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TELEVISION

SERVICING·VIDEO·CONSTRUCTION·DEVELOPMENTS

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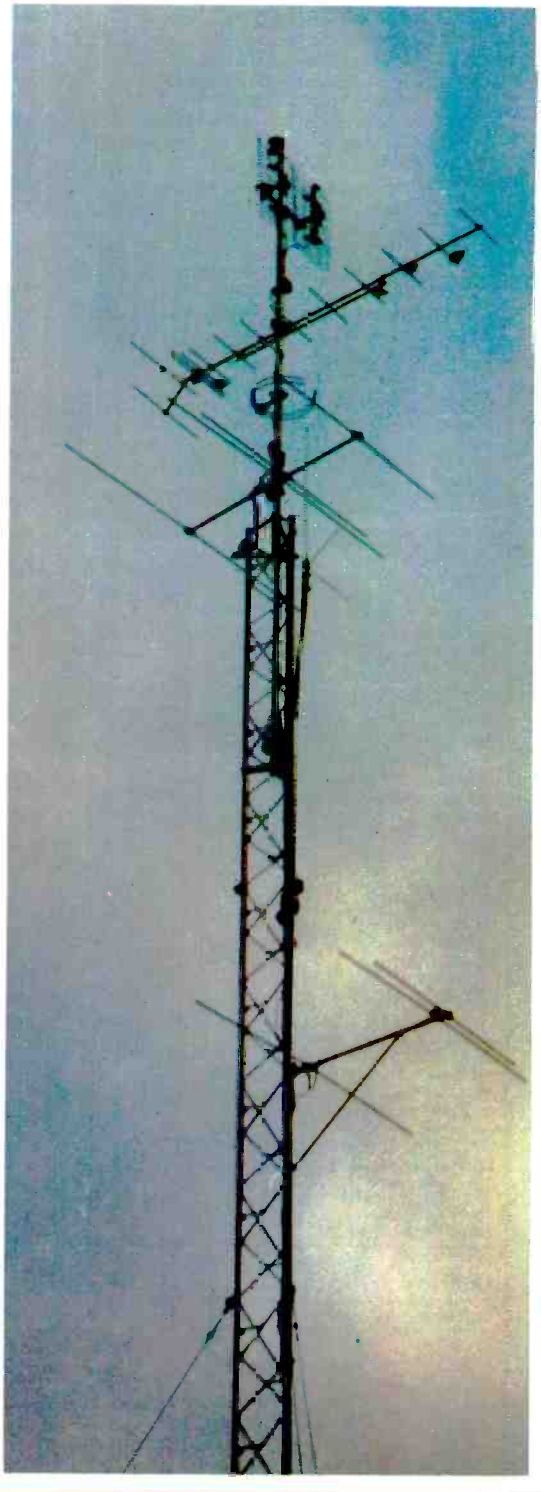

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DX-TV

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TELEVISION

April 1984

Vol. 34, No. 6
Issue 402

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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.

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this month

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INTEGRATED CIRCUITS

AN240	3.84
AN214Q	3.91
AN7150	3.97
CA555	46
CA741	25
CA748	45
CA3065	1.80
LA4031P	3.21
LA4102	3.37
LA4250	3.57
LA4400	3.05
LA4422	3.28
LC7130	5.93
LC7120	5.87
LC7137	5.50
LM1303N	2.63
HA1151	3.89
MC1307	1.99
MC1310P	1.60
MC1327	1.70
MC1351P	2.93
MC1330P	90
MC1349	1.99
MC1350	1.50
MC1352	1.75
MC1358P	1.50
MC1495L	3.00
MC14011BCP	66
MC14049UB	43
ML231/ETTR6016	2.20
MC232	2.20
ML236	5.35
ML237	2.50
ML238	6.00
ML239	2.50
ML920	4.12
ML922	3.29
ML926	2.18
ML928	2.18
MRF475	2.50
MRF477	10.00

MSN5807	7.87
MS1513L	2.80
MS1515L	3.28
SAS560S	1.89
SAS570S	1.89
SAS580	2.90
SAS590	2.90
SL901B	5.50
SL917B	6.50
SL1310	1.80
SL1327Q	1.20
SL76544	2.05
SN76003N	2.49
=SN76013N	
SN76023N	2.00
SN76110N	1.15
SN76115N	2.27
SN76131N	2.00
SN76226(DN)	2.00
SN76227N	1.18
SN76532N	1.50
SN76533N	1.70
SN76033N	2.49
SN76544N	2.35
SN76650N	1.05
SN76660N	80
SN76666N	80
SN76530A	1.47
S/W153	2.74
TA7050P	95
TA7051P	95
TA7074P	1.00
TA7108P	3.43
TA7120P	2.43
TA7129AP	3.76
TA7130P	1.93
TA7141P	95
TA7193P	5.67
TA7171P	1.85
TA7172P	1.85
TA7173P	1.85
TA7176P	2.50

TA7202P	4.27
TA7204P	3.77
TA7205AP	3.72
TA7208P	3.40
TA7210P	6.60
TA7222	2.42
TA7223P	3.74
TA7227P	5.98
TA7228P	5.98
TA7310P	2.78
TA7609P	4.39
TA7611AP	2.92
TAA300	58
TAA310	2.83
TAA320	2.00
TAA350A	60
TAA550	55
TAA570	2.75
TAA630	3.90
TAA8400S1	1.96
TAA661B	1.20
TBA120A (A),(S),(AS),(SA).	80
TBA120B	1.30
TBA120SB	1.37
TBA120U	1.10
TBA395	1.20
TBA396	80
TBA440N (TBA1441)	2.75
TBA440P	2.50
TBA480(Q)	1.50
TBA510	3.00
TBA520Q	1.68
TBA530(Q)	1.38
TBA540	1.68
TBA550(Q)	1.58
TBA560Q	1.59
TBA570	1.79
TBA690	1.50
TBA641BX1	3.50
TBA673	2.45
TBA700	2.12

TBA720	2.64
TBA750	2.98
TBA800	1.62
TBA810AS	1.10
TBA820	1.70
TBA890	3.94
TBA920(Q)	3.00
TBA950(2X)	3.05
TBA970	4.09
TBA990	1.90
TCA160	1.20
TCA760	2.30
TCA270SQ	2.50
TCA800	3.10
TCA940	1.95
TDA440	2.20
TDA1002	1.95
TDA1003A	5.50
TDA1004A	3.35
TDA1006A	2.50
TDA1011A	4.00
TDA1035	4.70
TDA1044	4.37
TDA1170	3.00
TDA1190	3.50
TDA1200	2.95
TDA1270	3.95
TDA1327	1.70
TDA1352B	1.60
TDA1412	1.20
TDA2002	2.80
TDA2140	5.95
TDA2190	4.70
TDA2020	4.66
TDA2030	2.80
TDA2521	4.17
TDA2522	2.40
TDA2523	3.40
TDA2524	2.25
TDA2530	2.70
TDA2540	3.84
TDA2541	3.84
TDA2560	3.50
TDA2571	2.56

TDA2581	3.30
TDA2590	3.25
TDA2591	2.95
TDA2593	2.95
TDA2600	5.30
TDA2611A	1.95
TDA2640	2.92
TDA2680	3.40
TDA2690	1.35
TDA3560	6.00
TDA3950	2.50
TDA3960	2.50
TDA9503	2.50
UPC1185H	4.00
UPC566H	2.95
UPC575C2	3.40
UPC1025H	2.95
UPC1181H	1.62
UPC554	1.34
UPC1182H	2.95
UPC1186	98
UPC1156H	4.26
UPC1158H	78
UPC1163-H	98
UPC1212C	1.34
UPC1230H	3.95
UPC1350C	4.15
UPC1367	3.45
UPC1378H	4.49
STK435	9.06
STK441	8.10

VOLTAGE REG.

