output at pin 14: the pulse trains differ for memory erase and memory store – during a store cycle the previously stored programme is first cancelled then the new one is written in. The band select, a.f.c. and auto-tune facilities incorporated in the i.c. are not used.

Fig. 2 shows a basic block diagram of the EMS system. The EMS panel is used in both remote and non-remote control versions of these sets. For remote control the preamplifier unit is added.

The EMS system is shown in rather more detail in Fig. 3 to enable its operation to be understood. The μPD1937C remote control receiver/decoder i.c. (IC1301) receives both the remote control commands and the programme/volume up/down signals from the touch board. The i.c. is clocked by a 455kHz resonator (X1301) connected between pins 10 and 11. Pin 13 receives the remote control input signals from the preamplifier while pins 1-5 receive the local commands – pin 1 power on/off, pin 2 channel up, pin 3 channel down, pin 4 volume up, pin 5 volume down. The outputs are at pins 6, 7, 14 and 15. Pin 6 goes high when an on command is received. Pin 7 provides an 18msec pulse output for volume control: the

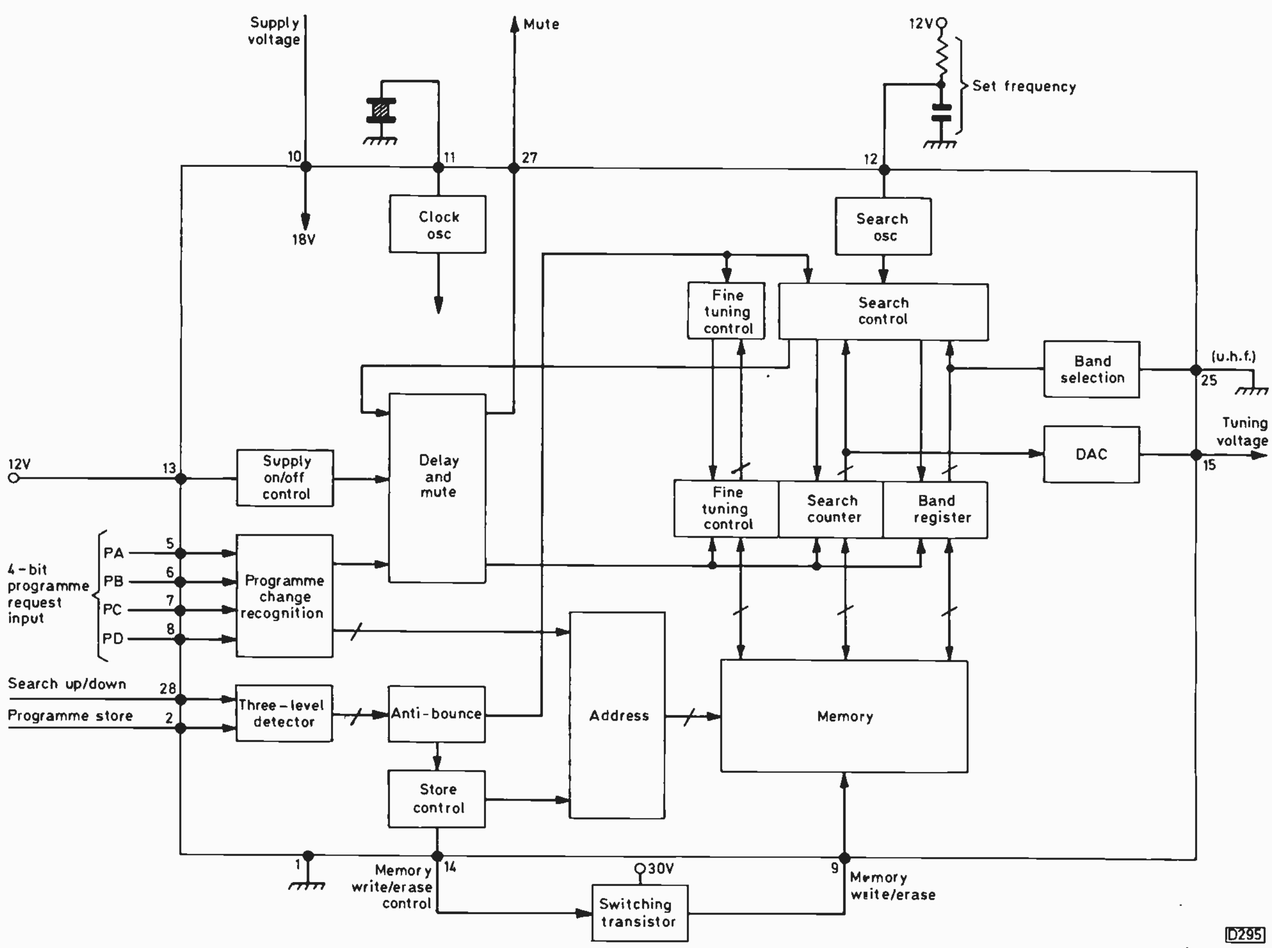


Fig. 1: Simplified block diagram of the M193 programme memory chip.

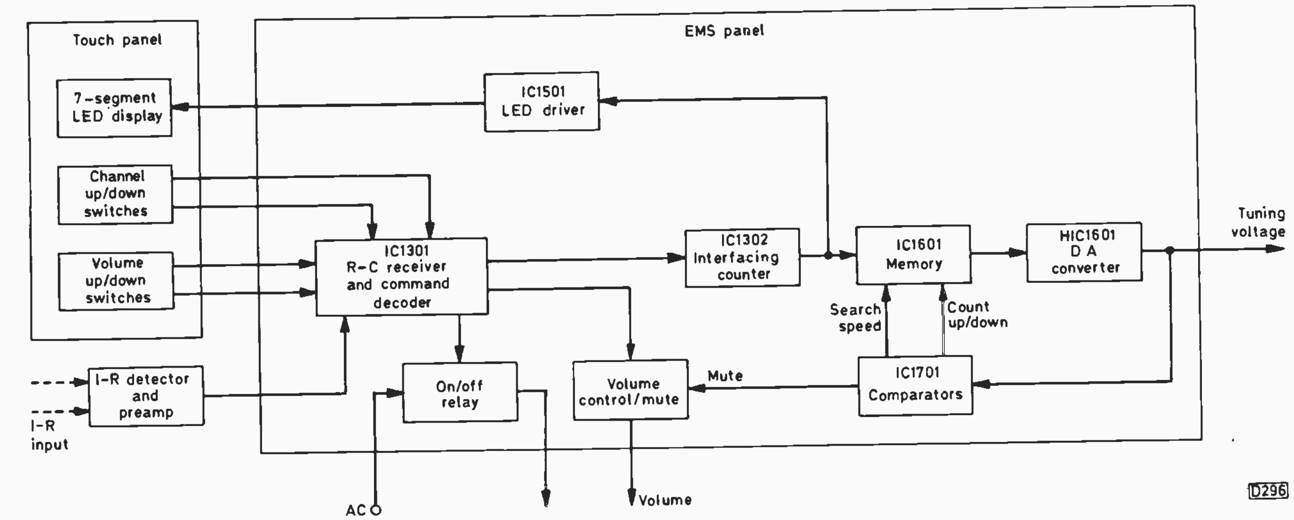


Fig. 2: Block diagram of the EMS system used in the Network NWC1402 series.

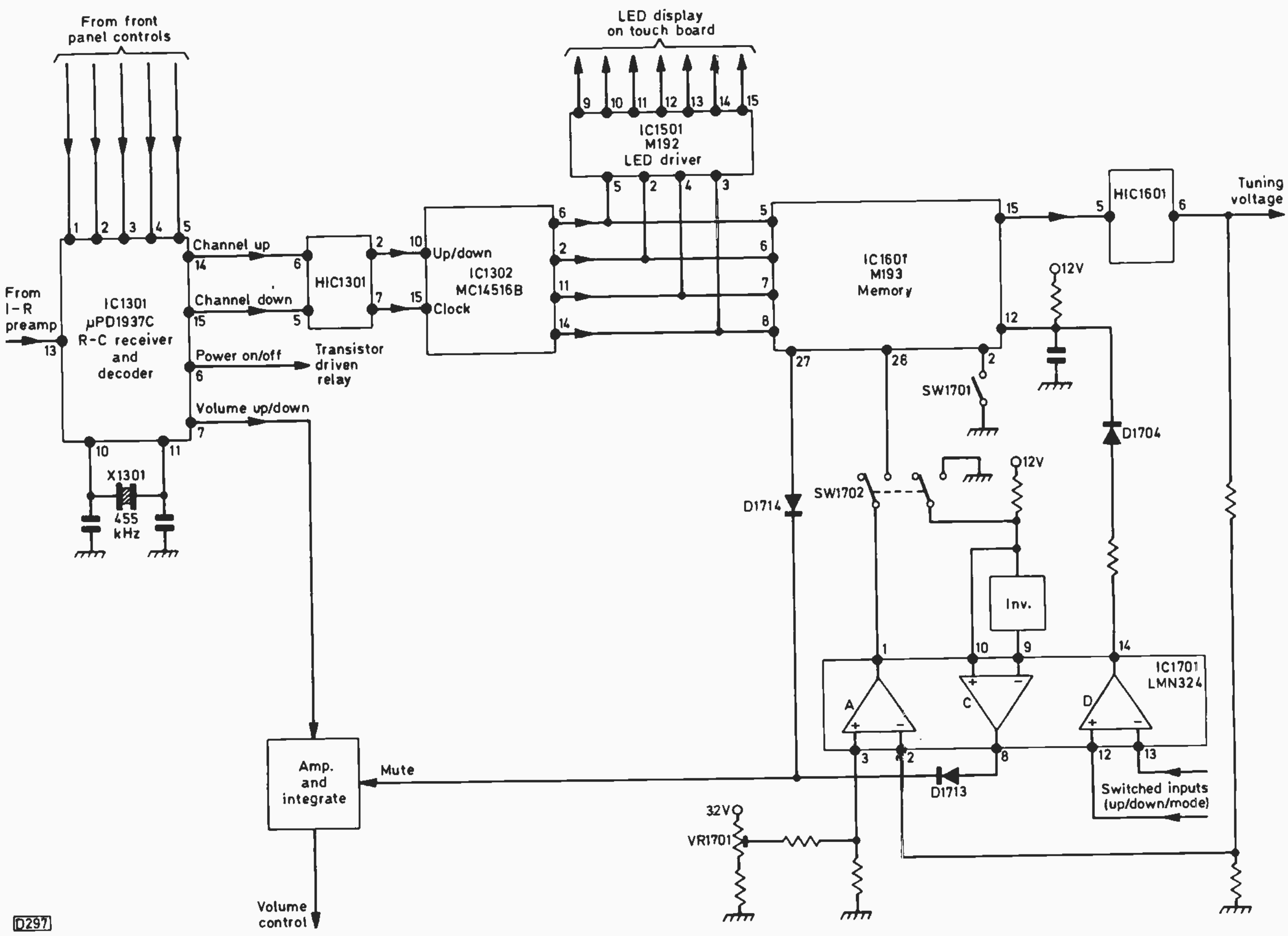


Fig. 3: Interconnections between the various i.c.s used in the EMS system.

mark-space ratio is short for low volume, long for high volume. Pins 14 and 15 both provide 18msec pulses, pin 14 when channel up is selected, pin 15 when channel down is selected. There should be a 20V peak-peak 455kHz sinewave at pin 10.

The up/down pulses from IC1301 go to pins 5 and 6 of the thick-film hybrid i.c. HIC1301 whose job is to gate the up/down signal on to a single line – the output is at pin 2. In addition it provides a clock signal at pin 7. The up/down and clock outputs pass to IC1302 which provides an interface with the M193 memory chip. This is an MC14516B 4-bit bi-directional counter whose outputs are taken from pins 2, 6, 11 and 14. These outputs go to the M192 LED driver i.c. IC1501 as well as the memory chip.

When a data input is applied to pins 5-8 of the memory chip IC1601 an output will be obtained at pin 15. This comes via a digital-to-analogue converter, but since this is clocked the output at pin 15 consists of pulses rather than d.c. The mark-space ratio of these pulses alters to provide the tuning voltage required. The following thick-film hybrid i.c. HIC1601 inverts and integrates the pulses from pin 15 of IC1601, producing the tuning voltage at pin 6. It

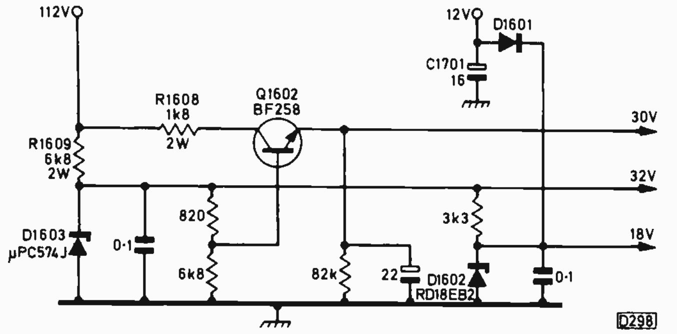


Fig. 4: Power supply arrangement for the M193.

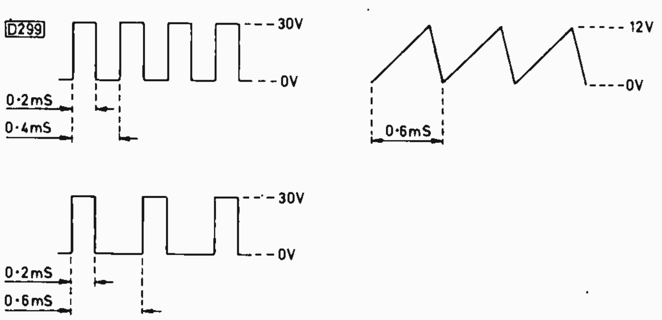


Fig. 5 (top left): Memory erase signal at pin 9 of the M193.
Fig. 6 (lower left): Memory write signal at pin 9.
Fig. 7 (top right): Ramp waveform at pin 12 of the M193.

can also be used for band changing on v.h.f./u.h.f. sets. When data stored in the memory is to be changed, i.e. a channel location is to be retuned, pin 28 (search up/down) of the M193 is connected to a comparator i.c. (IC1701) via the mode switch SW1702 – an indicator LED then lights.

The power supply arrangements for the M193 chip are a bit ticklish. It requires 12V at pin 13, 18V at pin 10 and a 30V supply for memory write/erase. The 12V supply must arrive first (D1601 provides the initial supply for pin 10). The 18V supply is derived from the set's 112V h.t. supply, which is delayed slightly. The 32V tuning voltage supply is also derived from the 112V line, in the usual manner. Fig. 4 shows the main items in the power supply system.

M193 Pinning

The M193 is a 28-pin device but not all pins are used in this application. Useful pin information to note is as follows:

Pin 2: Voltage falls to 0V when the memory switch is operated.

Pins 5-8: Data address signals from IC1302 at 12V logic levels. A low on all inputs gives programme one, a high on all inputs programme 16. Programmes 2-15 are given by different combinations of 1 and 0 on the four lines.

Pin 9: 30V peak-peak pulses are applied to this pin for memory erase/write. For the erase part of the cycle the pulse duty cycle is 0·4msec (see Fig. 5). For the write part of the store cycle the pulse duty cycle is 0·6msec (Fig. 6).

Pin 11: Clock oscillator pin. A 3·58MHz crystal is connected to this pin. If you suspect that the crystal is faulty, connect a X10 scope probe to this pin via a 1MΩ resistor. A 150mV p-p sinewave should be displayed. If the 1MΩ resistor isn't included the oscillator will stop.

Pin 12: An *RC* network is connected to this pin to set the frequency of an internal oscillator which produces the scan ramp in the search mode. The ramp is normally of 0·6msec duration (Fig. 7) but shortens to 0·2msec initially (see later).

Pin 14: Pulses as at pin 9.

Pin 15: 5V p-p pulse train. A small mark, wide space will eventually tune in channel 68: for channel 21 a wide mark and small space are required.

Pin 27: Sound muting. Goes high (5V) when changing channel.

Pin 28: Memory data up/down selection. When low the data clock counts down, when high the data clock counts up. At 6V the data clock is inhibited.

The Comparator Chip

The final i.c. on the EMS panel, IC1701 (LMN324), is a quad comparator of which three sections are used.

Comparator A provides the up/down information for pin 28 of the memory i.c. The non-inverting input of this comparator is fed by VR1701. The inverting input is supplied with a potted down portion of the tuning voltage. If the non-inverting input is positive with respect to the inverting input the output will go high and the memory data will scan up to provide a new channel. The opposite applies with reversed inputs.

Comparator C provides sound muting for approximately one second when the channel up or down button is pressed.

Comparator D alters the search speed at pin 12 of IC1601 for approximately one second after the up, down or mode switch is operated.

Fault Finding and Modifications

The two most common failures are no output from pin 15 of the M193 memory i.c. and failure of some memory locations to store data.

When there's no output from pin 15 of the M193 the device usually gets very hot due to an internal short.

Failure to store data at some memory locations is caused by an internal problem which can be checked by monitoring the waveform shown in Fig. 6. New data will not be entered if the memory erase waveform (Fig. 5) is seen.

Tuning drift has been a problem with some of these sets. There are two possible reasons for this: (1) temperature drift; (2) a.f.c. locking range.

When the temperature within the set reaches 40°C the varicap tuning voltage starts to drop. This is caused by the inverter transistor in thick-film module HIC1601 not turning on fast enough. Eventually, the changed output voltage will be too much for the a.f.c. to handle and the set will go off tune. To eliminate this effect remove the thick-film module HIC1601 from the EMS panel and add a tantalum bead capacitor as shown in Fig. 8: any value between 0·22µF and 2·2µF will do.

The other problem arises from the fact that on one

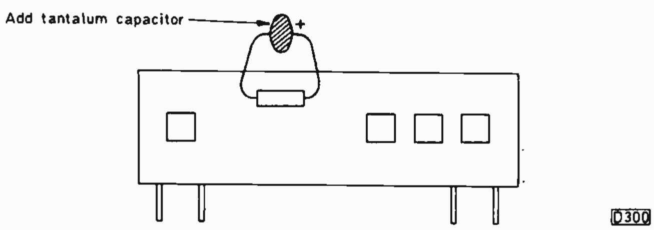


Fig. 8: Temperature drift modification.

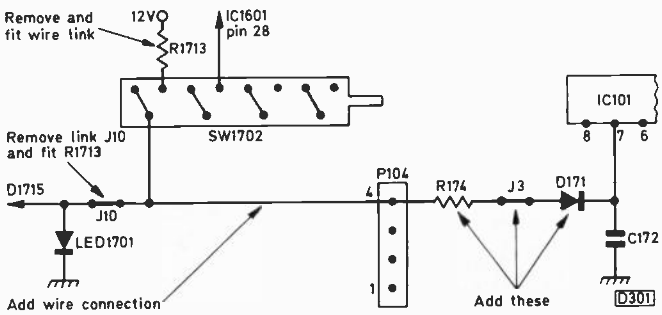


Fig. 9: A.F.C. disable modification.

version of the chassis there's no a.f.c. disable when programming the memory. This may cause the set to appear to have drifted off tune when changing channel – it usually happens when going from a higher to a lower frequency. To overcome the problem add diode D171 (1N914 or 1N4148) in the vision i.f. screening can, add R174 (22kΩ) near P104, add link J3 and add a connection wire from P104/4 to SW1702. See Fig. 9.

There's a version of the EMS panel which is electrically correct but R1713 (820Ω) is incorrectly sited so that the a.f.c. disable doesn't operate. To correct this, remove R1713 from the panel and replace with a wire link. Fit R1713, with extended leads, in place of link J10 (see Fig. 9).

To ensure correct operation, check as follows:

(1) The voltage at P104/4 should be 11-12V when the mode switch is pressed.
(2) The voltage at TP14 should be 5·5V ± 0·5V when the mode switched is pressed.
(3) The voltage at TP14 should remain as at (2) when the mode switch is released after tuning.

If the voltage at TP14 is incorrect or tuning drift still occurs the a.f.c. coil L171 may be incorrectly tuned. The following procedure is suggested:

(1) Desolder the a.f.c. pin of the tuner from the PCB pad.
(2) Connect a variable bias supply to the a.f.c. pin. A PP9 battery and 10kΩ potentiometer can be used.
(3) Set the bias at 5·5V with respect to chassis and tune the set to a good signal.
(4) Alter the a.f.c. bias and note the effect. The tuning should shift visibly. If not, suspect the a.f.c. varicap circuit in the tuner.
(5) Reset the bias to 5·5V.
(6) With the set correctly tuned, monitor TP14 with a meter. The reading should be 5·5V ± 0·5V. If the voltage is incorrect, retune L171 slightly to bring the voltage back to 5·5V.
(7) Disconnect the a.f.c. bias and reconnect to the PCB.

I hope the information provided in this article will be of help to engineers who come across the NWC1402 and its variants. Hopefully my telephone will cool down a bit! My thanks to Network Industries for permission to publish these service notes.

TV Fault Finding

Reports from Mick Dutton, P.A. Smith, Bob McClenning and Maurice Kerry

Rediffusion Mk. 4 Chassis

We've had several chopper transistors fail in this chassis. In every case the cause of the problem has been poor soldered joints on the chopper transformer. It's a good idea to remove the transformer, clean the legs then resolder it. **M.D.**

Philips CTX Chassis

A portable set fitted with this chassis was brought in because it was tripping. It was fairly new and we were surprised to see the rust marks on the chassis – it must have been kept in very damp conditions. To cure the tripping we had to change the tube (cracked glass), the TDA2577 sync/timebase generator/chopper control i.c., the TDA3651 field output chip and the 26V rectifier D6590.

Another of these sets had an intermittently dark picture. Flexing the PCB would produce the fault but we could find no cracks or dry-joints. After a lot of probing around we found that C2656 (0·039μF) on the earthy side of the e.h.t. circuit had never been soldered through the panel – the beam limiter line is linked to this capacitor. **M.D.**

Panasonic U3W Chassis (TC2211)

The complaint with this set was line tearing. We found that the supply lines were low which led us to check the h.t. reservoir capacitor C853 (100μF). It had gone rotten, dropping to pieces when we removed it from the panel. The h.t. smoothing capacitor C854 (47μF) also had to be replaced. These blue high-voltage capacitors used by Panasonic often seem to give trouble, causing all manner of weird effects **M.D.**

Thorn 9000 Chassis

Fuse blowing in this set was caused by a shorting chopper transformer. We've never had that one before though the sets have been around for a long time now. **M.D.**

NordMende 3602 (F8 Chassis)

This colour portable, fitted with the F8 chassis, had no luminance with red flyback lines showing. The set employs a TDA3300 colour decoder chip, which we first suspected, but the problem turned out to be due to the TDA1170 field timebase i.c.

The problem with another set fitted with this chassis was blue smearing that looked like a low-emission tube. RV43 (47kΩ) in the blue output stage had gone high in value. **M.D.**

Philips G8 Chassis

The owner of one of these sets complained of picture jitter. We were short of time so we swopped the power panel, but the owner phoned back to say that he still had a problem. The cause of the trouble was the 600μF h.t. smoothing capacitor C5536, which is mounted on the line output panel – it had gone open-circuit. A clue is given by the fact that the power supply won't set up correctly, with jitter at 200V or less and no jitter at 205V.

Another of these sets, fitted with the combined i.f./chroma panel, suffered from loss of colour. This led us a merry dance until we found that the voltage at pin 7 of IC3540 (TBA560C), the burst output, was low while the voltage at pin 5 of IC3550 (TBA540), the input to the burst detector, was high. The two pins are connected by a filter, U3008, which contains a series 220pF capacitor. It turned out that this capacitor was leaky. **M.D.**

Hitachi CPT1471

This 14in. colour set was tripping. When switched on the e.h.t. came up then the power supply shut down. On two previous occasions we've had faulty chopper chips in these sets, IC901 (STR6020), but with both these cases the power supply would shut down intermittently when warm. We changed IC901 just in case but this made no difference.

No shorts etc. could be found in the line output stage so we decided to try disconnecting the various rectifiers fed from the transformer. When we lifted D771 the set came to life. This diode provides the main 12V line so we started to disconnect the various sections of the set this feeds. When R604 was lifted the set ran with sound but no raster. At this point we took a closer look at the circuit. R604 feeds IC701 (LA7801) which contains the sync circuitry, the line oscillator and the field oscillator and driver stages. It's in two "halves" with separate supplies, 12V via R604 to pin 12 for the field circuits and a supply from the emitter of the line driver transistor to pin 15 where an internal zener diode provides the supply for the rest of the chip – the line driver transistor is fed from the main 115V h.t. rail so there's no need for a start-up supply. Replacing IC701, also the STA441C field output chip IC681, cured the problem. If the line output stage in these sets is unloaded the power supply doesn't regulate properly, so it's essential to reduce the mains input, preferably by using a variac, to prevent damage to the line output transistor whilst testing. With the sort of fault we had (field timebase) Hitachi recommend replacing the flyback switching transistor Q681 (2SC1213A) as well. **M.D.**

Zanussi 22ZT505

This was an oddball – we'd never seen one of these sets before. The complaint was intermittent no results. After a long soak test and much prodding around we found that the collector of the chopper transistor was dry-jointed, causing the set to go into standby. **M.D.**

Philips G11 Chassis

We came across an unusual fault recently on a G11 power panel. The screen symptom was a small picture and a check on the h.t. voltage at fuse F4037 revealed that this was low at 130V instead of 153V. After much scratching about we discovered that zener diode D4048 in the trigger pulse phase control circuit had decided to become a 6·1V zener instead of a 7·5V zener. Replacing this item cured the trouble – a large brandy settled my nerves. **P.A.S.**

ITT CVC1100/CVC1200 Chassis

These sets incorporate the CMR800/1 r.f./i.f. module. When the problem is low volume with distortion, before leaping to change the TDA1035T sound i.c. replace C228 (100μF, 16V) which stabilises the audio feedback. The symptom sounds like a very badly stuck speech coil. This module is used in a wide range of ITT models. **B.McC.**

Hitachi NP83CQ Mk. II Chassis

This set produced a bright, high-contrast picture and loud sound, with the sound, brightness, colour and contrast controls inoperative. A PCD8571 memory i.c. mounted on a panel (difficult to get at) under the c.r.t. stores the digital level codes for the above controls. These are fed to the SAB3037 chip on the main panel, where they are converted to analogue signals. The memory chip (IC1502) proved to be at fault. **M.K.**

Hitachi NP81CQ Chassis

An STR441 chopper chip (IC901) had been ordered by another engineer but when I fitted it the set remained dead. There was a supply of 345V at pin 1, which is connected to the collector of the chopper transistor in the i.c., but no voltage at its base (pin 4). Apart from feedback and bias components a standby switching transistor (Q901) is connected to this pin. There's a zener diode (ZD901) between the base and collector of this transistor and a check revealed that it was leaky (150Ω). The set remained dead when a replacement was fitted and it then seemed that Q901 had a base-emitter short-circuit, though it checked all right out of circuit. The apparent short was due to link J907 touching IC901's heatsink – this link goes to the base of Q901. After removing the short and switching on the set was still dead, due to R905/6 in the chopper feedback path being open-circuit. Replacing these restored normal results with a good picture. **M.K.**

Letters

MICROCOMPUTER FAULT FINDING

Now that TV engineers are being asked to take on home computers your readers may be interested in some of the more common faults I've encountered whilst servicing these beasties.

The BBC Model B has proved to be an excellent and reliable machine with only a few common faults. The keyboards on later versions tend to have one or two characters that are either over or under sensitive: contact cleaner spray seems to have little effect and the only cure is to replace the offending switch. The screen filling with rubbish after an hour or so of use is usually caused by the video ULA (IC6) which is sometimes fitted with a clip-on heatsink to relieve the problem. Later versions of this chip don't seem to suffer from this problem however – they are available from advertisers in the magazine *BBC Micro User*. Failure to load or save programs on cassette can be due to incorrect cassette recorder volume setting or failure of the LM324 chip which is located next to the cassette socket at the rear of the machine.

The early Dragon 32 microcomputer suffered from loss of colour. This can be easily corrected by adjusting a preset inside, towards the rear of the PCB. These machines are quite critical about cassette recorder volume level and care must be taken to ensure that it's correct. The Dragon's mains transformer is prone to developing shorted turns – a replacement is available from advertisers in the magazine *Dragon User*.

The Commodore VIC 20 has two recurrent faults. First blowing of the 1A l.t. fuse for no apparent reason: I replace it with an anti-surge type and have had no returns. Secondly no picture and/or no sound due to the lead from the computer to the modulator unit developing internal breaks. A Commodore 64 that came in recently had a blown l.t. fuse but it seemed that the cause was the flying earth lead on the cassette plug having come into contact with the expansion edge connector at the back of the computer. As there doesn't seem to be anywhere to fasten this I taped it to its own lead. Commodore cassette recorders give few faults and head cleaning is usually enough to get them working. I have however had cases where the head is slightly out of alignment, giving occasional data errors. With one head the attached tape guide was out of alignment with the head itself.

The Sinclair Spectrum seems to produce a blank or rubbish-filled screen in response to faults, the most common of which is failure of the ZTX450 transistor that forms part of the power supply circuit. It produces −5V from the 9V supplied to it and is mounted near a small coil on the right-hand side of the board. This coil forms part of an oscillator circuit with the transistor – a buzzing noise is heard from the coil when the oscillator is working correctly. Replace the transistor with a ZTX650 or ZTX651.

Beware of add-ons that are plugged into the back of these machines: always ask the customer to bring *all* the bits in. A poorly locating joystick controller can short out the pins on the expansion port and blow the transistor again. Check that the index locating peg is correctly positioned and not bent.

The 48K memory is built up using eight 16K chips and eight 32K chips. The 32K chips are prone to internal shorts – an oscilloscope is required to determine which chip has developed the fault.

A keyboard that doesn't respond properly may be due to the connectors linking the board and the keyboard being split. They are made of thin, flexible plastic on which tracks are laid. If the break is at the board end it's possible to cut a little off the connector and remake the end. If the connector has been creased or broken along its path a repair is possible using stiffening pieces made from cardboard and conductive paint – don't put a soldering iron near these connectors as they disintegrate.

Finally, test the whole machine – add-ons as well. It'll save a lot of hassle later.

G. Jackson,
Hyde, Cheshire.

SPECTRUM PROGRAM CORRECTION

There were a couple of errors in the Spectrum 48K colour bar program of mine you published on the letters page last month (page 241). The last number in line 130 should be 175, not 178; the last number in line 260 should be 116, not 16.

M. J. Edis, G4RPT,
Broughton, Nr. Kett, Northants.

THE PHILIPS T8E CHASSIS

A bit of a problem arose recently with a Pye monochrome portable fitted with the Philips T8E chassis. The initial fault was poor line sync. Naturally the video/a.g.c./sync chip IC607 was suspected. It's shown as a TBA690 on the circuit diagram, so a couple of these were obtained. When tried, both died instantly. It wasn't until another of these sets came in for a different video fault that a clue was obtained. This set was unmistakably fitted with a TBA890. Fitting one of these put matters right. A further check with the manual showed that a TBA890 is specified in the semiconductor list at the front and in the parts list at the back, so presumably the circuit is wrong.