7805	78
7806	78
7808	78
7812	78
7815	78
7818	78
7824	78
78L05	68
78L08	68
78L12	68
78L24	68

7905	98
7906	98
7908	98
7912	98
7915	98
7918	98
7924	98
79L05	72
79L12	72
79L15	72
79L24	72

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

DIL to QUIL

14 way	32
16 way	34
18 way	37

QUIL to QUIL

14 way	32
16 way	36

T.T.L. 74LS SERIES

74LS00	58
74LS02	58
74LS03	58
74LS04	58
74LS05	58
74LS08	58
74LS09	58
74LS10	58
74LS11	58
74LS13	37
74LS14	46
74LS15	19
74LS20	19
74LS21	19
74LS22	19
74LS26	19
74LS27	19
74LS30	19
74LS32	60
74LS37	19
74LS38	20
74LS40	20
74LS42	36
74LS47	80
74LS48	80
74LS49	80
74LS51	19
74LS54	19
74LS55	19
74LS73	28
74LS74	26
74LS75	46
74LS76	22
74LS78	22
74LS83A	60
74LS86	26
74LS85	62
74LS90	35
74LS92	35
74LS93	35
74LS107	46
74LS109	27
74LS112	27
74LS113	27
74LS114	27
74LS123	52
74LS125	46
74LS126	46
74LS132	46
74LS138	48
74LS139	48
74LS151	44
74LS153	44
74LS155	44
74LS156	44
74LS157	90
74LS158	44
74LS160	60
74LS161	60
74LS162	85
74LS163	60
74LS164	65
74LS165	65
74LS174	57
74LS175	47
74LS191	66
74LS192	65
74LS193	66
74LS194A	69
74LS197	80
74LS240	80
74LS241	80
74LS242	76
74LS243	76
74LS244	80
74LS245	1.18
74LS251	54
74LS253	1.00
74LS257	53
74LS258	67
74LS259	74
74LS273	80
74LS283	50
74LS293	70
74LS352	1.54
74LS353	1.10
74LS365	36
74LS366	36
74LS367	36
74LS368	36
74LS373	99
74LS374	99
74LS393	80
74LS670	1.20

'4000 B' SERIES CMOS

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

SEMICONDUCTORS

AC107	35
AC126	30
AC127	32
AC128	32
AC128K	40
AC141K	39
AC142K	38
AC176	35
AC176K	32
AC186	41
AC187	35
AC187K	38
AC188	35
AC188K	39
AD143	82
AD149	98
AD161	54
AD161/2	1.15
AD162	54
AF106	49
AF114	89
AF118	1.20
AF121	75
AF124	48
AF125	46
AF126	46
AF127	38
AF139	58
AF178	1.54
AF239	60
AL102	2.00
AU106	2.50
AU107	2.00
AU113	2.00
BC107	20
(A),(B),(C)	20
BC108	20
(A),(B),(C)	20
BC109	20
(A),(B),(C)	20
BC114	12
BC115	17
BC116A	16
BC117	30
BC118	24
BC119	36
BC139	28
BC140	32
BC141	26
BC142	30
BC143	31
BC147	13
BC148	9
BC149	12
BC157	16
BC158	16
BC159	15
BC160	25
BC161	28
BC170B	15
BC171	15
BC171A	10
BC171B	10
BC172	15
BC172A	10
BC172B	10
BC172C	10
BC173C	12
BC174A/B	10
BC177	27
BC178	26
BC182	9
BC182L	12
BC183L	12
BC184L	14
BC204	10
BC208	13
BC209	10
BC212	9
BC212L	13
BC213	13
BC213B	10
BC213L	9
BC214	9
BC214	9
BC214L	15
BC237	14
BC238	14
(A),(B),(C)	
BC251A	18
BC252A	12
BC252B	12
BC261A/B	18
BC262A/B	18
BC300	50
BC301	33
BC303	33
BC307	20
BC308A/B	25
BC327	18
BC328	18
BC337	18
BC338	18
BC461	30
BC547	13
BC548	13
BCX32	30
BCX34	27
BC549	8
BC550	7
BC557	8
BC558	9
BCY72	13
BD115	45
BD116A	65
BD124P	79
BD131	50
BD132	49
BD133	60
BD135	38
BD136	38
BD137	38
BD138	35
BD139	35
BD140	44
BD144	1.70
BD150	60
BD159	65
BD160	1.90
BD166	52
BD179	70
BD182	1.20
BD183	75
BD201	85
BD202	91
BD203	80
BD204	99
BD222	46
BD223	56
BD225	47
BD232	68
BD233	60
BD234	63
BD235	60
BD236	65
BD237	57
BD238	65
BD243	85
BD244	85
BD410	79
BD434	74
BD437	86
BD438	94
BD507	52
BD508	55
BD509	56
BD510	60
BD517	60
BD520	75
BD526	62
BD535	82
BD536	91
BD696A	1.49
BD697	1.24
BD695	1.39
BD698	1.50
BD707	95
BDX32	2.10
BF115	38
BF117	36
BF125	26
BF127	47
BF154	23
BF158	18
BF160	27
BF167	24
BF173	22
BF177	52
BF178	46
BF179	28
BF180	39
BF181	39
BF182	36
BF183	29
BF184	36
BF185	36
BF194/394	16
BF195	16
BF196	16
BF197	16
BF198	18
BF199	21
BF200	35
BF224	25
BF225	20
BF241	25
BF256	55
BF257	28
BF258	25
BF259	35
BF262	84
BF263	75
BF271	24
BF273	24
BF274	24
BF310	30
BF311	30
BF336	36
BF337	41
BF338	41
BF355	56
BF362	68
BF363	72
BF371	30
BF457	35
BF458	43
BF459	43
BFR39	27
BFR90	1.74
BFT42	39
BFT43	39
BFW10	60
BFX29	40
BFX84	42
BFX85	30
BFX86	30
BFX88	46
BFY50	30
BFY51	30
BFY51	24
BFY52	24
BFY90	95
BR100	34
BR101	45
BR103	83
BRC4443	94
BRC4444	98
BRX46	40
BRY39	56
BRY56	57
BSW67	68
BSV57B	72
BT100	1.65
BT101	1.20
BT102/500	1.20
BT106	1.60
BT107	1.69
BT108	1.69
BT116	1.21
BT119	3.66
BT120	3.66
BT151/800	1.20
BU104	2.00
BU105	1.58
BU108	1.80
BU124	1.90
BU126	1.75
BU204	1.50
BU205	1.42
BU206	1.80
BU208	1.60
BU208A	1.65
BU208/02	2.10
BU326A	1.75
BU407	1.70
BU500	2.30
BU526	2.46
BU508	3.20
BU806	1.40
BU807	2.94
BUW81A	3.84
E1222	40
MJE340	68
MJ3000	1.98
DT112	1.91
DT121	1.91
R2008B	1.90
R2010B	1.92
R2265	1.50
R2322	62
R2323	67
R2461	1.50
R2540	2.80
RCA16334	90
RCA16335	90
TIP29C	43
TIP30A	47
TIP30C	43
TIP31C	55
TIP32C	42
TIP33B	75
TIP34B	1.06
TIP41C	47
TIP42C	50
TIP47	70
TIP120	65
TIP2955	90
TIP3055	63
TIS91	21
TV106/02	1.80
2N696	21
2N918	82
2N2904	51
2N2905	28
2N3054	60
2N3055	60
2N3702	11
2N3703	10
2N3705	10
2N3706	10
2N3708	17
2N2904	30
2N5294	48
2N5296	48
2N5298	69
2SB337	1.86
2N5496	53
2N6107	75
2N6109	81
2SA715	1.98
2SC495	1.10
2SC496	1.31
2SC643A	1.50
2SC1096	1.72
2SC1172Y	2.20
2SC1173Y	1.69
2SC1306	2.73
2SC1307	3.00
2SC1449	1.67
2SC1520	68
2SC1678	2.67
2SC1909	2.90
2SC1953	1.44
2SC2028	1.82
2SC2029	2.60
2SC2078	2.90
2SC2091	1.34
2SC2166	2.73
THY 15/80	2.20
THY 15/85	2.20
(General Purpose Thyristors)	
DEC 1 Multipurpose Thyristor	
DEC 2 Multipurpose Thyristor	£2.20

THERMISTORS

VA1104	75
VA1040	75
VA8650	55
VA1039	35
GEC Dual	
Posistor	1.68
2 0 4 0 (CK1)	1.98

L.E.D.s

5mm TIL TYPE

Red	14
Green	14
Yellow	14
Amber	22

T1 TYPE 3mm

Red	12
Green	14
Yellow	14

FLASHING

CQX21	62
CQX22 Red Only	66

3 COLOUR

Red/Green/Yellow V518P	76

PANEL CLIPS

3mm	4
5mm	4

CRYSTALS & FILTERS

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

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	80
ECF82	88
ECH81	1.60
ECH84	1.66
ECL80	84
ECL82	1.30
ECL86	1.99
EF80	95
EF86	1.96
EF183	99
EF184	1.09
EH90	1.02
EL34	3.50
EL84	1.05
EL90	82
EY86/7	68
EY500A	1.50
EZ80/1	56
GY501	1.45
GZ34	3.50
KT66	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	1.60
3AT2B	5.00
12BY7A	3.75

LINE OUTPUT TRANS.