The fault in the second set was an overbright picture with flyback lines and very weak contrast due to the BF422 video output transistor being leaky.

These sets are not all that simple to service – they might be worth an article in *Television*.

Laurie Watkinson, Telesonic Services,
Holsworthy, Devon.

Editor's note: Thanks for the tip! Anyone want to contribute any notes etc. on the T8E and the similar T8?

TELETEXT DECODING FAULTS

With reference to G. Beard's letter in the January issue on degraded text decoding with a Tifax XM11 module the following notes may be of assistance.

The XM11 was designed to accept more data lines when they became available, so it's more likely that Mr. Beard's fault is due to either short-term echoes (ghosting) because of an aerial problem or misadjustment of the video signal amplitude fed to the module. The make of receiver being used isn't mentioned but the three makes using the XM11 that I'm familiar with, i.e. ITT, Rank and Thorn, all have provision for adjusting the amplitude of the video input to the XM11 module (plug 2, pin 16).

Texas specify a p-p value of 2-3V. This however needs to be adjusted to compensate for differing power supply voltages and the characteristics of the video and i.f. circuits in the receiver and the module itself.

The video interface circuit usually consists of an emitter-follower. ITT suggest that adjustment is done as follows. Reduce the signal strength progressively, using an aerial attenuator, until errors start to appear in the display. Adjust the video input level to the XM11 for fewest errors, using the preset provided. Progressively increase the attenuation, adjusting the preset for fewest errors with greatest attenuation.

This will correct faulty decoding only if the aerial and the i.f. circuits are o.k. of course. The data bit rate with the teletext system is 6·9MHz, which means that a delay of only 140nsec is sufficient to cause errors. My company still has some of these decoders in the field: we've had no similar complaints from our customers.

It's also possible that the transmissions are at fault. At the time of writing the data bridge at Leeds is causing decoding problems from Leeds northwards. This sometimes results in missing rows of text, but the most annoying fault (on Ch. 4 only) is that the next page in the magazine appears instead of the one you call up, i.e. if you call up 597 you get 598. The IBA engineers are aware of the fault but because it's very intermittent a solution hasn't been found.

During regional opt out on BBC-1 from my local transmitter (Emley Moor) the clockcracker page displays errors. The engineers at Leeds say the signal leaving there is o.k. and blame the fault on local reception conditions. I've checked the clockcracker page at a number of customers' premises throughout our service area however and all show the same fault, so there must be a problem at the transmitter. There are no problems when network programmes are on.

In conclusion, Mr. Beard is not suffering from the effects of an early design – though modern decoders are much improved. My first decoder was an XM11. I now have an XM12, which has background colour, double height and four pages of memory. I think it's a lot better than the Mullard decoders. Unfortunately Texas no longer make any teletext or viewdata decoders and I'm unable to obtain circuit diagrams etc. for the XM12. Can anyone help with this information?

L.D. Sears, Chief Engineer,
Hepworth and England Ltd.,
Mirfield, W. Yorks.

Vintage TV: The Vidor CN377

Vivian Capel

To start with, Vidor was a name associated solely with batteries and torches. Then other things came along such as boiling rings and grillers, and like their rivals Ever Ready they started to produce a range of portable radio sets. It was something of a surprise when the first television sets were announced in the late forties, and some people felt that the firm might be overreaching itself. The manufacture of Vidor television sets continued until 1956 however. By that time a number of models had been released and the sets had become quite popular.

One of the first sets to appear was the CN377, a two-channel, 9in. table model that was very like a table radio receiver in appearance. There was a large, fabric-covered speaker baffle at the front left and to the right of this, where you'd expect to find the station scale, there was the screen. Four knobs were arranged along the bottom of the cabinet – contrast, volume-on/off, focus and brightness.

To further increase the resemblance to a radio set there was a wavechange switch with wafers similar to those used in the radio counterparts. It was mounted at the back of the r.f. subchassis however, and operated with a screwdriver as a preset channel selector – the two channels were London and Birmingham of course.

The Receiver Unit

Being of superhet design, the receiver unit was more advanced than its many t.r.f. contemporaries. It used what would later have been considered rather low i.f.s however – 9·75MHz vision and 6·25MHz sound. There were nine valves on this compact subchassis, seven EF42s, a couple of EB91s and the EL41 audio output valve. The first three EF42s were used as the r.f. amplifier, local oscillator and mixer. There were two vision only i.f. stages using EF42s and a single EF42 sound i.f. amplifier stage. The final EF42 was used as the video amplifier. The two EB91s acted as detectors and interference suppressors in the vision and sound channels. The use of the largish, eight-pin EF42 was an odd choice – the contemporary console Model CN370 used seven-pin EF91s in the same positions (this difference led to surprisingly few circuit or even component value changes). A sensitivity control was provided in one corner of the subchassis: it set the cathode bias applied to the r.f. amplifier valve.

Video and Sync Circuitry

The video and sync separator circuits are shown in Fig. 1 – V7 and V8 were on the main chassis. The negative-going detected video developed across the load resistor R25 was applied to the video output valve's control grid. Series and shunt peaking coils, L9 and L10 respectively, were included in the valve's anode circuit, R27/8 being the load resistors. C23 coupled the positive-going video signal to the c.r.t.'s grid – the voltage at the c.r.t.'s cathode was set by the brightness control. The coupling to V7, which acted as the sync separator, was via C22.

As so often in those early days the sync circuit was a little unusual. The video signal, with negative-going sync pulses, was fed to the cathode of the first section of the EB91 sync separator. It's anode was biased by the voltage developed across R38. This section of the valve remained cut off during the positive-going section of the video waveform, conducting when a negative-going sync pulse appeared at its cathode. The pulse output was d.c. restored by the second section of the EB91 and applied to the control grid of V8, which acted as a sync pulse amplifier. Note that the d.c. restoration action also affected the c.r.t. drive, via R31. The line sync pulses developed across R36 were differentiated by C28 and R39 and fed to the line oscillator. The field sync pulses were integrated by R34 and C26 and coupled to the field

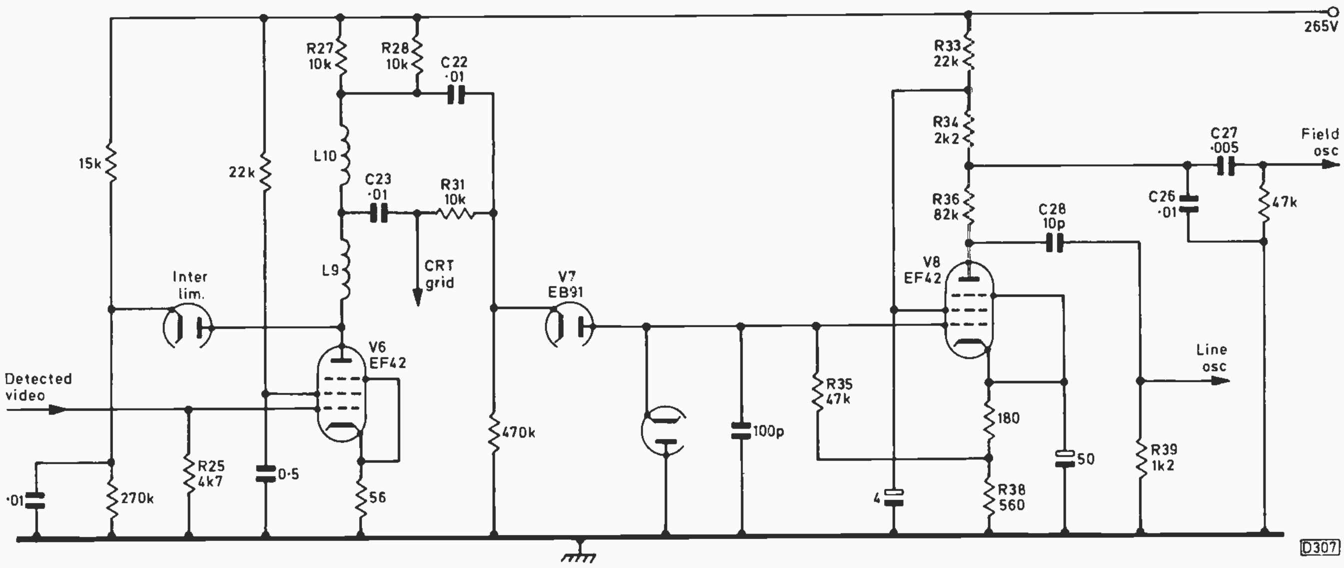


Fig. 1: The video amplifier and sync separator circuits used in the Vidor CN377.

oscillator by C27. In the absence of a sync pulse input V8 was conductive since its control grid and cathode were linked via R35.

Timebase Circuits

Thus positive-going sync pulses were developed at the anode of V8. These were applied to the control grids of the T41 gas-filled triodes (thyratrons) used in the line and field oscillator circuits. While it was quite common to use a thyratron as the field oscillator it was not so common to used one as the line oscillator – a hard-valve oscillator was generally preferred here. The use of the same type of valve in each timebase is an advantage from the servicing point of view however, since the valves can be swapped over to provide a quick check. Thyratrons tend to be temperamental, and it could well be that one is more effective at line than field frequency or vice versa.

The two timebase oscillator and output stages were very similar, and it was easy to get them mixed up from a brief glance at the circuit. Even the two sets of deflection coils were both series connected. An EL33 was used in the field output stage and an EL38 in the line output stage – easily distinguishable by its top cap connection. Both output stages used transformer coupling – in the otherwise similar CN370 *RC* coupling was used in the field output stage.

The main presets were situated at the rear of the main chassis and consisted of four linear sliders with locking control knobs. From the top to bottom they were field hold, line hold, height and width. The last two functioned by varying the h.t. applied to the appropriate output valve. They were in the cathode rather than the anode circuits: since the control grids were returned to the positive ends of these controls they did not affect the bias applied to the valves.

Each timebase also incorporated a linearity control. These were mounted on the main chassis alongside the respective output valves – they were screwdriver operated rotary presets. The field linearity control was part of an *RC* network in the output valve's control grid circuit: as it varied the amplitude of the waveform it also affected the height. The line linearity control was part of an *RC* damping network across the line scan coils: it controlled the left-hand part of the screen. The line output valve was operated as a class A amplifier, the damping network being used to remove the post-flyback overshoot.

The Power Supply

Perhaps the most significant feature of this receiver was the transformer power supply, complete with mains-derived e.h.t. – never a very popular feature with service engineers! A 6·4V winding on the transformer supplied the parallel connected valve heaters, a separate 4V winding being used for the thyratrons. A third heater winding was used for the h.t. rectifier, a GZ32 in a full-wave circuit. This produced 360V across its 16μF reservoir capacitor. There was choke smoothing with the choke tuned to a minimum frequency of 100Hz by a parallel capacitor combination (0·2μF plus 0·5μF in parallel). The focus coil also formed part of the smoothing circuit. Further *RC* smoothing was incorporated in the feeds to the anode of the field output valve and to the receiver subchassis.

An HVR2 rectifier produced some 5kV across its 0·1μF reservoir capacitor. A point to note here is that the earthy end of the e.h.t. winding on the mains transformer was connected to chassis via a 270kΩ resistor. If this went open-circuit it could be wrongly assumed that the winding itself was open-circuit – if a check was made from the hot end to chassis.

Switch-off Spot Suppression

A form of switch-off spot suppression was incorporated: a switch opened to add a 10MΩ resistor in the c.r.t.'s cathode circuit to ensure that the cathode bias didn't fall too rapidly.

The CN390 Series

The following CN390 series was similar in many respects but in some ways moved to what was to become standard practice – it used cathode c.r.t. drive and a conventional pentode sync separator for example. The EL38 line output valve was used in a self-oscillating arrangement, with feedback to its control grid from the line output transformer's secondary winding: an overwinding and an EY51 rectifier produced the e.h.t.

Long-distance Television

Roger Bunney

From the DX-TV viewpoint a major event during the past year was the end of 405-line transmissions in Band I. It left the band wide open for DXing, clear of local TV signals. The problem of the 49MHz cordless phone continued, though the situation has become no worse now that legal 47MHz versions are available – the kiddies' 49MHz walkie-talkies seem to have disappeared from the market stalls. We have still to see what the effects of the amateur 50-50·5MHz allocation will be: ch. R1 vision will suffer to some extent, and the use of horizontal polarisation by amateurs won't help. For over two decades now I've advocated reduced i.f. bandwidth operation for DX reception. This does help to reduce interference and improve weak signal performance. Those who use the full i.f. bandwidth will suffer most from interference problems – perhaps this is the time to consider adding an in-board i.f. preamplifier with integral i.f. notch tuning by means of a simple varicap system. Interference from microcomputers has declined now that interest in them has fallen and types with improved suppression have been introduced – at one time in my town centre location three Spectrums and an upmarket word processor were producing visible interference in Band I! It's unlikely that we shall see any official PMR activity in Band I during 1986.

Looking forward to the prospects for 1986, since we are in the early stages of sunspot cycle 22 there's no chance of enhanced F2 or early evening transequatorial skip reception – we shall have to wait another two-three years for these rather more exciting Band I signals. I'm hoping for a good year for Sporadic E reception, perhaps slightly better than 1985 when we all received signals from the Middle East. Pirate TV activity at u.h.f. is likely to be minimal and confined to the London area – transmissions on ch. E36 were expected over Christmas, from the Crystal Palace area, but there have been no reports of reception. Look out for the first independent French TV stations from February onwards, and the Munich "TV Weiss Blau" station on ch. E59 from around May/June.

December 1985 was a quiet month. There was a sudden tropospheric opening on the 15/16th, giving really strong W. German Band III and RTL ch. E7 reception across the south east and south, spreading as far as Cornwall, with noise-free reception until close downs. Meteor scatter/shower reception was disappointing. The Ursids just before Christmas gave only a small lift to the residual pings and the quadrantids similarly had little effect – the peak for the latter was at midnight on January 4th when most European TV stations were off air. The mornings during this period, traditionally a good time to watch, proved disappointing.

The minimal SpE signal log is as follows:

13/12/85	TVP (Poland) chs. R1, 2 from 2100 onwards.
14/12/85	+PTT (Switzerland) E2; ORF (Austria) E2a from 1500 onwards.
15/12/85	NRK (Norway) E2, 3 from 2140 onwards.
21/12/85	TSS (USSR) R1-5 (ch. R5 heard on scanner only); ARD (W. Germany) E3; MTV (Hungary) R1; NRK E2, 3 from 1200 onwards.
25/12/85	RUV (Iceland) E3 (at midnight).
26/12/85	SR (Sweden) E2; TVP R1; ARD E2; TVE (Spain) E2 from 0730-0930.
1/1/86	TVE E3 at 0830.

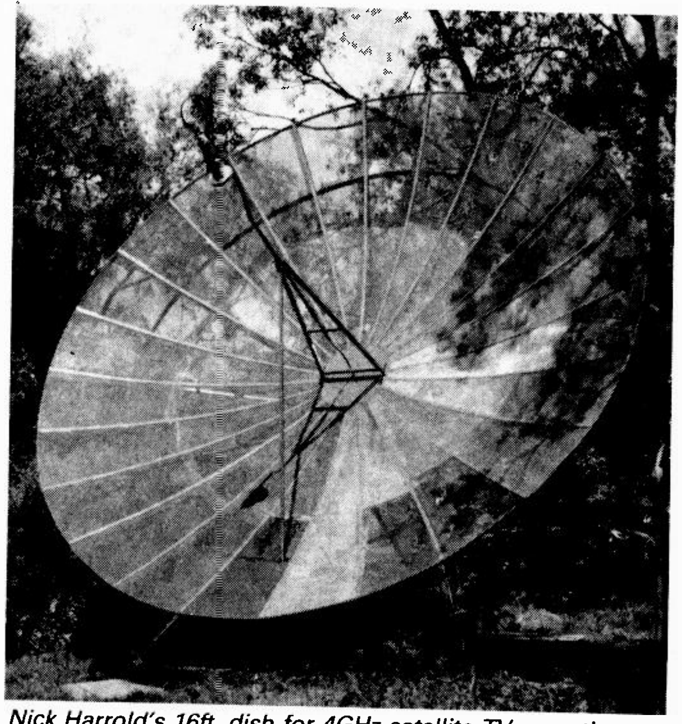
As usual then there was the characteristic mid-December opening. A thin month – my thanks to Iain Menzies (Aberdeen), Simon Hamer (Powys) and Reg Roper (Torpoint) for supplementing my meagre loggings.

The 50MHz Amateur Band

As mentioned in Teletopics last month (page 223) the band 50-50·5MHz has been allocated to class A licensed radio operators from February 1st, running in any transmission mode but limited to e.r.p.s of 14dBW carrier and 20dBW peak envelope power (for SSB). The transmitting aerial should not be more than 20m above the local terrain and must be horizontally polarised. No repeaters will be allowed. The situation will be reviewed after a year with a view to allowing class B operators use of the band. All precautions must be taken to avoid interference to Band I broadcasters elsewhere in Europe – should interference prove to be troublesome the allocation will be cancelled. There's every possibility of extending the band at a later date if no problems arise.

Another Threat to Band I

A recently received leaflet illustrating a new portable radiophone system being marketed under the Bohsei brand name, available through a telephone retailer in Brentford (though the leaflet is marked "export only"), represents another threat to Band I. The base station transmits in the 48·9-50·99MHz spectrum, using f.m. at 10W (into 50Ω). The portable unit, housed in a black brief case, features a push-button telephone, cassette recorder and transmitter/receiver system: it transmits in the 146-152MHz spectrum, at 10W. Both units are crystal controlled with a claimed range, subject to local terrain,



Nick Harrold's 16ft. dish for 4GHz satellite TV reception.

of 18-25 miles. The base and mobile unit can both be operated with a type 50/70 linear amplifier which provides up to 70W output with 10W input: ranges of up to 75 miles are claimed. The 48MHz output could be a problem for DX-TV enthusiasts but perhaps of more concern is the mobile 146-152MHz coverage since this is allocated to police communications following Band II re-engineering. The information has been passed to the appropriate authorities and hopefully problems will not arise.

From our Correspondents . . .

Hugh Cocks, formerlly resident in East Sussex, has moved to the Algarve, Portugal where he's busy producing and installing TVRO equipment for the 11GHz band. The Eutelsat and Intelsat signals there are some 6dB down on UK levels – 2·8m dishes are used to compensate for this. He comments that Moroccan Band III TV stations are well received during the evenings.

Nick Harrold has sent us a photograph of his home-made 16ft. diameter dish. It's fitted to a polar mount and is used in conjunction with a 110°K LNA and a Sat-Tec 5000 receiver unit. Sparkle-free reception across the 4GHz band is obtained down to 26dBW on half transponder signals.

Terrestrial Interference Shield

Continental Satellite Systems, a US company, has introduced what it calls a terrestrial interference shield for fitting to dishes of its own manufacture. The shield consists of a sectional lip that fits to the rim of the dish. So far as terrestrial interference is concerned it reduces the focal length to 0·3 – the focal length for satellite signals remains at 0·36. This changed focal length reduces terrestrial interference by up to 12dB.

A Decade of Satellite TV

Satellite TV reception in 1986 usually means signals at around 11GHz – and for a few the lower 3·675-4·2GHz international telecommunications band. Yet ten years ago in 1975/6 a few enthusiasts were having their first experience of the joys and frustrations of satellite TV – at u.h.f.! These were the pre-Ekran (714MHz) days as well.

NASA launched ATS-1 in 1966. It was the first in a series of "application technology satellites" that featured on-board experiments covering solar measurement, telecommunications/propagation and other diverse packages. Of interest to TV enthusiasts was the sixth in the series (ATS-6) since this carried a high-power TV transmitter with f.m. video, the purpose being to establish the feasibility of low-cost receiving terminals and obtain general technical data. If you recall the beam was directed at India, whose government wanted to know whether a satellite broadcasting system for general entertainment and instructional programmes was a practical proposition. The craft had a thirty food parabolic aerial with ribs supporting a mesh, giving an f/d of 0·44. The equipment for uplink reception and downlink transmission was housed in a 54in. cube. The experiment was called SITE (satellite instructional television experiment) and was to last a full year from August 1975 to July 1976. The satellite was initially at 94°W where it carried out various communications experiments for a year. Moving it to 35°E for the SITE experiment took nearly three months. It arrived in the new orbital position in early July 1975. The TV uplink from Delhi or Ahmedabad was at 5·950GHz

with the downlinks at 860MHz and 3·750GHz, using a 30MHz bandwidth. The Indian government installed some 2,500 direct receiving terminals and 2,700 receivers adjacent to existing v.h.f. transmitters for rebroadcast throughout the country. The broad objectives of the experiment were successful in establishing that transmission of wideband f.m. signals from a satellite at u.h.f. worked well. On the ground there were certain problems – where terminals were installed in remote areas without mains electricity for example. The experiment came to an end when the satellite was moved to 105°W for further research purposes.

Details were given in this column up to two years before the start of the SITE experiment. It was generally felt in UK DX circles that there was little chance of receiving the signals in the UK. How wrong we were! On Christmas Eve 1975 I received a Christmas card from Steve Birkill in Barnsley enclosing some dramatic shots of Indian TV which he'd received using a five foot dish, a head amplifier feeding a conventional u.h.f. tuner and an f.m. video demodulator. This started a flurry of activity. Various dishes were constructed from chicken wire, using a dipole/reflector arrangement at the focal point, with domestic preamplifiers. Before long reports of reception began to trickle in – some enthusiasts were using standard TV sets with slope detection of the f.m. signals. Perhaps the excitement was that it could be done, with poor to fair results, using normal DX-TV equipment with the addition of a simple dish. The cost was minimal and signals were received daily.

Professional broadcasters took an interest, including RTE, TDF, IBA (Israel) and RAI, but it was the

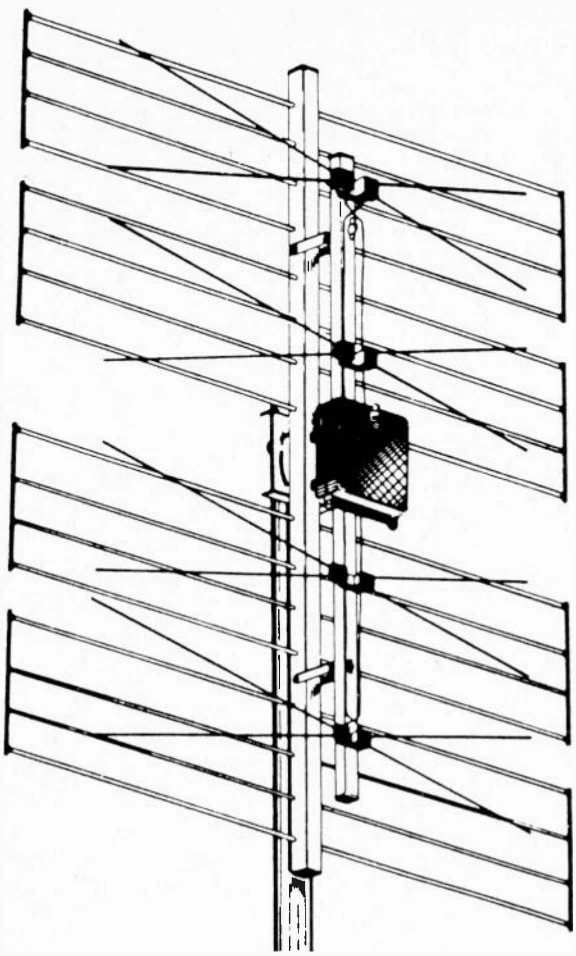


Fig. 1: The Jaybeam Model JBB/4 stacked bowtie array.

amateurs who proved that it was possible – Steve Birkill, Ian Beckett, Hugh Cocks, Clive Athowe, Reg Roper, Peter Jaansen, myself and a few others. All that was ten years ago and since then satellite TV for Europe has moved to 11GHz. This is much more demanding and amateur interest seems to have declined, presumably due to the cost and complexity. Where, I wonder, will we be ten years from now?

Bowtie UHF Aerials

The new Jaybeam "Aluminium Billboard" wideband u.h.f. bowtie array, Model JBB/4, was briefly mentioned in this column last month. This type of array has been popular for DX use for some years now because of its wide bandwidth, relatively level gain across the band (compared to a Yagi type array), minimal wind resistance and visual impact and the fact that it's relatively inexpensive. Such arrays are available from several manufacturers including Jaybeam, Triax, Wolsey, Fuba, Hirschmann and Wisi – some of these manufacturers supply other firms who market the aerials under their own names. Wolsey also have a two-bay version (the Colour Prince) which is mainly sold as a caravan aerial. Stacked colinear and broadside are other names for the stacked bowtie system. The Jaybeam JBB/4 is 80 cm high, 60cm wide and weighs 1·5kg. It has easy adjustment for vertical or horizontal polarisation.

There's some confusion about the performance of this type of array, particularly with respect to gain. The gain figures quoted by Wolsey for their Colour King are some 2dB or more up on a standard array, though no reference standard is given. Aerial gain is normally in dB relative to a half-wave dipole (dBd). It's known for manufacturers to quote dBi figures (dB power gain with reference to an isotropic source) which add another 2·1dB with respect to the half-wave dipole standard. Wolsey quote neither dBd nor dBi. For the record we quote the following figures for the Hirschmann Fesa 805 Alu array:

Channels	21-31	32-41	42-50	51-60	61-68
Gain (dBd)	10dB	11dB	12dB	13dB	12dB
Front-back ratio	20dB	22dB	22dB	23dB	20dB
Horizontal beamwidth	50°	47°	42°	39°	37°
Vertical beamwidth	40°	35°	31°	29°	28°

The beamwidths are at the −3dB (half power) points. The vertical beamwidths are smaller because of the phase cancellation produced by stacking the dipoles side by side.

Early versions of this type of array used solid aluminium bowties. It was subsequently found that an equivalent bandwidth product could still be obtained after cutting away the central part of the bowtie to leave a skeleton outline – stiff rods normally subtending an angle of 30°. The four-bay, full-wave dipoles are stacked with half-wave spacing between each bay, the spacing between the dipoles and the rear reflector screens normally being between 0·15 and 0·2 wave – at mid-band. To ensure in-phase coupling of the bays and a predictable main lobe the feed lines between the outer and inner dipoles are reversed. The reflector screens are usually at least 0·25 wave greater than the bowties all round to give a good front-back ratio figure: some imported versions have the reflector screens bent round at the edges for optimum front-back performance.

The full-wave stacked bowtie system is coupled with balanced line and the nominal output impedance at the centre point is 300Ω (the dipole stack/reflector screen spacing is set to give the desired impedance). Where balanced ribbon feeder is used the downlead connection is at this point. Where coaxial downleads are used – in the UK for example – a balun is used at the centre point to get correct wideband matching to the feeder. Imported W. German/Dutch arrays are normally supplied with details for either type of connection.

A stacked bowtie array works well for DX/weak signal use, the wide vertical capture area producing an even response from a transmitter over its four channels. Aerial riggers often find that a Yagi array at a difficult location gives two good channels, one not so good and the fourth awful: moving the Yagi shuffles the combination about but you inevitably end up with unequal signal levels. The bowtie array will often overcome this problem. The relatively wide forward beamwidth with horizontal polarisation is a problem for DX use, but stacking two arrays in close proximity, coupled using a wideband coupler such as the Triax stripline 720/U, will substantially reduce the beamwidth and increase the power gain by almost 3dB.

I've used twin Triax grids for some two years at my location, which is pretty poor for reception, and have found that the results are good compared to those achieved with a multi-director Yagi array. The Triax grids work well down to the ATV 435MHz band and have even given useful reception at 1,300MHz (ATV again), the arrays still maintaining their directional characteristics!

My thanks to Jaybeam and Hirschmann for information provided. For further reading I suggest the *ARRL Antenna Book* and the aerial section of the RSGB's *VHF/UHF Manual.*

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.

SONY KV2062UB

There's bowing at the sides with bent verticals. Adjusting the pincushion amplitude control won't correct the problem without bending at the top and bottom edges. The set seems to have had the fault from new.

If the set is an early one (serial number below 561100) try replacing R808 with a series combination consisting of a 1·8kΩ fixed resistor and a 3·3kΩ preset. If adjustment of this preset doesn't improve the situation it's likely that T802 has insufficient inductance. Replace it (part no. 1-421-610-00).

NATIONAL TC261G

This set gives a very snowy picture at switch on. If the aerial plug is disconnected then replaced the picture usually returns to normal and stays all right until the set is switched off and on or there's a break in the transmission. We've tried replacing the aerial socket, also the three i.f. amplifier transistors.

The problem could well be due to a fault in the a.g.c. circuit. Try putting a fixed potential of 5V on the tuner's a.g.c. pin, i.e. across C1003. If normal operation is obtained, check the AN331 "jungle" i.c. (IC301) and R102 (68kΩ) in the i.f. a.g.c. feed network. If the fault persists the tuner itself is suspect.

GEC HYBRID CTV

This set still has a good tube and I'd like to use it with a VHS VCR. The trouble is jitter on playback and occasional loss of line hold on picture search. Are there any recommended modifications to this chassis for VCR use?

Normally these sets don't require any modification for VCR use. We suggest you check the flywheel line sync filter capacitor C505 (0·01μF), the discriminator block D500 (FSY41A) and C69 (150μF) which smooths the HT3 line used by the sync separator transistor, then if necessary try reducing the values of the anti-hunt components R508 (33kΩ) and C506 (0·1μF) by up to fifty per cent. Ensure that any such modification doesn't impair normal off-air reception. It may be worth checking with another VCR to ensure that the one being used is not faulty or in need of a service.

RANK T22 CHASSIS

After replacing the line output transformer and line generator chip and carrying out repairs to the scan board this set is now running nicely except for no colour. The three decoder chips have been replaced and shorting test points TP9/10 to override the colour killer produces unlocked, horizontal colour bars.

The fact that unlocked, floating colour bars are produced when the colour killer is overridden indicates that the reference oscillator is way off lock. This will give the no-colour symptom. Try replacing the 8·8MHz crystal X1 then if necessary check the trimmer VC1.

ITT FT110

The problem with this set is jitter that affects the top of the picture more than the bottom. It's intermittent in that the fault is not present every time the set is used. Switching off and on again sometimes clears the fault.

This could be a nasty one, involving tedious component substitution checks. Start with C719 (100μF) which smooths the supply to the line oscillator, then check the following items in the flywheel line sync circuit: diodes D701/2, C714 (0·47μF electrolytic) and R713/4 (both 2·7MΩ). If necessary check the sync separator and line oscillator bias resistors R702 (3·3MΩ) and R721 (1MΩ) respectively, also for smooth operation of the line hold and horizontal shift potentiometers.

GRUNDIG 8635GB

This set works all right on BBC-1 but the other channels appear to be unstable, with line jitter: there's also very unstable video from a VCR. The contrast seems to be low on the poor channels – I suspect the i.f. amplifier chip. The aerial installation has been checked.

This sort of thing is very often due to an a.g.c. fault. It would be as well to check the a.g.c. smoothing/decoupling capacitors before replacing the chip – indeed replacing all the electrolytics in this area should help.