R.B.M. T20A	13.95
R.B.M. A774 Mono	11.74
R.B.M. Z179	15.00
R.B.M. Z718 22"	19.50
PHILIPS 320	8.70
PHILIPS 210/300 Mono	10.00
PHILIPS G8	8.75
PHILIPS G9	7.75
PHILIPS G11	13.50
PYE 697 (Printed)	14.50
PYE 713/731	10.00
PYE 725 90°	10.50
PYE 169	10.00
DECCA 80/100	8.58
DECCA 1700	9.00
DECCA 1730	8.58
DECCA Z230	8.58
GEC 2110	9.45
GEC 2040	9.50
GEC 2200	6.65
ITT CVC 1-9	10.85
ITT CVC 25/30/32	8.65
ITT CVC 20	8.60
THORN 3000 EHT	9.95
THORN 3000 SCAN	7.95
THORN 8000	11.33
THORN 8500	11.33
THORN 9000	10.65
THORN 3000/3500 Mains	10.00
THORN 1591	8.68
THORN 1691	9.68
THORN TX10	12.50
THORN 1615	9.75
PHILIPS KT3	8.15
RANK BUSHRANGER	£10.00
PYE 741	7.95

WIREWOUND RESISTORS*

4W 1R-10K	24p
7W 1R-22K	26p
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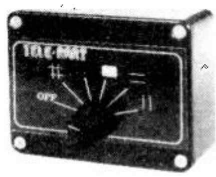

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TELEVISION

The Skills Required

At the end of last month's leader I commented that there's probably no harm in manufacturing under licence rather than undertaking the original research. The subject deserves to be kicked around a bit more, since it has great relevance to the UK's present industrial condition and where we go from here.

The point I wished to make was that there's no advantage to be gained from a bone-headed insistence on being scientifically or technologically self-sufficient. At the other extreme, to abandon research and come to rely entirely on imported technology, becoming in the process a nation of odd-jobbers for multinational companies based elsewhere, won't do either. To cut ourselves off from original technological development would in the long run be asking to cease to be a country with a substantial industrial base. The problem is what sort of balance to strike, how to allocate funds, resources and know-how, and in deciding what's worth doing and what's best left to others. There is also the interesting business of joint venture efforts, which can be quite different from simply manufacturing under licence.

The history of the UK's television industry has been a rather mixed one. There's been plenty of research and development, but not quite the same degree of success with applied technology for mass production. The UK did not develop a colour TV system, neither has it developed a VCR system. It did however pioneer TV development initially, played a major role in the application of solid-state technology to TV receiver use, developed teletext and viewdata and, more recently, the MAC system for satellite transmission. Plenty of R and D then, but not all along the line. This is as it should be. The world would have been no better a place with a UK colour or VCR system to add to the confusion in these fields. The basic technology here can be had under licence agreement. It's beneficial however if one has something to offer in return.

Joint venture agreements in the fullest sense involve two-way collaboration, with both sides contributing to the technology involved. Merely assembling bought in kits on the other hand means opting out of the technology concerned. An interesting example of a joint venture with technological commitment on both sides was highlighted last month – RCA and Hitachi's collaboration over the CED disc system. Joint venture arrangements that involve technical collaboration end up with both sides having a foot in the research department door.

It's not always easy to get at the full details of such joint ventures – they must, after all, be subject to a degree of commercial secrecy. But this sort of arrangement is an important way in which a country with limited means and technological resources can keep in touch with technical development. Provided of course one is in a position to offer technological collaboration. What one needs here above all else is qualified manpower. And this seems to be something of a problem.

UK universities are at present producing some 2,000 electronics *and* electrical graduates a year. This is nothing like enough, and is appalling in view of the hopes placed on the electronics industry in particular for future industrial regeneration. Plessey alone is on record as stating that it would like to employ another 700 graduates "in the electronics and other numerate disciplines". The company has reached the point where it has had to send recruiting officers to Australia and New Zealand and advertise on the continent. Plessey's personnel director Parry Rogers thinks that "the situation of skill shortages will get worse, and threatens to become the major limiting factor in our growth".

There is something deeply disturbing about this. Shortage of trained manpower affects not only companies like Plessey, which tend to do much of their own R and D work: it also affects the prospects for joint venture operations, whose importance for a country such as the UK we've just noted. A recent paper on foreign investment in the UK, produced by the Royal Institute of International Affairs, pointed out that one of the main attractions of the UK has been the availability of "scientific skills". It seems that this means much more to a foreign multinational company contemplating investment in the UK than the offer of hand-outs to locate plants in depressed areas. It may be that we have a just adequate pool of skilled people to meet current needs, but it's quite clear that the government and the educational authorities have been doing nothing like enough to ensure an adequate supply of trained personnel to meet future needs.

Unfortunately the problem doesn't stop with the need for a few more new graduates and technicians. The skills required are increasingly of a wider variety than numeracy and a specialist degree or certificate. Creative engineering ability tends to come with experience and means the ability to see opportunities in business and production terms as well as basic technological ones. How many engineers are there who've taken a course in business studies? The need is possibly for some restructuring of higher education. We need only look to certain other countries to see how it can be done. There are also some perhaps less obvious aspects of the need for a wide range of skills. There's been a fascinating correspondence recently in the *Financial Times* on the need for engineers to be able to speak Japanese. We tend to think of English as the international language of electronics, as indeed it is, but if you have to talk business to a senior Japanese engineer you will soon appreciate the importance of being able to do so in his own tongue. The significance of this in making joint venture agreements work is clear enough. But how many engineering degree courses include Japanese as an option? It's not entirely unknown, but hardly commonplace!

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COVER PHOTO

Our cover photo this month shows the aerials in use on Roger Bunney's lattice mast at Romsey, Hants. At the top a double stacked Triax BB u.h.f. grid system which is also at present being used for ATV reception. Lower down there's a 13-element wideband Triax Band III array, an omni-directional Triax 88-108MHz f.m. array and a three-element wideband Band I array.

NEXT MONTH

Watch out for next month's bumper issue – see page 300 for details.

Notes on the Rigonda VL100

Malcolm Burrell

These small (6in. tube) monochrome portables have been around for many years and were imported in considerable quantities. I've not had a lot to do with them but recently I wanted a small set for use as a simple video monitor. I bought a couple of VL100s in pieces and set about getting one of them going. Whilst most shops are reluctant to handle these sets, you quite often come across one in the corner of a workshop. The problem is lack of information and the Russian components with markings that tend to cause confusion. This is a bit of a pity. Although the design is very basic, they are interesting sets that can in most cases be repaired quite economically provided the tube is known to be good. The Television Tube Shop advertises the tubes at £14 plus VAT, and even this major replacement could still be a viable proposition.

The first point to note when servicing these sets is the Russian symbols for the transistor connections. As near as we can get, K is the collector, b the base and 3 the emitter (sometimes the shield as well).

Power Supply Circuits

The mains unit screws to the rear and supplies about 14V d.c. to the input socket at the back. If you haven't got one, it should be a fairly straightforward item to build. Alternatively a 12V car battery can be used.

The input from the mains unit or battery is fed to a series regulator which provides a 10·5V supply to operate the set. The bulk of this circuit lives on the top panel, with adjustment provided by R132. This is set for 10·5V at the collector of T27 (later version, see Fig. 2), which is mounted on a heatsink at the rear.

The main difference between the two versions of this chassis (Models VL100 and VL100M) lies in the power supply, see Fig. 1. In the earlier version a simple emitter-follower T26, with feedback to its base, drives the series regulator transistor T27. Three transistors are used in the later version. T30 provides sensing, driving the emitter of T26 by emitter-follower action. T27 is the series regulator as before.

Excessive voltage with a hum bar may well indicate a fault in the regulator. Check the transistors – the types don't seem to be very critical and things like the BC142 or BFY50 (npn) and the BC143 or 2N2905 (pnp) work well for the smaller types while a TIP32 can be used for T27 with modifications to the mounting.

The Signals Side

On the r.f. side, the rotary u.h.f. tuner can be one of two or three types and tends to occupy quite a large area within the set. In some versions there's a separate preamplifier stage. The main i.f. strip employs three transistors followed by a diode detector. The sound signal is extracted at the collector of the video driver transistor. There are two intercarrier sound amplifier transistors followed by a ratio detector. The five-transistor audio circuit uses a two-transistor class A output stage. While the video driver/output transistors, the audio driver and the a.g.c. transistors are npn types, the rest of the signal transistors are pnp types with their collector circuits returned to chassis.

One of the vision i.f. transistors in my rebuilt set was open-circuit. An AF117 put that right. The audio output transistors T28/29 were missing and, after replacing the bias diode D21 which was short-circuit, acceptable audio was obtained by inserting a pair of AC128s. One of the a.g.c. transistors was missing while the other was short-circuit. That good old standby the BC107 worked a treat in both positions.

A BF337 can be used in the video output transistor position (T5).