FINLUX PEACOCK 67990

There's colour only when the tuning is right at one end of the channel, i.e. almost off tune. The colour then obtained is locked and steady but rather weak.

The a.c.c. control range is not very great with this model. It can be improved by interchanging R03 (1·2kΩ) in the chrominance module with R01 (12kΩ) in the colour sync module. Set the a.f.c. by carefully adjusting L1 on the a.f.c. module for correct tuning: leave the tuning door shut when you do this.

ITT VC300 CHASSIS

The problem is field collapse. T12 (BC140/10) in the field output stage was found to be open-circuit but a replacement has failed to cure the fault. The other transistors in the amplifier/driver/output stages have also been tried. The voltages are only slightly different from those quoted in the manual and there are no obvious faults such as print breaks or dry-joints. The flyback diode and the electrolytics in the output stage have also been checked.

QUERY COUPON

Available until 19th March 1986. One coupon, plus a £1·50 (inc. VAT) cheque or postal order, must accompany EACH PROBLEM sent in accordance with the notice above.

TELEVISION MARCH 1986

It's difficult to fault find in this d.c. coupled circuit without a scope. Use of a scope to check the waveforms would quickly indicate whether the failure is in the oscillator or amplifier sections of the timebase. As you've checked the most likely culprits in the amplifier/output section it could well be that the oscillator is at fault. If the two transistors here (T6/7) are o.k. check the components in the timing circuit, R77 (100kΩ) and C65 ($0{\cdot}33\mu F$) – these have been known to stop the oscillator.

TEST CASE

279

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.

For several years now most GEC sets have been fitted with Hitachi chassis. The reliability of these chassis is excellent – none more so than the NP8CQ, which was the subject of a servicing article in our June 1985 issue. It's rare to find one of these in the workshop, rarer still to have to struggle with it!

The set we had was in fact an Expert Model C2261H, which is basically the GEC C2255H. The symptoms were complete lack of sound and vision: there was no e.h.t. and the tube's heaters were not lighting up – their supply comes from the line output transformer. Since it was a Saturday morning and the workshop radio was tuned to one of those "remember the sixties" pop programmes your scribe's mind went back to the TV sets he used to repair in the days of the Beatles and the Rolling Stones. No i.c.s, no choppers – and no faults like this one! Lashing Radiospares' dropper sections into pre-BEAB sets, diagnosing open-circuit heaters with a flick of the neon screwdriver, cleaning system switches – no-go sets were easy to sort out then. But we digress.

The e.h.t. could be heard to rustle up at switch on, and some minutes were lost in finding out that the e.h.t. voltage appeared fleetingly at switch on then disappeared, as did the 108V h.t. supply from the chopper circuit. Some sort of power supply problem then.

Investigation of the power supply revealed that there was virtually no voltage on the 108V and 54V lines while a low-pitched squeal was coming from the chopper transformer (T901). An oscilloscope check at the collector of the chopper transistor (Q901) produced a display of very narrow needle pulses at a low repetition rate. Knowing that the thick-film module CP901 (HM9102) which supplies the error amplifier with reference and feedback voltages can misbehave we fitted a replacement. This didn't have the slightest effect. Cold ohmmeter checks were carried out on the error amplifier (Q902) and driver (Q903) transistors in circuit. There were no obvious shorts or open-circuits. Each time the set was switched off however the squeal would continue for a second or two after which there would be a brief burst of energy, with a clear line whistle and the momentary appearance of the e.h.t. and first anode voltages, and presumably scanning energy as well.

If every stage in the set seemed to be capable of working, even if only for a second or two at switch on and switch off, there was little point in looking for the sort of excessive-loading faults one might otherwise have suspected. Instead we hooked up a variac and slowly wound up the mains input to the set. This was much more rewarding! At about 32 per cent of the mains supply the set would perk up and produce about 80V across the h.t. reservoir capacitor C909 on the output side of the chopper transformer. When the tube's heaters had had time to warm up a raster of sorts could be seen, with blurred snow. As the variac was wound up to give 40 per cent of the mains input the raster filled out and a good, locked picture could be tuned in. Further increments of the variac pushed the 108V h.t. line beyond its normal voltage, and at around 120V the set shut down, reverting to the low-pitched squeal condition previously described.

The experiment was repeated with a voltmeter connected to the collector of the error amplifier transistor. This showed that the voltage here rose dramatically as the 108V h.t. line reached and then passed its correct level. At this point the diagnosis was almost complete. What more was required? See next month.

SOLUTION TO TEST CASE 278
– page 260 last month –

Last month's test case was not quite the horror it sounded – in fact it was quite a simple one, the answer being summed up in the last few sentences of the story. You'll recall that the set, a Decca receiver fitted with the 70 series chassis, had an intermittent fault: the supply lines would rise in voltage during the second or two before the chopper transistor blew up.

The main possibility in a circuit of this type, with separate secondary windings on the chopper transformer feeding half-wave rectifiers, is a chopper drive waveform whose duty cycle is incorrect. This implies that the control i.c. is failing to give the required regulating action. In addition the over-voltage facility was inoperative, and the only discrete component likely to have been responsible for this (the voltage sensing zener diode) had been eliminated from the search. Both these factors pointed the finger of suspicion at the TDA2581 chip. And so it was: fitting a replacement restored correct operation on a permanent (we hope!) basis.

We had a similar situation with a Ferguson Model 37340 (TX10 chassis). In this case the chip is a TDA2582 which is presumably a later version: it was blowing chopper transistors as quickly as they could be fitted.

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 Riverside Press Ltd., Thanet Way, Whitstable, Kent. Distributed by IPC Magazines Ltd., Lavington House, 25 Lavington Street, London SE1 0PF. Sole Agents for Australia and New Zealand – Gordon and Gotch (A/sia) Ltd.; South Africa – Central News Agency Ltd. Subscriptions: Inland £13, overseas (surface mail) £15 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.

HITACHI VHS COLOUR CAMERAS

Mains Only Tested/ Working

VHS VIDEOS

FERGUSON

3V00, 3V22, 3V23, 3V16, 3V29, 3V30, 3V31, 3V32, 3V35

NATIONAL PANASONIC

NV8600, 8610, 2000, 7000, 370, 333, 2010

SHARP

620, 630, 640, 2300 H T/P

BETAMAX

SANYO VTC 9300, 5000, 5300

SONY C5, C6, C7, C9 and SL F1UB T/P

Also Bush, Toshiba, Hitachi and Blau Punkt

PLUS

17" 18" 20" 22" 26" Hybrid/ Solid State CTVs Remote Control & Teletext

Discount for Quantities

Complete loads delivered from pick up point

JOHN CARTER (Electrical) LTD

FURNACE ROAD, GALLOWS INN, ILKESTON

Phone: 0602 303124

★★ CHANGE OF ADDRESS ★★

ALL ORDERS SHOULD NOW BE SENT TO OUR NEW ADDRESS SHOWN BELOW

TOP 50 VIDEO SPARES

CASSETTE LAMP (FERG/JVC)	£1.80	PINCH ROLLER (SANYO)	£7.95
CASSETTE LAMP (PANASONIC)	£1.80	PINCH ROLLER (SONY C5/C7)	£5.95
CASSETTE LAMP (SHARP, 9300 ETC)	£2.15	VIDEO HEAD DRUM (FERG)	£37.50
BELT KIT SONY (STATE MODEL)	£6.50	VIDEO HEAD DRUM (PANASONIC)	£39.50
BELT KIT FERGUSON (STATE MODEL)	£6.50	VIDEO HEAD DRUM (PAN NV366)	£56.95
BELT KIT SHARP (STATE MODEL)	£6.50	VIDEO HEAD DRUM (HITACHI)	£39.95
BELT KIT PANASONIC (STATE MODEL)	£6.50	VIDEO HEAD DISC (SONY C5/C6/C7)	£39.50
BELT KIT SANYO (9300, 5300, 5400)	£6.50	VIDEO HEAD DISC (SONY SL8000)	£44.50
BELT KIT SANYO (5000)	£1.99	VIDEO HEAD DISC (SANYO)	£49.90
BELT KIT HITACHI (STATE MODEL)	£6.50	VIDEO HEAD (SHARP 7300, 7700)	£51.58
REWIND KIT SONY C5/C7	£6.95	VIDEO HEAD (SHARP 9300, 381 ETC)	£49.90
REWIND KIT SONY C6	£6.95	VIDEO HEAD (TOSHIBA 9600)	£49.95
REEL IDLER (SHARP, 9300, 381, ETC)	£3.90	VIDEO HEAD (TOSHIBA 8600)	£54.60
FF/REW IDLER (HITACHI VT-11, ETC)	£6.50	REEL DRIVE PULLEY (SANYO 5000)	£8.88
FF/REW IDLER (HITACHI VT8000)	£4.72	REEL MOTOR (SANYO 5000 ETC)	£14.20
FF/REW IDLER (HITACHI VT9300)	£4.75	REEL MOTOR (SHARP 9300, 381, ETC)	£15.30
REEL IDLER (FERG, 3V29/30)	£3.45	CAPSTAN MOTOR (SONY C5/C7)	£39.85
PLAY IDLER (HITACHI 9300)	£6.50	A.C.E. HEAD (SONY C5/C7)	£26.45
FF/REW IDLER (NAT/PAN NV370)	£4.50	CAPSTAN MOTOR FERG/JVC 3V22 ETC	£36.45
REEL IDLER (NAT/PAN) STATE MODEL	£3.45	DRUM MOTOR FERG/JVC 3V22 ETC)	£36.60
PLAY IDLER (NAT/PAN) STATE MODEL	£4.72	TAKE-UP CLUTCH (FERG/JVC)	£6.95
PLAY CLUTCH (PAN NV7000)	£5.50	CLUTCH ASSY (FERG 3V29/30)	£4.50
PINCH ROLLER (FERG)	£5.95	AUDIO RELAY (SONY C5/C7)	£3.95
PINCH ROLLER (SHARP)	£7.90	HEAD CLEANING STICKS	£0.50
PINCH ROLLER (PANASONIC)	£5.95	HEAD CLEANING FLUID	£1.50

MOST SPARES AVAILABLE FOR HITACHI, PANASONIC, SONY, SANYO, SHARP ETC. RING FOR AVAILABILITY.

TELEVIDEO SERVICES

NOTTINGHAM (0602) 226070

145 STATION RD, BEESTON, NOTTINGHAM.

Please add 50p post & packing and then add 15% VAT to the total.

ALL STOCK ITEMS ARE DESPATCHED BY RETURN OF POST

Send 17p stamp for full list

BOLTEN LTD

45/46 London House, 271, King Street, London W6 9LZ

Tel: 01-748 4137 (2 lines)

Telex: 262421 BOLTEN G

Video Heads

Ferguson/JVC (Universal)	£29.50
National Panasonic (Universal)	£29.50
Sony C5/C7/T7	£29.50
Toshiba 5470	£29.50
National Panasonic 370/380	£32.95
Hitachi	£32.95
Sanyo	£44.95
Belt Kits (Most Models)	£3.99
Pinch Wheels (Various Models)	£5.95
Remote Controls	
Grundig/Philips)	£16.95
Video Cable Kit	
(any model to any model)	£7.50
Cutters/Minipliers/Snipper/Microshear/ Wire strippers	£4.95
Solder Pumps Midsize	£4.95
Solder Pumps Large	£5.95

Please add 15% VAT plus £2.00 p&p per order.

Delivery within 7 days.

MAIL ORDER ADVERTISING

British Code of Advertising Practice
Advertisements in this publication are required to conform to the British Code of Advertising Practice. In respect of mail order advertisements where money is paid in advance, the code requires advertisers to fulfil orders within 28 days, unless a longer delivery period is stated. Where goods are returned undamaged within seven days, the purchaser's money must be refunded. Please retain proof of postage/despatch as this may be needed.

Mail Order Protection Scheme
If you order goods from Mail Order advertisements in this magazine and pay by post in advance of delivery, Television will consider you for compensation if the Advertiser should become insolvent or bankrupt provided:
(1) You have not received the goods or had your money returned; and
(2) You write to the Publisher of Television summarising the situation not earlier than 28 days from the day you sent your order and not later than two months from that day.

Please do not wait until the last moment to inform us. When you write, we will tell you how to make your claim and what evidence of payment is required.

We guarantee to meet claims from readers made in accordance with the above procedure as soon as possible after the Advertiser has been declared bankrupt or insolvent.

This guarantee covers only advance payment sent in direct response to an advertisement in this magazine not for example, payment made in response to catalogues etc., received as a result of answering such advertisements. Classified advertisements are excluded.

SETS & COMPONENTS

OCHREMILL TECHNICAL the GRUNDIG SPARES PEOPLE. Fast helpful service, thousands genuine items stocked, sensible prices, also manuals. TELEQUIPMENT Oscilloscopes, assorted test gear. 0785 814643.

THORN, GEC, DECCA's stripped for spares. Panels, Tuners from £2.50. Phone for prices: WELLINGTONS, Dartford 0322 337212.

HITACHI, MITSUBISHI, Panasonic, Sony, Toshiba, JVC, Sharp, fully refurbished. PEARSON TELEVISION, 0484 863489. Delivery arranged.

TURN YOUR SURPLUS capacitors, transistors, etc., into cash. Contact COLES-HARDING & CO, 103 South Brink, Wisbech, Cambs. 0945 584188. Immediate settlement.

---

15 UNUSED RE-GUNNED Delta colour tubes plus two Sony tubes for sale together at £385 inc. Also some tested ex-equipment Delta and Mono tubes available separately. Tel. Watford 45590.

PHILIPS G11 AND BUSH T20 regular supplies. For prices phone 01-845-2036.

TUBES

£29.00 INCLUSIVE, REGUNS TWO YEAR GUARANTEE, QUANTITY DISCOUNTS SIX
£14.50 MONTH GUARANTEE SLIGHTLY USED

A56-120 A56-140 A51-110 A49-191 A47-342 or 343 A44-270-1 A66-120 A66-140 (410) A67-120
(All 26" add £5)
No need to spend £5 returning old delta tube.
Slightly used in-line tubes from £29.
Six months guarantee.

IN-LINE 1 YEAR GUARANTEE

51-575, 51-580, 51-590, 51-001AXT, 510JKB, 56-611, 56-615, 56-001AXT, 51-161, 51-510, 51-570, 56-500 — **£45** inclusive

56-540, 66-540, 66-500 — **£55** inclusive

PORTABLE TV TUBES From £45
370 – KRB – LHB – HGB – HFB – JRB – HUB – EGB – EFB – BCB – MEB – GUB – GYB – AXT 37-001, AXM 37-001, 37-565, 420 EDB, 42-001, 42-590

SONY £66 (Cash & Carry only)

HITACHI
490DKB22 **£34**
560DZB22 **£49**

PROFESSIONAL STICK
DE-GAUSSING COILS
£19.50 (1 YEAR GUARANTEE)

Philips G11 AND DECCA 100
Panels from **£10.00**. Breaking for spares, Push button units, Tube bases. All good working order.

RADIO and TELEVISION SERVICING BOOKS
(MacDonalds). New 74/75 **£15**; 75/76, 76/77, 77/78, 78/79, 79/80, 80/81, 84/85, 82/83, 83/84 **£22.50**.

FREE DELIVERY
Except Tubes £5 each. All prices are inclusive

U-VIEW
29, Warmsworth Road, Doncaster, Yorkshire DN4 0RP. Tel: 0302 855017.
Callers ring first, open every day including Sunday
½ a mile from A1

VIDEO & HI-FI ELECTRONICS
379 EDGWARE ROAD
LONDON W2
TEL. 01-258 0328

ALL VHS PARTS AVAILABLE. EXAMPLES:

VIDEO HEADS

JVC, Ferguson, Akai, Saba, Telefunken	£35.00
Sony (Betamax)	£45.00
National Panasonic	£45.00
All Hitachi heads from	£42.00

INTEGRATED CIRCUITS

UPC 1365C	£6.30
UPD 553C	£10.20
UPD 552C	£9.56
HA 11711	£10.50

All makes of idlers, pressure rollers, clutch assembly and motors in stock.
Many other parts available. Send SAE for list.
ALL PRICES INCLUSIVE OF VAT
ADD £2.00 FOR P&P

TELEVISION

No other consumer magazine in the country can reach so effectively those readers who are wholly engaged in the television and affiliated electronic industries. They have a need to know of your products and services.

The prepaid rate for semi display setting £6.78 per single column centimetre (minimum 2.5 cms). Classified advertisements 40p per word

FOR THE BEST QUALITY AND BEST PRICES IN BIRMINGHAM.

TESTED AND UNTESTED TV's AND VIDEO's

RING – 021-772 2733

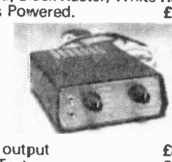
WILTSGROVE LIMITED
(Next Door to UNCLE'S DISCOUNT STORE)

128-130 Ladypool Road, Sparkbrook, Birmingham B12 8JA.

CASH ONLY

COLOUR BAR GENERATOR
Pal Colour Generator with 11 patterns plus sound. Grey scale, Colour Bars, Red, Green & Blue Raster, Crosshatch, Dots, Chequer Board, Black Raster, White Raster, Half Black & White, Mains Powered. £75.90

OUTPUTS PROVIDED
UHF OUTPUT
VIDEO OUTPUT
SOUND OUTPUT
LINE PULSE
FIELD PULSE



Same as above plus RGB output	£81.50
Line Output Transformer Tester	£11.50
B/W Generator, Crosshatch, Peak White, Dots, Half Black & White and Grey Scale UHF output	£18.50
Same as above but with Video Output	£20.50
Capacitance Meter measures 10pF to 1μF complete with moving coil meter	£14.75

CRT TESTER/REJUVENATOR SEND S.A.E.
S.A.E. for details. Prices include VAT.
Postage on Colour Bars £1.75, others 75 pence.

C.M.J. ELECTRONICS
Unit 8, 16 Union Mill Street, Horseley Fields, Wolverhampton WV1 3DW.
Tel: (0902) 871563

EXPRESS PANELS

A highly skilled staff using specialized service jigs and some of the most up to date techniques and test equipment available means we can save you time, money and heartache.

EXAMPLES FROM OUR RANGE (exch. basis)

Bush T20/22/26 power supply £14.75	**Sony 1820/2000/2204 power supply £16.75**
G11 power supply £14.60	**GEC 20AX/30AX power supply £14.75**

All prices subject to VAT, P&P FREE (if orders over £10.00). Panels also available for outright sale, discount for quantities (any mix) all panels guaranteed 3 months, are chemically cleaned and print re lacquered, and have no damaged print etc, so they not only work they look good too. Send S.A.E. for NEW CATALOGUE or ring with your requirements.

TRADE SERVICE AVAILABLE for VCR's.
Callers by appointment only. Telephone orders accepted using Access & Visa.

021-359 3753
ARGO SERVICES (B.HAM) 53, Lawley St, B.Ham B4 7XH

SERVICE PAGES

(minimum 12 words), box number 70p extra. All prices plus 15% VAT. All cheques, postal orders etc., to be made payable to Television, and crossed "Lloyds Bank PLC". Treasury notes should always be sent registered post. Advertisements, together with remittance, should be sent to the Classified Advertisement Dept., Television Room 2612, IPC Magazines Limited, Kings Reach Tower, Stamford Street, London SE1 9LS. (Telephone 01-261 5942).

SCREENPLAY

Your Friend in the TV Business

COLOUR SETS FROM	£5.00
MONOS FROM	£3.00

PANELS BY POST – PRE-CALIBRATED

WORKING SETS TO ORDER

Phone Baldock 894905
SECTION 3, UNIT 4,
SERL COMPLEX,
LONDON ROAD,
BALDOCK, HERTS.
OPEN 6 DAYS 10-6.30pm/10-5pm SAT.

KM

* Britain's most reliable source of quality TVs.
* Hundreds of working polished TVs.
* GEC Starline
* Decca 80
* Decca 88
* Decca 100
* Pye G11
* Thorn 8800
* Pye 222 Series

All working and polished. These are not from major companies. A lot are from hotels and have had very little use.
Excellent reliable sets for rental.

Krystal Marketing Ltd,
Breedon Cross
Storage,
Dale Road, Selly Oak,
Birmingham B29 6AQ.

Phone 021-471 3023
Telex 335540-G
Ask for Les

INDEPENDENT TELEVISION AND VIDEO COMPANY

LARGE STOCKS TO CLEAR EVERY WEEK

COMPETITIVE PRICES

EXAMPLES:

B&W 20"-24"	From £1.00
COLOUR:	
Bush 1-2 I.C.	£4.00
Philips 520-550, 26"	£6.00
Thorn 3500	£6.00
GEC-Decca-ITT	£6.00

Philips 550 22"	£10.00
Pye 18"-20"-22"	£10.00
GEC 20"-22" 26"	£12.00
Thorn 8800-9000-9800	£15.00

Many Other Modern Sets and VHS Videos

PHILIPS G11 – ITT – Bush T20-T22-T26, Hitachi, Nat. Pan. – Sony Off Pile from £40

Phone Frank: Nottingham (0602) 864627
Unit 3
Meadow Trading Estate,
Meadow Lane,
Nottingham NG2 3HQ.

WOODSDALE COMPONENTS

RANK BUSH MURPHY TRANSFORMERS

Line Ouput
Z718 (T703A, T706A)

New (Complete)	£19.00
Less Focus Module and Rectifier	£10.50
T20, T22 (T705A)	£11.00
T26 (T705B)	£11.00

TDA2190 Plug-in Replacement module suitable for Bush T22/26 and any set using same device **£6.00**

Switch Mode
T114A **£6.00**

Genuine RBM Units.
Prompt Postal Service P&P Paid.
Add 15% VAT to all prices.
DISCOUNT for QUANTITIES.

34 Field End Road, Eastcote, Pinner, Middlesex. HA5-2QT.
Tel: 01-868 5580.
N. Skehan
Agents Office. Callers by appointment only.

WIZARD DISTRIBUTORS MANCHESTER

TV & VIDEO SPARES

We stock spares for THORN, PHILIPS, PYE, RANK, GEC, SHARP, SONY, DECCA + ITT.

FIDELITY SPARES MAIN DISTRIBUTOR.

Did you know we also stock

FUSES	I.Cs
TUBES	TOOLS
AERIALS	VIDEO LEADS
AEROSOLS	AUDIO LEADS
RESISTORS	SEMICONDUCTORS
CAPACITORS	SERVICE MANUALS
VALVES	TEST EQUIPMENT
HANDSETS	TV/VIDEO TROLLEYS

AND MUCH MORE

Counter open Monday-Friday 9am-4.45pm

TRADE ONLY

EMPRESS STREET WORKS,
EMPRESS STREET,
MANCHESTER M16 9EN.
Tel: 061-872 5438; 061-848 0060.

LOOK HEAR TV

THE BEST TRADE WAREHOUSE IN THE EAST MIDLANDS FOR QUALITY TV'S AND VIDEOS

* HUGE SELECTION COLOUR TV'S
* ALL MAKES, SUBJECT TO AVAILABILITY
* VHS VIDEOS, ANY QUANTITY
* MOST STOCK CLEAN, TESTED AND WORKING
* OFF THE PILE ALSO AVAILABLE
* **NO MINIMUM QUANTITY**
* PANEL REPAIR SERVICE AVAILABLE, PLEASE ENQUIRE

OPEN: Mon-Sat 10-5.30, Sunday 10-12.30
CASH ONLY PLEASE

Unit 4, King Street Buildings,
King Street, Enderby, Leicester.
Only 5 mins from Junction 21, M1
Ring ADRIAN BALMER on
LEICESTER (0533) 867530

STARLITE ELECTRONICS

WILLOWS FARM,
A13 RAINHAM, ESSEX.
Rainham 23225 also
Hornchurch 50238.

EX RENTAL TVs
UNTESTED FROM £15.00
WORKING TVs £20.00
RE-GUNNING TUBES

2 year guarantee
Most types available
including Sony

BARCLAYCARD VISA

NORTH WEST ELECTRONICS

Formerly UNIT 12, Wharfedale Rd
M606 Euroway Estate Bradford

25 YEARS SUPPLYING THE TRADE

WE HAVE MOVED

To Laurel St, Leeds Road Bradford Tel (0274) 660995

H.P. REPOS AND EX. RENTALS COLOUR TV'S AND VIDEOS

Refurbished TV's

BUSH T20/T26 .... £45
G11 .... £50
PYE KT3 .... £70

Others done to order.

DISCOUNT FOR QUANTITY

Annual Clearance Rock Bottom Prices

PYE G11 EXC CAB. £40
BUSH T20/26 CH £35
HITACHI 191 .... £20
FERGUSON TX (NOT D.E.R. Etc.) £65
GEC 2010 .... £20
PYE 222 .... £20
PHILIPS 550 .... £15
BUSH 718 .... £20
BUSH 2 CHIP £8
GRUNDIG 5010 ...... £10

PYE KT3 .... £50
GEC 2213 .... £30
THORN 3000 .... £7
GRUNDIG G415/4206

Best Stock in Country over 2000 in stock (90% of our TV's Switch on)

Special Price Quoted For Bulk Purchases From Source.

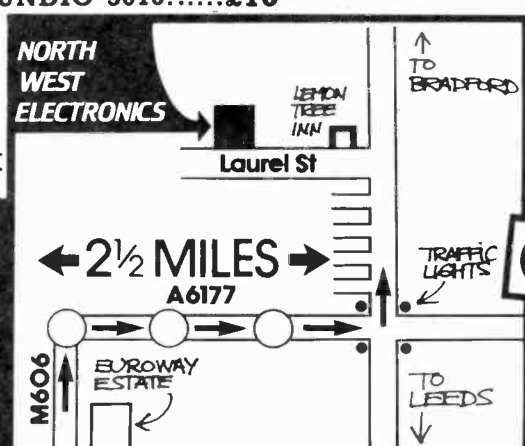
Video

SHARPS 7300, 8300 9300, HITACHI, VT11, FERGUSON 3V29

(Not Ex D.E.R. etc.)

SANYO, SONY, BETA

100's PX
HOOVER JUNIOR VACS
All models in stock



HOOVER JUNIORS
Fully reconditioned
(Like new) £27

Tel (0274) 660995

CASH ONLY

OPEN 6 DAYS
SAT 9-5.30

HALTON TV TRADE DISPOSAL

Wide range of TVs available.
Working and non-working.
TRADE ONLY
(We have NO retail outlet)
St Michaels Industrial Estate, Widnes
Tel. 051 423 1577

RE-GLOW TUBES
(ESTABLISHED 1959)

INLINE TUBE
20AX SPECIALISTS 30AX
INLINE – PIL – BONDED
DELTAS FROM **£28** **INLINE** FROM **£36**
(VAT EXTRA)
RE-GLOW TUBES 33-37 MILES PLACE
(off DELCE RD.) **ROCHESTER, KENT**
Tel: **MEDWAY 43952** (STD 0634)

TELEVISION

AT LAST!

QUALITY USED TELEVISIONS & VIDEOS

EXCELLENT CABINETS & GOOD WORKERS
TELETEXT & REMOTES (BOTH WITH HANDSETS)
THORN TX 9600, 9000, 9200, 8800 & 8000
BUSH T20 & Z TYPE PHILIPS G11

WORKING VHS VIDEOS FROM £90

MONITEC
The Heathlands, Kidderminster Road, Bewdley, Worcs. Tel. 0299 400233/400933

BOURNEMOUTH

LARGE STOCKS OF WORKING NON-WORKING SETS, MOST MAKES AND SIZES.

FAIR PRICES – TRADE ONLY

WAREHOUSE OPEN:
Mon-Fri 9-1, 2-5; Sat 9-1

HILLIER'S, UNIT 2A,
11-15 FRANCIS AVENUE,
WALLISDOWN. TEL: 0202 581932

PLEASE MENTION TELEVISION WHEN REPLYING TO ADVERTISEMENTS

PRECISION VISION LTD.

For:

- ★ LATE MODEL USED COLOUR TVs
- ★ REFURBISHED TO HIGH STANDARDS
- ★ BECOME ONE OF OUR REGULAR HIGHLY SATISFIED CUSTOMERS
- ★ EARLY COLOUR TVs FROM £5

Unit 10, Chiltern Business Centre,
Garsington Road, Cowley, Oxford
(next to B.L. Works).
Phone 0865 711966

VIDEO

V.H.S. VIDEO'S 100's IN STOCK

Famous brands:
JVC · PANASONIC · FERGUSON
Also stockists of Grade B Units, Microwaves, Hi-Fi, Radio/Cassettes etc. etc.
CONTACT MICK ON:
021-772 1591

VHS VIDEOS

WORKING £110
NON-WORKING £75
NO VAT
PORTLAND VIDEO
01-843 9942
SOUTHALL, WEST LONDON

WORKING CTVs

THE BEST & CHEAPEST IN LANCASHIRE

SPECIAL OFFER

Working Decca Bradford Including Black Fronts
18" 20" 22" 26" **ONLY £20.00 each** in 6 units
Working GEC Plastic & Wooden. All models
20" 22" 26" **ONLY £22.00 each** in 6 units
Working Bush 20" 22" 26"
ONLY £15.00 each
Philips G8 (520) 22" & 26"
ONLY £20.00 each
Plus many more makes & sizes in stock, inc. Tanburg, Nordmende, Thorn.
1st COME 1st SERVED
ALL SETS TESTED & WORKING
CALL
JOHN POWNEY
TRADE TV SALES & SERVICE
Unit 31 Progress Industrial Estate, Kirkham, nr Preston
(0772) 683392
UNTESTED PANELS FOR ALL MAKES OF TV
£1.25 per panel *plus post & packing*

TELFORD ELECTRICAL SPARES & SERVICE

GENUINE SONY SPARES
VIDEO HEADS
TRANS-FORMERS
E.H.T. TRAYS
AUDIO PRODUCTS
CAPACITORS
TUNERS Varicap & Push Button
SEMI-CONDUCTORS Diode
SOLDERING IRONS

Access

TESS SERVICE

UNIT 42, HEATH HILL INDUSTRIAL ESTATE, DAWLEY, TELFORD, SHROPSHIRE TF4 2RH.
Telephone: Telford (0952) 501618

TRADE COUNTER OPEN 6 DAYS EACH WEEK
Television Video Audio Microwave

VISA

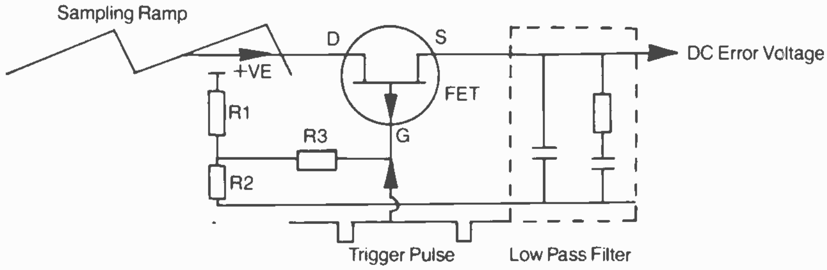
NEW – GENUINE FERGUSON SPARES
COMPUTER SPARES
Beswick FUSES
INSTRUMENTS
AERIAL PRODUCTS
RESISTORS
VALVES
SEMI-CONDUCTORS Integrated Circuit & Socket
TUBES Monochrome & Regunned Colour
SOLDER & ACCESSORIES
S.A.E. FOR FREE CATALOGUE. A4 SIZE

Try Us.
We endeavour to provide a fast delivery of top quality components for the keenest price.