Timebase Circuits

The line output transistor T25 is mounted inconspicuously alongside the top regulator panel, which also houses the line output transformer. I was interested to see what might happen if you need to replace the line output transistor, so I wired in a TIP32 – it worked! An AU110 is reputed to work here, with possibly some alteration required to the values of the flyback tuning capacitors C81/2. The deflection power requirements are very low, due to the 70° tube with its extremely narrow neck. One bonus from this is the lack of heat developed, and I would think that most line output transistor failures are likely to be the result of the inherent problems with germanium

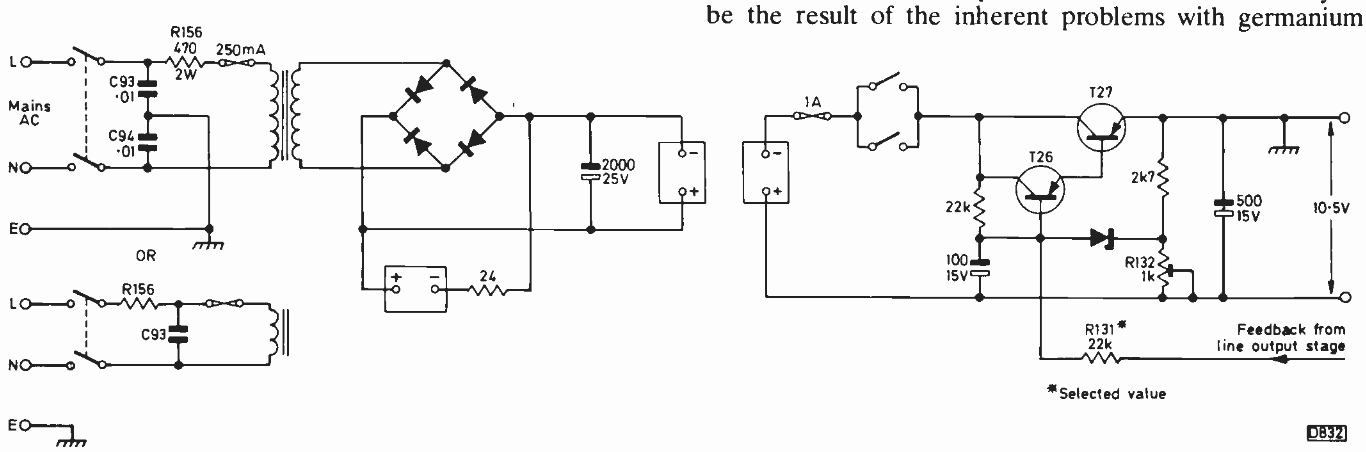


Fig. 1: Mains unit, with battery charging socket, and the earlier two-transistor series regulator circuit.

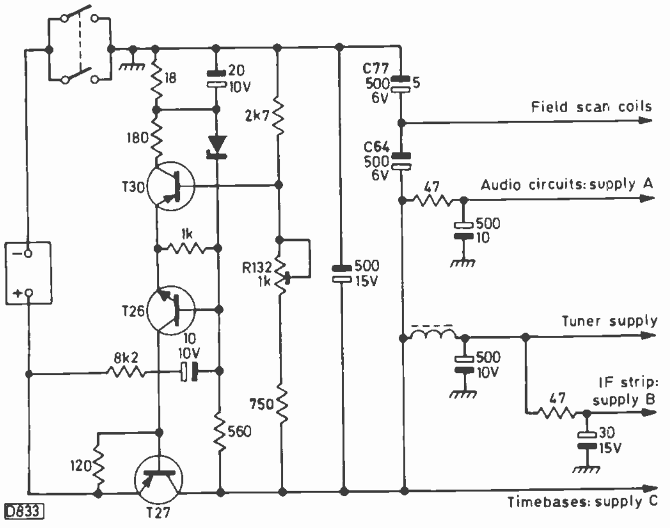
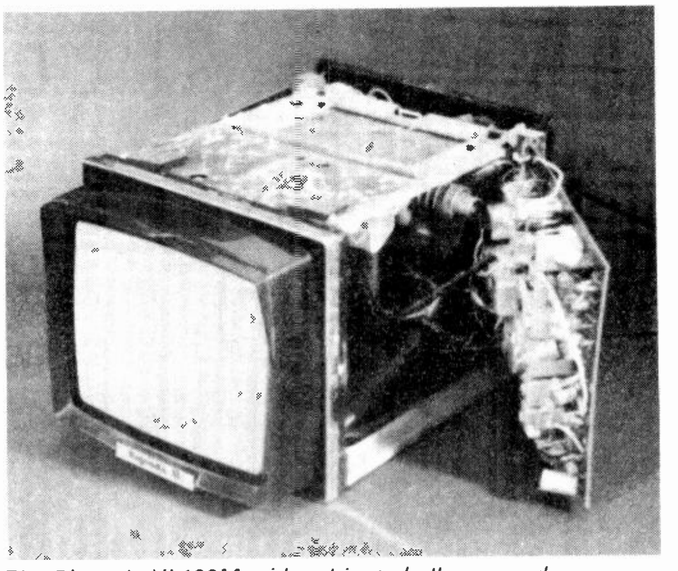


Fig. 2: Later three-transistor regulator circuit.



The Rigonda VL100M with cabinet shell removed.

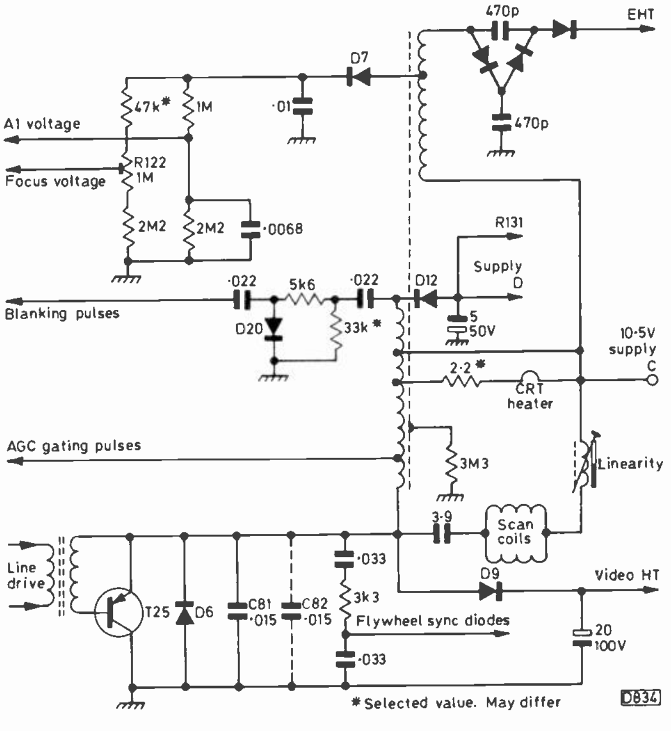


Fig. 3: Line output stage circuit.

types rather than overwork.

The field timebase is a bit unusual. The first stage T13 is an emitter-follower used to apply the negative-going field sync pulses to the emitter of T14. When they occur, T14 switches off and T15 switches on to discharge the field charging capacitor C57. This gives the flyback. During the scan, C57 charges via T14 and T16. Linearity feedback is applied to the emitter of T16. In the absence of field sync pulses T14 will switch off when the negative charge on the left-hand plate of C57 exceeds the fixed bias applied to the base. R78 acts as the hold control. The oscillator section is followed by a complementary-symmetry driver stage and a totem-pole output stage. AC188s with heatsinks can be used in the output stage. I found that field sync was weak due to T13 being open-circuit base-to-collector: fitting a BC212 in this position gave marvellous locking.

Out of curiosity I tried a BC107 in the sync separator position (T21). It worked quite successfully. The sync separator feeds T13 in the field timebase, via a double integrating network, and the phase-splitter transistor T22 in the flywheel line sync circuit. A BC212 was tried in the line oscillator position (T23) but it was necessary to reduce the value of R108 to restore the correct frequency. The line driver is T24.

Faults and Servicing

Whilst soak testing the rebuilt set a sound fault put in an appearance – there was intermittent volume variation, crackle and sometimes excessive intercarrier buzz. Probing and voltage checks were unhelpful, but a replacement AF117 in the T8 position put an end to the trouble. It seems that the transistors used in the intercarrier sound channel are prone to be noisy.

Several hours elapsed before the set eventually went dead, with a puff of smoke from the power unit. R156 was the source of the smoke and C93 was found to be short-circuit. Replacing these components restored normal operation.

Since the panels hinge outwards for service, sudden loss of sound, vision or odd effects should direct attention first to the wire connections, which have a habit of fracturing close to the board.

The earphone jack socket was not present in the sets I had, though one was used as the aerial connector. Removing this and drilling a larger hole enabled me to use a

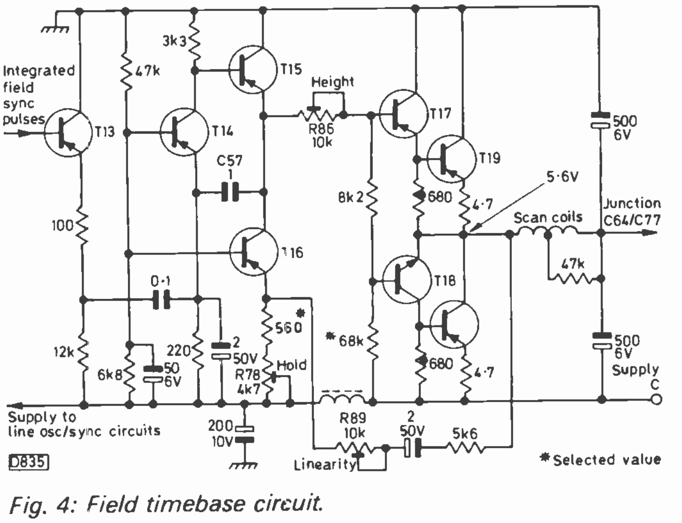


Fig. 4: Field timebase circuit.

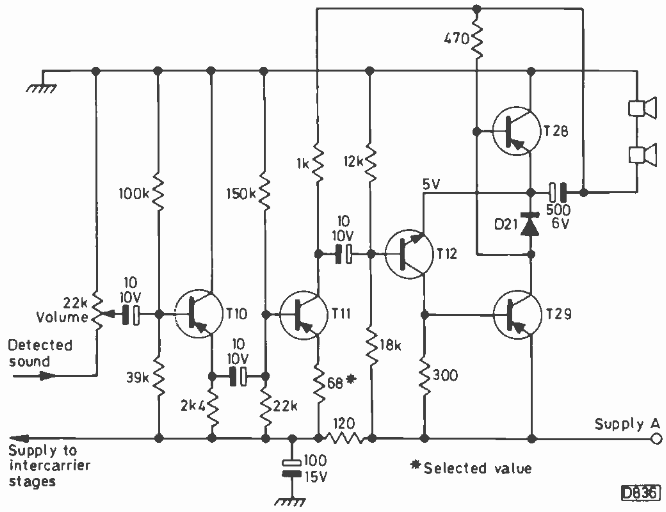


Fig. 5: The audio circuit.

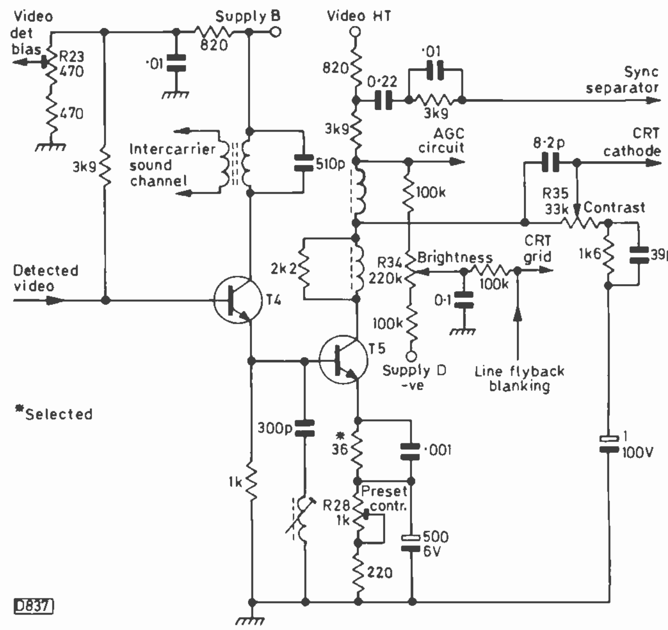


Fig. 6: Video driver and output stages.

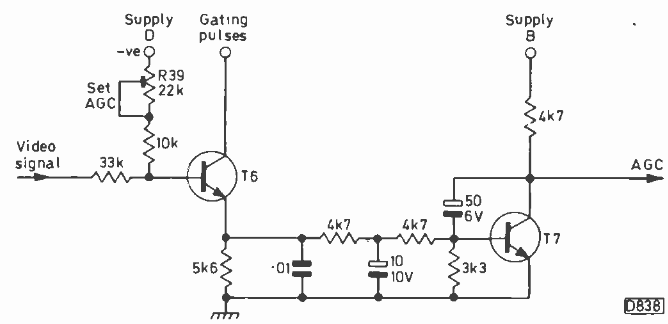


Fig. 7: A.G.C. circuit.

chassis-mounting coaxial socket – some difficulty was experienced as the tuner connections tended to foul this when the panel was hinged down. No isolation components are required.

Spare parts are available from Rigonda Supplies, 332 Cann Hall Road, London E11. Send a s.a.e. with enquiries.

These are quite nice little sets, soundly built and probably better than some small screen portables from other parts of the globe.

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AC131	40	BC172	9	BC559	8	BF180	33	BFR90	1.74	OT121	2.08
AC138	40	BC174B	23	BC595	8	BF181	30	BFR91	2.08	R1038	80
AC141K	39	BC177	24	BCX33	22	BF184	30	BFT42	30	R1039	80
AC142K	38	BC182LB	12	BCX34	11	BF185	30	BFT43	30	R2008B	1.40
AC153	39	BC183L	12	BD115	49	BF194	16	BFX38	40	R2010B	1.10
AC176	33	BC184L	13	BD131	30	BF195	16	BFY50	30	R2030	70
AC176K/		BC187	24	BD132	46	BF196	16	BFY51	34	R2265	1.30
AC128K	93	BC204	15	BD133	59	BF197	15	BFY52	34	R2305	80
AC188	38	BC208	9	BD139	36	BF198	19	BRC116	1.50	R2322	50
AD142	1.18	BC212L	9	BD140	38	BF199	15	BRC1693	1.43	R2443	25
AD143	1.08	BC213L	12	BD144	1.70	BF223	18	BU105	1.00	RCA16446	30
AD149	98	BC237	12	BD163	98	BF224	19	BU126	1.10	RCA16599	1.25
AD161	32	BC238B	8	BD201	74	BF238	20	BU207	1.05	RCA16600	1.40
AD162	32	BC238L	8	BD203	78	BF240	9	BU208	1.15	RCA16799	1.13
AD263	1.05	BC250A	15	BD204	99	BF241	21	BU208A	1.15	RCA16800	1.42
AF127	45	BC251	8	BD222	48	BF255	10	BU326A	1.30	RCA16802	1.38
AF139	38	BC252A	20	BD225	52	BF256S	20	BU407	1.70	S1299	2.25
AF239	41	BC294	37	BD232	50	BF257	28	BU408	2.76	S28000	1.25
AU113	2.10	BC301	32	BD233	60	BF259	28	BU500	2.30	S6080A/B	3.50
BC107	15	BC303	31	BD234	60	BF271	25	BU526	2.46	T6050V	1.30
BC108	15	BC307	10	BD237	55	BF274	11	BU807	2.94	T6052V	1.30
BC109	15	BC308	8	BD238	65	BF337	29	C1129	9	T9003V	1.25
BC115	16	BC309	14	BD241	59	BF338	34	C1172B	9	T9010V	1.45
BC117	21	BC327	18	BD244	85	BF355	40	E5386	54	T9053V	1.30
BC125	26	BC328	18	BD278A	81	BF362	50	E9003	28	T9054V	1.00
BC126	23	BC337	17	BD386	68	BF391	21	E9005	25	T9039V	1.10
BC139	27	BC338	17	BD433	71	BF394	16	ME0404	10	TIC45X	50
BC141	34	BC347	8	BD437	83	BF422	47	ME0412	10	TIC46	48
BC142	30	BC394	8	BD592	1.20	BF423	53	ME6002	10	TIC106C	40
BC143	31	BC454	8	BD589	1.20	BF450	43	MJ2501	2.36	TIP29	42
BC147	12	BC455	8	BD677G	1.35	BF453	53	MJ3001	2.21	TIP30	42
BC148	12	BC456	10	BD707	95	BF458	37	MJE182	47	TIP31	35
BC149	12	BC460	40	BD708	95	BF459	40	MJE340	50	TIP32	43
BC153	16	BC463	22	BDX10	93	BF461	59	MJE520	50	TIP33	61
BC1540R	16	BC546	8	BDY20	1.09	BF556B	35	MJE2955	1.40	TIP41	42
BC154YL	16	BC547	12	BDY82	99	BF596	15	MJE3055	15	TIP42	45
BC157	12	BC548	12	BF137	20	BF694	16	NKT241W	8	TIP110	61
BC158	12	BC549	8	BF153	20	BF757	62	NKT241G	8	TIS91	25
BC159	15	BC557	10	BF154	25	BFR52	31	NKT241Y	8	ZTX550	30

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BRC1330	1.40	SN76013ND	1.80	TBA530	1.26	TDA2030	2.10
BRC3064	1.00	SN76023N	1.80	TBA540	1.00	TDA2522	2.10
BRC/M/200	1.00	SN76033N	2.00	TBA550Q	1.82	TDA2530	2.61
BRC/M/300	1.00	SN76115	2.00	TBA560C	1.50	TDA2540	3.50
CA3060	1.58	SN76131N	1.58	TBA641	2.05	TDA2560	3.50
LM1303P	1.48	SN76226N	1.25	TBA651	2.50	TDA2581	3.00
ML231B	2.20	SN76227N	1.00	TBA720A	2.49	TDA2591	1.96
ML237B	2.00	SN76530P	1.30	TBA750	2.20	TDA2611A	1.95
ML239B	2.86	SN76622N	1.00	TBA800	1.62	TDA2640	2.90
MC1327AP	1.25	SN76660N	80p	TBA920	2.08	TDA2690A	1.50
MC1358P	1.30	SN76666N	75p	TBA950	1.95	TDA3560	6.00
MC1455P	18p	SN76744	1.92	TBA1440	1.92	TDA9503	2.90
MC14516BCP	60p	TA7117P	1.00	TCA270SA	1.05	TCEP100	3.48
SAA1025	7.20	TA7109AP	2.80	TCA270C	1.05	TEA1009	1.95
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SL432A	1.80	TBA120C	1.20	TDA10351	3.50	MC14514	5.00
SL1430	2.50	TBA120CQ	70p	TDA1037	2.72	UA758PC	2.50
SN15846N	60p	TBA120S	70p	TDA11705	1.50	UA1008A	2.66
SN74123N	65p	TBA120U	1.00	TDA1200	2.42	ULN2165	1.30
SN74154N	1.40	TBA395	1.00	TDA1270	2.76	ULN2216A	1.25
SN76001N	1.40	TBA480Q	1.40	TDA1327	2.53	UPC1365C	5.75
SN76110N	1.14	TBA510	1.90	TDA2002	2.80	SC9488P	1.40
						SC9511P	1.40
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Thorn 8/8K5 ex equip panels untested