SITS VACANT

MANAGER/ESS REQUIRED for wholesale & retail ex-rental T.V. & Video business. Applicant must be skilled T.V. engineer with flair for selling. Excellent opportunity for the right person. (London area). Write Box No. 206.

SERVICE PAGES



As a Technician in TV, Video or Electronics who can follow the circuit diagram above; have you ever thought of imparting your knowledge to other technicians?

Providing you have a sound knowledge of current TV and Video, no training experience is necessary to earn an attractive salary with a Company Car.

For full details of how you can join our team of instructors at either Tottenham or Nottingham, write or phone to John Johnston, Granada TV Rental, Godwin House, George Street, Huntingdon PE18 6BD. Tel: (0480) 50911.

GRANADA TV RENTAL

RAVENSBOURNE COLLEGE OF ART AND DESIGN
SCHOOL OF TELEVISION AND BROADCASTING
Technical Staff vacancies

Senior Technical Assistant

Scale 6 – £8,979-£9,591 plus £657 London Weighting

To lead a team of full and part time technicians in the installation and maintenance of the Television Studio systems in the College Television School. The full time technician will assume administrative responsibility for stock control and facilitating the work of visiting technicians, ensuring all repair work is completed to a satisfactory standard. Applicants should ideally be qualified to B/TEC HNC level in Electronics or Communications or equivalent but more weight will be given to experience in maintaining and demonstrating electronic technician work. The applicant should be able to demonstrate a sound knowledge of analogue electronics as well as digital work and a diagnostic ability.

Technical Assistant

Scale 4/5 – £6,900-£8,697 plus £657 London Weighting

Under the guidance of the Senior Technical Assistant to be jointly responsible for the maintenance of television apparatus used in the Department. To play an active role in the planning and installation of new equipment and modification to existing systems. Stock control and the setting up of laboratory demonstration equipment would be required.

Applicants should ideally be qualified to C & G full technical Certificate in radio television servicing or equivalent. Familiarity with television/video equipment would be a considerable advantage and the candidate should be able to demonstrate a sound diagnostic ability.

Application forms and further details can be obtained from the Registrar, Ravensbourne College of Art and Design, Walden Road, Chislehurst, Kent. BR7 5SN.

AERIALS

MULTI-OUTLET/MULTI-CHANNEL Installations. Large or small distribution systems. Equipment and/or consultancy by post or on site. Catalogue (full of trade know-how and trade equipment) £1 (refundable). WRIGHTS AERIALS, 43 Greaves Sike Lane, Micklebring, Rotherham. (0709) 813419.

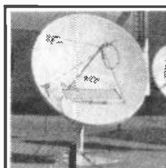
SATELLITE T.V. RECEPTION EQUIPMENT

DX

Complete systems 10.9-12.7 GHz. Low noise block downconverters. Demodulators, splitters and line amplifiers. Dishes, polar mounts and brass scalar feeds.

SAE for details to:

KESH ELECTRICS LTD
MAIN ST, KESH, CO FERMANAGH, N. IRELAND
PHONE KESH (03656) 31449



Euro–Sat
Parabolic Dish Antennas
(Parent company est. in TV communications since 1969)
SATELLITE TVRO ANTENNAS
TOP QUALITY SOLID
GLASSFIBRE DISH ANTENNAS
TRADE PRICES

1M. DIA 11-12-4 GHZ BANDS	£77.00
1.2M. DIA 11-12-4 GHZ BANDS	£93.00
2M. DIA. 11-12-4 GHZ BANDS	£215.10
3M. DIA 11-12-4 GHZ BANDS	£437.00

Trade & Export Enquiries Welcome
Prices do not include delivery
Euro–Sat
107 Cross Street, Sale, Cheshire, England.
Tel. 061-437 2631 061-881 4249

SATELLITE TELEVISION

Buy direct from the manufacturers, low cost, full band satellite TV system.

Agents Distributors required

Write or telephone for details or call in at our factory showroom

NETWORK SATELLITE SYSTEMS
Unit 7-8, Newburnbridge Ind. Estate, Hartlepool, Cleveland
Tel. 0429 74239

AERIAL BOOSTERS

B45-UHF TV next to the set fitting. Gain 10dbs (trebles gain), works off PP3 type battery or 8V to 14V working. **Price complete (excluding battery) £5.00.**

Video Transmitter. This will transmit good quality pictures and sound more than 30ft. **Price £8.90** (S.A.E. for more details).

We also make aerial boosters for VHF/FM radio £7.70, and VHF television, prices £7.70 & £8.70. p&p 50p per order.

ELECTRONIC MAILORDER,
62 Bridge Street, Ramsbottom, Lancashire, BL0 9AGT.
Tel: Ramsbottom (070 682) 3036.
S.A.E. leaflets. Access/Visa Welcome.

FOR SALE

PHILIPS TEST EQUIPMENT: PM 3214 Dual trace with delayed timebase OSCILLOSCOPE. Various probes etc. PM5519 Colour TV. Pattern generator. PM 5107 L.F. Generator 10MHz-100MHz. PM 2554 AC Millivoltmeter 2Hz-12MHz PM 2517E Digital Multimeter + various attachments. ALSO spares & service manuals, mainly Philips/Pye video heads for VR2220, Philips/Pye portable VCR V2000 system. For further details Telephone 074632 406.

TEKTRONIX SCOPE 533A Manual and probes, perfect order. Offers. Phone 0702 522929.

Sabaco For a great deal!

TRY US YOU'LL LIKE US

TOP QUALITY TV'S & VIDEO'S AT ROCK BOTTOM PRICES

VAN LOAD DIRECT FROM SOURCES
ALL SETS & VIDEO'S OFF THE PILE
(Mostly switch-ons)
Largest selection of 4000/8800/9000/9200/ 9600/Ferg TX9/TX10 Stereo Teletext Colour Portables
Mainly teletext and remote with handset.
Also Pye KT30/G11/T20/T26/Hitachi/ Philips 550/Grundig & many more.
BRAND NEW SETS AT LOW PRICES

VHS VIDEO'S

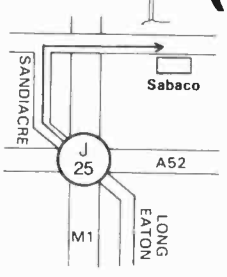
Good Working Order from 3V22, 3V23, 3V29 Portable Video's etc.
Also a selection of brand new video & E180 video tapes

OPENING HOURS:
MONDAY TO SATURDAY 9am to 5.30pm
SUNDAY 10am to 4 pm

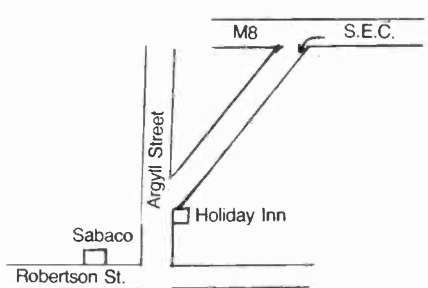
CASH ONLY All goods subject to VAT & availability

PHONE NOW FOR UP TO DATE COMPUTERISED PRICES AND DELIVERY DAYS, BE HERE WHEN LORRY ARRIVES FOR FIRST CHOICE — PHONE US NOW ON:

(0602) 397555



Only 2 minutes
Junction 25 M1



(2 minutes from M8)

Head Office:
Sabaco
Saba House,
46A Derby Road,
Sandiacre, Nottingham
(0602) 397555

Sabaco
75 Robertson Street,
Glasgow
(041) 221-2146

DEVONICS

Quality Rebuilt Tubes
2 YEAR WARRANTY

470 ERB22	£43
510 KCB22	£45
A51-161/500/510/ 570/580/590X	£45
560 AKB/DZB/TB22	£45
A56-500/510X	£45
A56-540X	£53
A66-500/510X	£46
A66-540X	£53
670 XB22	£46

Deltas from £30
Plus carriage and VAT
2A BARTON HILL ROAD, TORQUAY TQ2 8JH
0803 - 33035

2 SETS OF FULLY RECONDITIONED tube re-gunning plants for sale. Training provided. From only £3,995. Tel. 0582-410787.

WANTED

GOOD 320 BTB TUBE WANTED. Phone Windsor 0753 860889.

IMMEDIATE CASH PAYMENT for working televisions, videos, microwave cookers etc. 01-778 7236 24 hr's.

WANTED TELEVISION 1963 – 82 UHF parts for Regentone 193 – 6 RGD 622 – 5 Defiant 9A50 – 56U etc. Tel. 0508 46364.

WANTED VIDEO'S, Portables, colour TV etc. Any quantity. Immediate collection, cash paid. Tel. Stoke on Trent 416401.

REPAIR SERVICE

BRISTOL – SOUTH WEST SOUTH WALES

Scratched and chipped CRTs can be Re-polished.
Tel: 0454 778635 for details

PRINTED PANEL REPAIR SERVICE

Printed panels and remote control handsets repaired. Most makes and models serviced.
RING 0934 418545
for Price List or Quotation.

SERVICE SHEETS

BELL'S TELEVISION SERVICES for service sheets on Radio, TV, etc. £1.50 plus S.A.E. Service manuals on colour TV and Video Recorders, prices on request. S.A.E. with enquiries to B.T.S., 190 Kings Road, Harrogate, N. Yorkshire. Tel. (0423) 55885.

SERVICE SHEETS

TECHNICAL INFO SERVICE – 76 Church St – Larkhall – Lanarkshire ML9 1HE
World's sole publisher of Comprehensive T.V. Repair Manuals. Largest known stocks of Service Manuals & Sheets from 1935 to latest for all kinds of equipment, espec. T.V. & Video.

Save time & expense – our big catalogues of Service Manuals & Sheets with Chassis Guide & £4 Vouchers – **only £3** – updated free.
Any published Service Sheet **£2.50 & l.s.a.e.** except CTV/Music Centres – **£3.50 & l.s.a.e.**
Service Manuals from **£4.50 to £39** – e.g. Thorn 8000/8004/8500/8600 only **£9.50.**

T.V. Repair Manuals **£8.50** each. Special offers The 5 McCourt **£40.** The 11 Tunbridge **£88.**
Video Repair Manuals **£4.50** per Chassis **or all 10 for £25.**

Comprehensive Practical T.V. Repair Manual **£9.50.** The Practical Radio Servicing & Repair Manual **£9.50.**

UNIQUE COLLECTIONS OF CIRCUITS & LAYOUTS
British CTV from hybrid to modern in 3 giant binders for only **£55.** Also 2 giant binders packed full for **£35 pair.**
Foreign CTV. Portable/Standard Mono TV. Domestic Equipment.
NEW RELEASE:- Offered to *'TELEVISION'* readers for **£20 (full price £25).**
Giant collection of modern portable British CTV circuits and layouts.

The Integrated British CTV Repair System – 2 giant binders full of circuits & layouts with 6 big Repair Manuals. Covers 1968 to the '80s. Plus! **£140.**
The Integrated TV Repair System – 16 big Repair Manuals/8 giant binders plus service data and other manuals. Covers 1968-1985. Priced separately over £300. **Our Offer for £250** cwo or supplied in 12 monthly sections at **£25 month.**
Offer includes any new TV publications we publish during 1 year from placing order. Service manuals to cover our range would cost over **£1,000.**
The Integrated Video Repair System – 10 booklets and 2 giant binders cover the early videos, all formats to V2000, 3V30, Sanyo 9300. **Only £55.**

S.A.E. brings any quotes required plus free magazine, service sheet & other offers.
or PHONE 0698 883334 FOR FAST QUOTES

TELEVISION SERVICE SHEET SPECIALISTS
Thousands of British, European and Japanese models in stock.
Colour £3.00 Mono £2.00
Manual prices on request.
All our prices include post and packing costs.
Send stamped envelope for free catalogue and any enquiries.
SANDHURST TV SERVICES (MAIL ORDER)
57 High Street, Sandhurst, Camberley, Surrey GU17 8HB.

MISCELLANEOUS

GET SHARP PARTS FAST
TELEPHONE
0734 - 876444
TELEX 848953
WVE
SHARP
Main U.K. Spare Parts Distributor
Audio-TV-Video ★ Microwave ★ Photo-copier ★ Typewriter
All U.K. model spares available. Same day despatch of orders received before 1pm.
Microwave, photocopier and typewriter spares to authorised service dealers/centres only.
WILLOW VALE ELECTRONICS LTD.,
11 Arkwright Road, Reading, Berks.

C.R.T. REBUILDING PLANT AND EQUIPMENT
Installation, commissioning, training and technical after sales assistance.
C.R.T. INTERNATIONAL
136 Badmington Road,
Coalpit Heath,
Bristol BS17 2SZ
Tel: 0454 778635

SPARES/MANUALS
BURROWS SERVICE — SAE QUOTES AND CREDIT DETAILS
415a WHITEHORSE ROAD, THORNTON HEATH, SURREY CR4 8SD. 01-683 1911 (2 lines)

SOLE SUPPLIERS TV/VIDEO Repair manuals/circuits, 1000s s/manuals supplied by return. S/sheets £2.50 except CTV/m.centres/stereos £3.50. LSAE with every order/query please brings free price list/magazine inc s/sheet – or phone 0698 884585 (883334 outside business hours) TIST, 76 Church Street, Larkhall, Lanarkshire.

BURGLAR ALARM EQUIPMENT. Latest discount catalogue out now. Phone C.W.A.S. ALARM 0274 731532.

The Theory and Practice of PAL Colour Television in three important Video Cassette Programmes
Part 1.
The Colour Signal
Part 2.
The Receiver Decoder
Part 3.
Receiver Installation
VHS★★★V2000★★★
BETAMAX★★★UMATIC
BARCLAYCARD VISA
For full details telephone
0253 725499 (Day)
0253 712769 (Night)
Or send for precis details
FLINTDOWN CHANNEL 5
339 CLIFTON DRIVE SOUTH, LYTHAM ST ANNES FY8 1LP
(enclosing this advert)
NAME ....
ADDRESS ....
.... TEL:..................

GRUNDIG VIDEO Infra-red remote control VIF-K1 brand new & boxed £5.95, complete with tele-pilot TPV355 £12.95, p&p £2, these units plug strait into Grundig 2×4 super (Trade Supplied) Philips video films, ex-rental £2.99. Videos & films wanted. STAN WILLETTS, 37, High Street, West Bromwich, West Midlands. Tel. 021-553 0186.

TRIPLERS 11 THY and 11 TFV all new STC module £2.50 large type focus, modules 50p, various types of transistors and IC's. Box No. 209.

BUSINESS OPPORTUNITES

T.V. VIDEO SALES REPAIRS & RENTAL SHOP
In pleasant Shropshire country market town. Small growing business making good profits run at present by engineer & wife, on a fairly leisurely 5 day week basis. Excellent 3 bedroomed accommodation attached, with gas c.h., walled garden.
Freehold £45,000 o.n.o. & S.A.V.
BOX NO. 205 for details

RENTED ACCOUNTS. Small number T.V./Video accounts producing a good income. Torbay, Devon. Box No. 207.

SUPERB WELL ESTABLISHED Television Electrical contracting Audio business for sale, Yorkshire Dales Market Town. Excellent profits, wonderful working area. Box No. 208.

BOOKS AND PUBLICATIONS

A-Z LIST OF MANUFACTURERS ADDRESSES. All major TV, audio etc plus many hard to get ones. Send cheques/PO for £3.75 to DOWNS ELECT. 135 Main Street, Newton Grange, Midlothian EH22 2PF.