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Thorn 9K ex equip panels untested

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Thorn 120+72+300	50p
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Pye 3R5+15+45 (713)	90p
Philips 2R2+682	90p
Philips 47R	52p
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Thorn 8/8500 Plastic	1.45

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Thorn 1500 3 stick	1.80
Pye 713 4 lead	5.83
Pye 713 5 lead	5.97
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200+150+50	350V	60p	50+50+8	300V	55p
200+200+100	325V	54p	100+50+100	350V	55p
32+32+16	275V	52p	16+16	350V	45p
200+200+100+32	350V	70p	100+150+50	350V	55p
100+50+150	350V	58p	2500+2500 (Thorn 8K)	63V	1.20
400+400	200V	72p	150+150+100	300V	1.80
32+32+16	350V	52p	200+47	250V	65p
200+32+300+100	350V	70p	500+500 175V Thorn TX9		1.00
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200+100	325V	65p	470 250V Philips G11		1.50
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200+100+100+50	350V	60p			

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100MF 150V	65p	2000MF 30V	50p
100MF 250V	70p	2200MF 40V Thorn 4K	95p
100MF 450V	75p	2500MF 35V	65p
220MF 400V Thorn 9K	1.30	2500MF 40V	65p
220MF 450V Thorn 4K	1.30	3000MF 30V	65p
400MF 350V Thorn 8K	1.00	3300MF 16V	50p
800MF 250V Print type	80p	3300MF 25V	60p
800MF 250V	70p	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 CVC8 On/Off Switch	65p
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

DIODES

AA112	8p	IN4003	4p
AA119	8p	IN4004	5p
AA143	8p	IN4005	5p
BA115	8p	IN4006	5p
BA154	8p	IN4007	6p
BB103	8p	IN4149	6p
BB105B	30	IN4742A	8p
BR303	46p	IN5254B	8p
BT106	1.50	IN5349	14p
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BY127	12p	IN5406	16p
BY188	16p	IN5408	16p
BY204	26p	IS025	8p
BY206	16p	IS131	8p
BY207	16p	IS1658	8p
BY208/800	38p	MR854	35p
BY223	95p	SKE1/02	20p
BY225	1.20	MCR106/1	1.00
BY227	28p	MCR406	35p
BY298	22p	2N4444	1.50
BYX22/400	30p	Y827	80p
BYX55/600	30p	Y969	75p
BYX71/350	80p	ZX150	12p
BZV15 C12R	1.16	OA91	5p
BZV15 C24R	1.16	MCR106/7	1.00
IN60	8p	MCR106/8	1.50
IN2070	8p	TD3F800H	2.80
IN4001	4p	TD3F800R	3.00
IN4002	4p	BY255	30p

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VS9500	29.95
VS9700	29.95
VS9800	29.95
BUSH	
BU6900A	38.95
FERGUSON	
3V00	29.95
3V16	29.95
3V22	29.95
3V24	29.95
3V30	29.95
GRUNDIG	
SUR4004	72.45
2000GB	63.00

RECORDER Model No.	Head Price £ + VAT
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VT3000E	38.69
VT5000ER	38.69
VT8500E	38.69
JVC	
HR3300	29.95
HR3660EK	29.95
HR7200EK	29.95
PANASONIC	
NV2000	29.95
NV2010	29.95
NV366B	38.13
NV777B	63.64

RECORDER Model No.	Head Price £ + VAT
PHILIPS	
1500	54.07
1502	54.07
N1700	59.50
N1702	59.50
N2000	59.50
SANYO	
5000	47.24
5300	47.24
5600	47.24

RECORDER Model No.	Head Price £ + VAT
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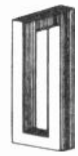
SONY	
C5	38.95
C6	38.95
C7	38.95
8000UB	38.95
8000E	38.95
8080	38.95
8080E	38.95
TOSHIBA	
V5250B	38.95
V5470B	38.95



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C7 & J7	4.25
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HR3360	4.50
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Wideband UHF Preamplifier

Roger Bunney

For minimal displayed noise (snow) on the screen, a preamplifier for use with weak signals should have the lowest possible noise figure, lower than that of the tuner's first r.f. amplifier stage. The ubiquitous OM335 hybrid preamplifier is not good enough in this respect: despite its high gain, typically 27dB, the noise figure of 6dB is somewhat above that of a u.h.f. tuner's first stage. It's a sad fact that many enthusiasts go for an amplifier with a high gain figure without considering the noise level: a 20dB gain with 5dB noise will produce degraded performance compared to a gain of 10dB with a 2dB noise figure.

The unit described in the present article was constructed for indoor use as a first-stage amplifier. It has linear operation across the u.h.f. bands, freedom from overload or instability, a lowish gain (typically 11·5dB) and a low noise figure (typically 2dB). If the amplifier is used following a mast-head amplifier there will be little improvement in weak signal performance since the system noise figure will have been set up the mast. It's vital that the first stage of electronic amplification contributes as little noise as possible.

Fig. 1 shows the circuit, which uses a BFR91 low-noise wideband amplifier transistor capable of operating at over 1GHz. With a collector current of 3mA, the noise figure at 500MHz is 1·8dB. Between 2-5mA the noise figure is under 2dB. The circuit is arranged so that Tr1 passes 4·5mA at 9V. Tr1's collector load consists of the u.h.f. choke L2 and the series damping resistor R3, the ratio of the turns to the value of R3 giving a slight lift towards the top of Band V. The value of R3 could be reduced to say 68Ω or 82Ω to flatten the response. Using an extra turn for L2 will move the peak in the response to group A or B. The winding is made from one of R3's leadout wires. D1 provides reverse polarity protection.

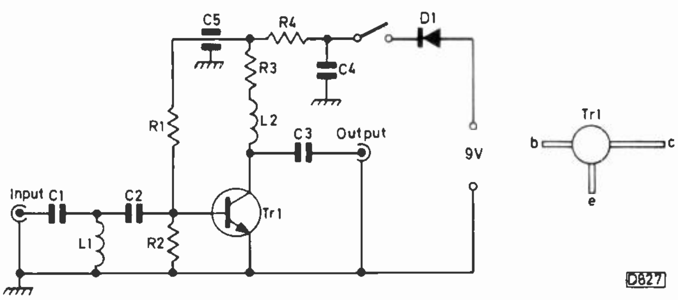


Fig. 1: Circuit diagram.

Component details

C1, C2 4·7pF
C3 5·6pF
C4 0·001µF
All 63V ceramic plate
C5 0·001µF feedthrough
R1 10k
R2 1·5k
R3 120
All ⅓W, 10% low-noise carbon film
R4 220, ½W
L1, L2 2¼ turns, ⅛in. diameter
Tr1 BFR91
Available from Ambit
D1 BA148 etc.
Box RS509-923.
Coaxial sockets RS455-539, surface mounting
Subminiature SPST switch

Construction

The smallest RS diecast box (35mm wide) was used, with the amplifier built across it on a small piece of copper-clad laminate held by the coaxial socket mounting bolts via 6BA tags soldered to the copper side. Use short lead lengths following normal u.h.f. practice. Since a 9V battery cannot be accommodated within the box, 2mm sockets are fitted for the supply.

Performance

I've found the design to be repeatable – the amplifier was originally conceived as part of a forthcoming DX-TV project. No alignment is required and the amplifier should work on completion.

For DX reception I use the ET021 series tuner, whose MOSFET amplifier has a very low noise performance. Because of this, many preamplifiers provide no improvement. With the present design however recognisable pictures are obtained with inputs as low as simply line syncs (P½ to P1½-2 on the ATV scale). There's complete stability across the spectrum with or without input termination. At 9V the noise figure is typically 2dB and the gain is as follows: 11·5dB at 470MHz; 11·5dB at 500MHz; 11·2dB at 600MHz; 11·6dB at 700MHz; 13·8dB at 800MHz; 13dB at 860MHz. The unit will work happily at up to 12V, but don't exceed this voltage.

Use of a tuned collector circuit, i.e. two turns tuned with a 2-10pF trimmer and with R3 deleted (and the value of R4 increased to compensate) would increase the gain and reduce the bandwidth. For increased wideband gain, C3 could be taken to the base of a second BFR91 transistor.

The amplifier is particularly useful where a nearby high-powered transmitter makes the use of a mast-head amplifier impractical.

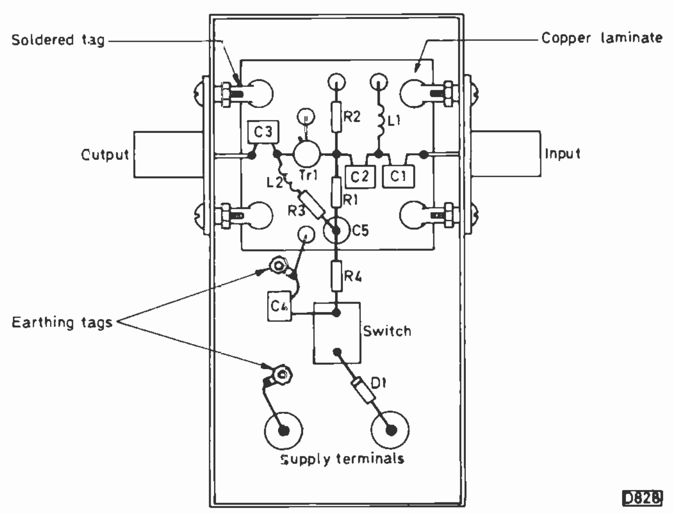


Fig. 2: Constructional details.

Teletopics

SATELLITE PROSPECTS

Douglas Hurd, the Home Office minister responsible for broadcasting, is on record as saying that the government would like to see a UK satellite TV service using a UK satellite. Wouldn't we all? But progress towards this aim seems to be painfully slow following the collapse of the BBC's plans to start a service in 1986. The tripartite working party set up to investigate the possibility of a co-operative DBS project, with representatives from the BBC, the IBA and the Independent Television Companies Association, has completed its initial investigation and has reported back to Jeffrey Sterling, the chairman of P & O and special adviser to industry secretary Norman Tebbit. Having identified the main problems, the working party has now set to work on a suggested plan of action.

Unfortunately, many of the problems are not of the sort that can be resolved quickly. There is in particular the problem of who should be authorised to spend money from which sources on setting up a DBS service? This is compounded by the fact that the present ITV companies' franchises will come up for review within the time scale of the establishment of a DBS system. Do we, this time round, ignore the elaborate legal requirements that were laid down to ensure the accountability of ITV companies to the public? Or do we alter the franchise system, as is being suggested? Whatever the answer, legislative action will be required and will introduce delays. This is something that can't be got round, as the government's recent problems over cable prove (see below).

Another problem is the likely cost of satellite receiving equipment. An official estimate that an installation could cost some £500, implying a monthly rental of around £16, is considered to be beyond what the public would find acceptable. The BBC's chairman Stuart Young has suggested a £50 subsidy for each adaptor and tax incentives to TV rental companies to enable them to keep their charges down. Sir Clive Sinclair has made a characteristic contribution to this aspect of the subject in announcing that Sinclair expect to be able to provide DBS installations, including the dish, down-converter and descrambling electronics, at around £100. The broadcasting authorities have welcomed this prospect, though other manufacturers expressed doubts. One wonders whether the idea would be to offer such units as loss leaders initially until production built up? Apparently however Sir Clive's main interest is in producing high-definition sets for DBS reception at around £500 each.

Douglas Muggeridge, managing director of BBC External Broadcasting, has suggested that an international satellite TV service should be established, i.e. a TV version of the BBC's world radio service. The BBC has been conducting an enquiry into the prospects for an international TV news service. Anything of this sort would require government funding of course.

In Japan, Mitsubishi have announced a DBS receiver system for use with the BS2a satellite, which is due to start transmissions this May. The satellite's main purpose is to eliminate areas of poor reception, but it's also expected to signal the start of the DBS age in Japan. Of particular interest is the use of digital pulse code modulation for the sound channels, giving high-quality sound similar to that obtained from the new compact audio discs. Mitsubishi's receiver system consists of a 75cm offset-type dish with low-noise converter and tuner. The use of Mitsubishi's dual-mode horn gives the aerial an aperture efficiency of over 70 per cent, which compares with 55-56 per cent for a conventional parabolic dish.

CABLE TV

The eleven cable operators who were awarded interim franchises last December have been told that due to legal problems firm licences will not be granted until late this summer, nine months later than originally planned. The government has discovered that it doesn't have the legal authority to issue licences until the Cable Television Bill and the Telecommunications Bill receive royal assent. Instead, the government has offered to issue letters of intent or provisional licences under the 1981 Telecommunications Act. The problem the operators have is in raising finance to start developing their systems, which is in turn delaying prospective start-up dates for the services. Michael Storey, managing director of Westminster Cable, commented that "it's not clear what has been achieved by the whole frenetic business of the interim franchises".

British Telecom has been awarded a contract to supply its Gamestar cable TV games service to Rediffusion's one million subscribers in the UK. A connection fee plus £9·95 a month rent for a Sinclair Spectrum microcomputer will be charged: twenty games a month will be provided, five being changed each month. A British Telecom spokesman commented "we expect to supply a growing number of interactive services as the cable industry expands."

BLUE TUBES

A reader recently sent us a cutting on the subject of tubes with light blue screens. Not that you would expect to find them in use in the UK. The idea is to use a phosphor system that filters out light in the yellow/green spectrum to give sharper contrast and improved brightness under brilliant lighting or sun-drenched viewing conditions. The rare earth element that gives the screen the blue appearance when the set is switched off is neodymium oxide. Sets fitted with these tubes are on sale in Japan and the USA.

AYR AGAIN

GEC-McMichael have acquired Ayr Viewdata, the manufacturer of teletext and Prestel adaptors that went into voluntary liquidation just over a year ago, and have resumed production of the former range at Ayr's West Byfleet, Surrey factory. Dealers interested in stocking these adaptors should contact GEC-McMichael Ltd. at Sefton Park, Bells Hill, Stoke Poges, Slough SL2 4HD.

VIDEO

Mitsubishi and Sanyo are both to double assembly of VCRs in the UK, from the present rate of 5,000 machines a month to 10,000. Sanyo has also announced plans to start production of VHS machines in Bavaria. Tatung and Binatone are expected to set up VCR assembly lines in the UK – Binatone is at present negotiating a licencing agreement with JVC. ITT's plans are to start production of VHS machines at their Bochum TV factory in W. Germany. The tape transport system will be imported but the electronics and control systems will be ITT designed, using some of ITT's digital TV electronics (Digivision).

Sharp is the latest firm to join the ranks of those who've announced their intention to introduce an 8mm camcorder later this year.

A new edition of the Ferguson "100 Questions and Answers on Video" has been published: 85,000 copies of the first edition were distributed. Copies can be obtained from the Ferguson Video Advisory Service, PO Box 121, Lea Valley Trading Estate, London N18 3BP. The new edition has been updated and revised to include the latest generation of video products.

New VCRs have been introduced by Mitsubishi, Hitachi and JVC. The Mitsubishi HS330 is a full-specification, two-speed machine with a suggested retail price of just under £700. Hitachi's VT33 front loader will replace the popular VT11 at a suggested price of around £450. JVC's new budget model HR110 is a non-remote control version of the HR120.

David Rozalla, managing director of Warner Home Video in the UK, has commented on the successes achieved against video piracy in the UK. He attributes this to the establishment of the Federation Against Copyright Theft in January 1983. Estimates suggest that piracy at present accounts for some 35 per cent of the UK market, down from a level of 65 per cent two years ago. Pirate cassettes with a street value of over £1m were seized in the UK last year. It seems that the pirates have moved to the continent, where they are said to be supplying some 70 per cent of the W. German, French and Benelux markets.

A somewhat contentious report on head wear with different brands of video tape has been released by 3M. The tests were not carried out under normal operating conditions, and the scale of the investigation was so small as to be statistically worthless. Measurements were made by comparing photomicrographs obtained using a scanning electron microscope before, during and after exposure of the sample head assemblies to the tape, the accuracy of the measurements being limited by the resolution of the photographs and the repeatability of the measuring operator. For what it's worth, Scotch, Maxell, Fuji and Memorex tapes all came out well.

The latest suggestion for entertaining bored pub-goers is the coin-operated video jukebox. The idea is that you get a three-minute film along with the music you select.

SONY'S MOVE

Sony (UK) have moved to a new head office in Staines, after fourteen years at Pyrene House Sunbury with offshoots at Slough and Andover. The new address is Sony (UK) Ltd., Sony House, South Street, Staines, Middx TW18 4PF (Staines 61688).