"RADIO AND TELEVISION SERVICING" books, new editions for the last 6 years usually in stock. Prices on request. BELLS TELEVISION SERVICES, 190 Kings Road, Harrogate, N. Yorkshire. Tel 0423 55885.

MACDONALDS R&TV BOOKS. New 74/75 £15. 75/76, 76/77, 77/78, 78/79, 79/80, 80/81, 82/83, 83/84, 84/85 £22.50. Free delivery. U-VIEW, 29 Warmsworth Road, Doncaster. 0302 855017.

METERS

METERS. Reconditioned 10p/50p available from stock. Contact THE METER CO. (Poole) LTD. (0202) 683498.

AVON METERS
We buy and sell and repair TV coinmeter. Reasonable prices, one year guarantee.
213 Cheltenham Road, Redland, Bristol.
0272-425281

ALARMS

D.I.Y. ALARMS
DOOR ENTRY PHONE
CC TV BS 4737 APPROVED
Showroom Demonstration.
Same Day Despatch.
FREE CATALOGUE
01-965 1230
SMITHS SECURITY SYSTEMS
43 Park Parade, London N.W.10.

Philips small stereo headphones £4
Stereo Philips headphones Electret N6325 £13
Rank UHF 4 push button tuner £4
GRC power supply PC743B £10
Rank front panel Z950 £5
Power panel 8.500 Thorn £5
Fedility mains switch & lead and filter panel £1
Fedility mono lopt with diode FBS1245AE £3
6 TAG print mains switch PREH 1983 ITT 75p
T134A Lopt panel £10
Rank T603A tuner on panel £6
Scan control panel Z544 £3
Rank Z582 IF £3
Rank convergence Z910 £3
GEC IF tuner panel PC786B £12.50
ML 232 I.C. on panel tuch unit Fidelity £3
Hitachi power panel PC036A £1
Rank IF 742 £3
Rank decoder Board MTS 200/1 Tuner & IF £12.
Z733 Rank mains in put-panel £1
G11 Chroma Can 3113 108 25300 £3
20AX Line lin coil 50p
GEC switch mode trans 20AX
ITT CVC20 etc mains switch 60p
ITT 2,800 mains remote switch 50p
2110 GEC Power Panel £8.00
Line o/p frame panels GEC 20AX £10.00
GEC 20 AX Transductor £1.00
ITT CVC40 Push Button Unit & Mains Switch £8

Rank Panels

Z904 18" Line Panel £10
Z905B Decoder £10
Z736 Tuner I.F. £10
A805 Conv. 7/8 £2
T136A Scan Drive £10
Z780 Line O/P £10
Z968 £10
Z582 I.F. Panel £5

Rank Power Panel

300+300m with diodes degaussing £3

BA 301	£1
TA 4127	£1
HD 3884 2A23	£3
TA 4184	£1
TA 2125	£1
TA 4190	£1
TA 4138	£1
TA 4196	£1
TA 4174	£1
TA 4139	£1
TA 4198	£1
TA 4167	£1
TA 4199	£1
BA 546	£1
BA 328	£1
TA 4176	£1
TA 4145	£1
TA 4191	£1
HA 11710	£1
TA 4188	£1
TA 4197	£1
TA 4183	£1
TA 4197	£1
TA 4183	£1
TA 4195	£1
TA 4175	£1
TA 4177	£1
TA 4192	£1
TA 4146	£1

The Service Engineers Guide to Teletex £1.50
Teletex Colour Training Manual £3
Mains Trans
C. Core 240v 4v+4v 4v04v 2AMP 12v lamp £2
Mullard split diode AT2076/80 £6
4 Types Fedility front panels with i.c. & pats £2 each
Amstrad TV chassis Complete damaged print £5 + £5 post

BB 103	10p
BB 105A×12	£1
BB 105B×12	£1
BB 105G×12	£1
BB 121a	10p
47	10p each

A 823A chassis
Scan drive £5
IF £3
Scan control panel £3
NEW A31/510 tubes with s/coil £6 + £2 post

1A/1600V	10p
2 amp bridge rec. wire end	15p
CV 8617	10p
Y 716	10p
Y 729	30p
Y 730	10p
Y 827: 6A/1KV	20p
Y 860	30p
Y 933	5p
Y 969	50p
Y 997	30p
Min 12 volt Relays	75p
R 1038	40p
R 1039	40p
R 2009	80p
R 2010b	£1
R 2029	50p
R 2210	60p
R 2257	60p
R 2265	50p
R 2305	50p
R 2306	30p
R 2322/2323 pair	80p
R 2323	15p
R 2396	50p
R 2461	80p
R 2030	50p
R 2443=BD124	40p
R2737	40p
R2738=TIP41	30p
R2775=TIP41c	40p
R3129=TIP47	40p
S 2008b	80p
2SD898B	£1
Hitachi sets etc.	
STR441	£2.50
STR454	£2
2SC940	£1
BU 105/04	80p
BU 108	£1
BU 124	50p
BU 126	80p
BU 180a	65p
BU 204	70p
BU 205	£1
BU 206	£1
BU 207	£1
BU 208	80p
BU 208A	£1.10
BU 208D	90p
BU 222	£1
BU 326	£1
BU 407	60p
BU 426V	60p
BU 500	£1.10
BU 508A	£1.20
BU 526	75p
BU 807	£1
BU 824	50p
BUW 84	30p
BYW 20-08-9	£1
TIC 106a	30p
TIC 116m	40p
TIC 116n/Y 1003	35p
TIC 126N	40p
TIC 206m	30p
TIC 225S	40p
TIC 226E	40p
TIC 226m	30p
TIC 236m	30p
TICV 106D (T092 case 2A/400V)	10p
TIP 29	20p
TIP 30	35p
TIP 30A	35p
TIP 30B	40p
TIP 30C	45p
TIP 31	30p
TIP 32	25p
TIP 33B	50p
TIP 33C	70p
TIP 34A	50p
TIP 34B	60p
TIP 34C	70p
TIP 35B	50p
TIP 35C	70p
TIP 35D	80p
TIP 36	50p
TIP 36C	70p
TIP 41B	40p
TIP 41D	70p
TIP 42/BRC 6109	30p
TIP 48	40p
TIP 49	30p
TIP 57	30p
TIP 100	30p
TIP 102	30p
TIP 115	50p
TIP 117	50p
TIP 120	35p
TIP 125	35p
TIP 130	30p
TIP 131	25p
TIP 136	30p
TIP 140	50p
TIP 640	50p
TIP 2955	35p
T 6032	30p
T 6036	40p
T 6040	40p
T 6047	40p
T 6049	40p
T 6051	40p
T 6052	40p
T 9004	40p
T 9005	40p
ZTX 107	10p
ZTX 108c	10p
ZTX 109k	5p
ZTX 213	5p
ZTX 341	10p
ZTX 342	10p
ZTX 384	10p
ZTX 451	10p
ZTX 550	10p
MJ 2253	60p
MJE 3040	60p
MJE 2209	10p
SP 8385	50p
SAB 3205	£1.00
SAB 4209	£1.00

G11 condenser £1.75
300M + 700 320V £1.80
200 + 100 + 100 + 50 300V 50p
150 + 200 + 250M 300V 50p
Chassis complete £35
Computer Transformer 20v/2.25A; 20v/1.5A; 17/.5A; 19/.5A; 28/.05A £3
Mains ViewData Torroidals £3.75
240V/240/6V/4 amp/6v 500m/a in / out - - - - - - -
Mains trans 240/12v-0-12v 2 amp £3.50

Voltage Regulators

+5V/UA78PO5SC	30p
−5V/LM79MO5CP	25p
−8V/79M08c	30p
+6V/78M06c	30p
+10v/78LA10	20p
LM 337	30p
LM 342/18	30p
LM 340T 5.0	50p
+12V/LM 340T12	50p
+15V/78M15	15p
+18V/MC78M18	20p
+24V/78M24	30p
MC 7724cp	40p
MC 7824	40p
TIS 90	10p
TIS 91	20p
TIS 92	20p
TIS 93	20p
U 19885	40p
U 3832	15p
U 3845	15p
MR 508	10p
MR 501	10p
MR 502	10p
BCW 71R	30p
BYF 1202	10p
BYF 1204	10p
BYF 3126	40p
BYF 3214	40p
BYX 10	6p
BYX 36/600	35p
BYX 38/300	25p
BYX49/600R	75p
BYX 55/350	10p
BYX 55/600 (Bead)	10p
BYX 71/350	20p
BYX 71/600	50p
BYX 72/300	20p
BYX 36/600	50p
BYV 95B	10p
BVY 95C	12p
BYZ 106	10p
BPW 41	15p
BYW 56 2A/1000v G11	8p
BZU 15/24	54p
BZY 93c75	50p
BZV 15/18	30p
BZV 15/30	30p
BZW 70c6v2	10p
BZX 79.3v	10p

Bush thyristor RCA 76122 £1
Transformer 240v/20v-500Ma 75p
Chassis type Transformer 240v/12 Volts 500m/a 75p
CVC 20 tube base £2
Tube Base Rank & G11 £1.20
6v-9v-13v tape motor 75p
Swiss made 250rpm/240V motor very small 75p
Infra red led LD57CA 15p
Mono scan coil £3
G 8 transductor £1.25
AT 4041/41 transductor £1
VHF 3 Transistor rotary tuner DX-TV £1
15K-20 turn pots 20p
Thorn panel 6×100 pot + changeover switch (Irish) 50p
Battery converter TA 75 for colour TV. 12/24v Thorn 3787 £6
Thorn 3500 2A cut out 50p
Stereo GEC amp 20 watt + pre-amp with 4 pots + mains power unit with circuit £6

SPECIAL OFFER
Decca-TTT etc.
FEO4/1/250AC/4
Mains filters
(grey type) × 4
80p

BRIDGES

SKB 2/08 L5A	30p
KBL 005	30p
KBL 02	30p
KBP 04	30p
W02	15p
W004	15p
W005	20p

AT 2076/35 £7
AT 2076/55 GEC split diode transformer £10
AT 2048/11 LOPTT Mullard £2.50
H1520 Multimeter 20,000 Ohms per volt. Fuse & Diode protected £17.50
Hitachi Split Diode 2433752 £6
K35 Split Diode £6
Z918 Front Panel with Mains Switch & I.C £4
Thorn Chass U916D Compleat £10
K3-K30 Hand Set Repaired £8
Thorn TX9 Remote Panels with I.C's £2.50
Thorn 9000 4 Slider Front Panel £4

10 Mixed TV & radio speakers £4
Philips car radio speaker door pair £7
2× Hi-Fi Philips car tune up tweeter EN8320 £10
ITT CVC45 8 way resistor unit for v/cap £3

4700/10v × 10	50p
68/16 × 10	50p
150/16 × 10	50p
47/25 × 10	50p
220/25 × 10	50p
1/250 × 10	50p
G8 Speaker	£1
8000/30v	50p
470/40v × 10	£1
22/100v × 10	£1
100/350v	70p
400/350v	70p
.47/500v	25p
1/600v	25p
.022/1kv	10p

VIEW DATA PANELS
NEW £3

VM6101
MULLARD TELETEX DECODER
With interface panel and data command panel
New £6 Post £2

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

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

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

20AX GEC Split Diode lead **£1.00**

MODEM
Line Terminal Unit
VM6501 £6
Designed to work at 1200/75 or 1200/1200. Diagram and Connection Data Supplies

Indicator Tube ITT 58705 £1
8 Seg Display FND500 20p
Mullarad 12.5V/170 Mc/s 45 watts BLW60C £4.00
Mullard Broadband R.F. power modules UHF. BGY22E £10.00
PT4236C, PT8706C, PT9783 £3
ITT Micro Phone M5 50p with switch
Sub-min Relay low voltage 50p
Mains relay coil 230v 30p
Philip PP3 batterys 10 for £3
12v battery holders A.A. 50p 1.5 battery
T/V 12v 2 pin battery lead 30p

Various Tools and Accessories

T/V V/Aerial 300Ω or 75Ω	£1.50
L.C.D. clock display with alarm	75p
* D/P push mains switch	20p each
Mains lead & two pin socket for radio cassette	35p
3 Video Leads	£1.00
Xcelitr cutter	£3.90
T/V loop aerial	75p
Radio Telescopic Aerial	£1.00
Philips Neon Lamps for TV sets	5p
Freeze	£1.20
Foam Cleaner	£1.20
Contact Cleaner	£1.20
Cans of Anti Static, Degrease Cleaner and Anti Corona	All at £1.20
Push Button Mains	75p
Lorlin Full Remote Relay Switch fit most T/V sets, mains 4 tag, 2 tag 12 volt	£1.00
Mains timer. 13 amp — up to 2 hours: easy to use, plugs into socket	£3.00
Sellotape PVC Electric Insulation 50mm × 20M	70p
Screen locking agent. large can	£1.50
20 GEC Service Manuals	£5.00
Red E.H.T. LAED and Anode Cap	£1.00
10 × G11 Cap 470/250	£15.00
Weller solder iron 15 watt/25 watt	£5.00
2 way baby alarm/intercom with long leads	£5
Phillips universal battery tester/charger, fuse/bulb tester	To Clear £4
12V Nicad pack. "AA"	£2.50
Hitachi 7.2v/1.8A Nicad pack	£6.00
Hitachi TP 007 Battery pack 7.2v/1.6A	£7
Hitachi Silver Oxide Battery G13 UCC357 IEC SR44 1.5V	60p
70ML Silicone Sealer (clear)	£1
100 Coax Plugs	£12.00
De-solder pump + 2 nozzels	£5.20
Plastic box for i.c.s 6"×3"×½"	50p
Can of handy oil 'mobil'	40p
Flat Red LED	12p
500gm 60/40 solder reel	£7
Clearweld glue pack	30p
Dual v/u meter -20 – +10db	£1
K30 thermistor 232266298009	75p
GEC Mains Power Supply R.E.G.	£3.00
1Kg reel of solder	£8.00

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

Quantity Reductions

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

Plastic Boxes 4¼ × 4 × 1 × ¾	50p
100 Fuses	£2.00
100 W/W Res.	£1.50
BF 199	20 for £1
10 × 20 Turn 100k pots. Rank	£2
Thorn 9 volt power supply regulated	£3.00
BF 470	20 for £2
20 Slider Knobs	70p
6 Mixed UHF Aerial Isolating Sockets, some with long leads. Fit ITT, GEC, Philips, Pye	£1.00

Mixed Packs

TO66 12 Power Trans RCA 16182 NPN Replacement for BD124 and Mounting Kits	£1.00
50 Mixed AC series Transistor	£4.50
15 Panel mount rocker switch 250V/10A	£1.50
25 Panel Mount Bulbs & Neons 10A	£1.50
25 LED red/yellow/green	£1.50
20I/C Holders	£1.20
20 Large LED Red	£1.00
20 Small LED Red	£1.00
10×20 Turn 100K Pots	£1.00
100 Transistor	£2.50
20 Convergence Pots	80p
10 Thermistors	50p
20 Slider Pots	£1.00
30 Presets	50p
15 VDR + thermistors, degaussing, HT, etc.	£1.00
40 glass reed switch	£1
10 press to make switch	70p
40 Pots	£1.50
5 Tube Bases	£1.00
1,000 Diodes, Condensers, Resistors on Bandolier	£2.00
Lucky Dip 600 gram	£1.00
Jungle Bag 5Kg	£5.00
20 Knobs	£1.00
20mm Fuse Holders Chassis Mount	20 for £1
IN4001/6 100 mixed	£2.50
EHT Diodes, small	20 for £1
20 Mixed Switches	£1

SENDZ COMPONENTS
TO ORDER SEE BACK PAGE