AVO'S LCR METER

An LCR meter, Model B183, has been added to the AVO range – it's very similar in appearance to the 2001 digital multimeter reviewed in these pages last February, being a hand-held, 9V battery-operated unit with LCD display. There are six inductance ranges from 2mH to 2H, seven capacitance ranges from 200pF to 200μF and seven resistances ranges from 20Ω to 20MΩ. Measurements are made using a sinewave test signal at a frequency of 1kHz or 100Hz depending on the range selected by the eight-position slide switch. Price to the trade is £185 plus VAT.

TV EQUIPMENT

At an expected inclusive retail price of around £400, Fidelity's latest introduction, the AVS1600 audio/TV rack system, should be a considerable success. The AVS1600 incorporates a 16in. colour set with remote control, eight preset channels, stereo sound capability and a spatial sound option to create a stereo effect through the separate, floor-standing speakers. It also incorporates a full monitor function for video and computer games sources via a 21-pin SCART socket, an anti-glare glass front and a headphone socket with volume control. The three-waveband tuner covers stereo f.m. plus MW and LW with synthetic stereo. The belt-driven record turntable glides in and out from behind an automatic flip-up inspection window at the touch of a button. Above this is the cassette recorder which can record from any of the other items including the TV set. The amplifier provides 8W r.m.s. output per channel (24W total music power) and can be used with all the other items including the TV set. Its features include dynamic noise reduction on all inputs, headphone and microphone sockets, and a comprehensive set of controls. The speakers are of the bass reflex type, with separate tweeters.

Ferguson and ITT have both introduced infra-red remote control versions of their 14in. colour sets. The Ferguson 37141 is fitted with the TX90 chassis and has voltage synthesis tuning with station memory.

The first Luxor models fitted with the new SX9 chassis (see article in our January issue) have now been released. These are the 22in. 5636 and the 26in. 6736.

FOCUS ADJUSTMENT

A new method of focus adjustment is being introduced at ITT's Basildon plant. It's based on the use of a meter to measure the light output from the tube phosphor in a way quite different from that employed by an ordinary photometer. A property of this measured light output has been found to coincide with optimum focus.

CRT REBUILDING EQUIPMENT

The Faircrest Engineering Ltd. range of c.r.t. rebuilding equipment is now being distributed by V.N. Barrett and Co., Ltd. of 1 Mayo Road, Croydon, Surrey CR0 2QP (01-684 9917). The company can supply all the equipment required for reprocessing both monochrome and colour tubes and in addition offers a full training scheme.

CCTV SYSTEM

Frowds Ltd. (4 Northarbour Road, Cosham, Portsmouth, Hants PO6 3TJ) have introduced a sophisticated CCTV surveillance system using a fully weatherproofed camera that can be fitted with various types of tube. The circuitry incorporates refinements to maintain performance over a wide range of lighting conditions, and an optional built-in telemetry system enables the camera to be remotely controlled via the coaxial cable at up to 1·7km.

PHILIPS-GRUNDIG

Further details of Philips' plan to take control of Grundig (see page 177, February) have been announced. The scheme is a complex one in which Philips, while achieving effective day-to-day control of Grundig, will actually end up with a smaller stake in the company – a reduction from 24·5 per cent to 22·9 per cent. Philips will first take over a further 7·1 per cent of Grundig's nominal capital, but at the same time a group of banks led by Dresdner Bank will take over a block of Grundig AG profit participation rights certificates which will later be converted into ordinary voting shares, leaving the banks with a 27·5 per cent interest in Grundig. The aims of these moves seem to be to satisfy the W. German Federal Cartels Office, provide Grundig with fresh investment funds, and ensure that joint Philips-Grundig administration is achieved whilst maintaining Grundig's operational independence. A Philips' nominee is to become chairman of the Grundig board of management on the retirement of Dr. Max Grundig, who will be 75 on April 1st.

HDTV

A new volume, "Compatible Higher-Definition Television", has been published by the IBA as the twenty first in the series of occasional engineering texts that have been provided as a service to broadcast engineers and students since 1972. The profusely illustrated 48-page book reflects interest in the development of TV systems capable of providing significantly higher quality colour pictures than are possible using any of the present broadcasting standards. In particular the argument is put forward that the MAC system proposed by the IBA and accepted by the government for satellite TV broadcasting is also capable of providing higher definition displays with a wider aspect ratio. The suggested E-MAC (extended-definition MAC) system would make optimum use of the information handling capacity of European satellite channels to give results at least comparable in quality with the HDTV system proposed and developed by NHK (Japan), without incurring the severe bandwidth and non-compatibility problems inherent with the NHK system.

Enquiries about the book should be sent to the IBA Engineering Information Service, Crawley Court, Winchester SO21 2QA.

VCR Clinic

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

Ferguson 3V36

A Ferguson 3V36 was sent in by a dealer from another dealer, with a vague account that there was a servo fault and that the dealer of the first part had apparently contacted Ferguson who had suggested replacing the servo board. The dealer of the second part didn't know whether this had been done. So it was up to us to play "spot the fault", a game most readers in service departments will have played when customers or sales staff can't be bothered to give any more comprehensive details than "faulty".

The first symptom encountered was a spotty picture not unlike that caused by a dirty video head, but with my luck it would turn out to be more complicated. Andy was optimistic however and got on with cleaning the heads (regular readers will note Andy's promotion to Head Cleaner). This, amidst cries of "told you so", did little good, so the replay f.m. signal was checked. Only one output was evident, and the drum flip-flop signal was only a single pulse instead of the usual symmetrical squarewave. Misadjustment of the drum PG pulse level control R459 was the cause of the incorrect waveform, and after setting up the drum and capstan servos normal record/playback functions were restored. Great, on with the covers.

That was when Andy decided to check the still frame performance. The tape stopped dead in its tracks with a very spotty picture, showing that the frame advance circuits were not operating to give a clear picture. If that wasn't bad enough, we couldn't get back into play. In fact we couldn't select anything or even switch the machine off to standby. The little red lights for stop, fast forward etc. followed the buttons, but the operate light stayed on. The only way to restore operation was to unplug the machine at the mains supply. It then worked normally until we selected pause, when it again locked out.

Measurement showed that the microcomputer IC201 was holding the capstan motor forward/reverse selector IC206 fully off. In a vain attempt to restore operation, I applied a full reset to the microcomputer chip by earthing pin 22. Surprise, surprise, everything then worked correctly, including the still picture circuit. So the noise bar and anti-bounce potentiometers could be set up, giving a very good still frame. Andy remarked that one of our own customers had had the same problem, and that unplugging the machine for a while at the mains had cured it. I wonder if this is a problem? Great, on with the covers.

Andy then suggested trying picture search and the timer before the machine went out. It was unlikely that picture search would be faulty, as it would have shown up whilst we were doing other things, but we tried it. Clang. Off with the covers. Selecting picture search is simple. The picture then broke up into horizontal lines which got bigger until there were no lines at all, indicating that the heads were not whizzing round. The safety circuit then operated and the tape unthreaded.

Various checks were made, including connecting one of the inputs (pin 12) to the servo operational amplifier IC406 to earth when picture search was selected. This stopped the drum servo. We're getting somewhere! The circuit back to pin 6 of the main servo chip (IC403) was then followed through (see Fig. 1). During playback there's a squarewave here. It was still present in picture search, but the output from the integrator (R456 etc.) was absent. R456 had a voltage at the IC403 end, but not at the IC406 end. Something was earthing the servo output between IC403 and IC406, and that something was IC405. By isolating pins 10 and 11 of IC405 we found that when pin 12 went high pin 10 would be earthed by an internal fault within the i.c. So the chip was changed to a CD4016.

Great. Now I can put the covers on. At least the timer worked! **S.B.**

Mitsubishi HS700

Some Mitsubishi repairs this month. First a common fault with the HS700 portable. The symptoms are intermittent play with excessive rewind speed and possibly tape dam-

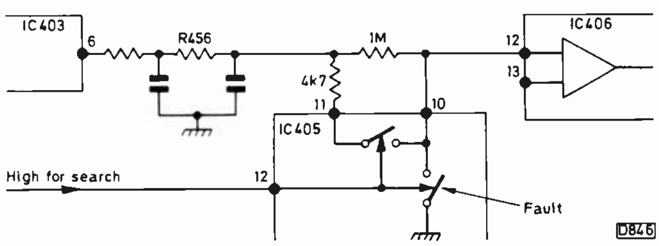


Fig. 1: Picture search fault, Ferguson 3V36.

age. This is caused by the small pinion wheel that drives the take-up spool. It's a push fit on the motor spindle, and has a tendency to come off slowly (see Fig. 2). Eventually the point is reached where it fails to mesh with the take-up spool. The result is intermittent play as the take-up spool stops rotating when the teeth slip. The drive from this motor is also used to provide back tension and some control of the other motor's rewind speed, so when there's failure to engage rewind becomes a bit frantic. The cure is to push the cog fully home and seal it in place with red paint.

Another common fault with Mitsubishi machines is intermittent failure to erase the previous sound recording. The cause is the plugs and sockets that connect the erase head to the bias oscillator: the official cure is to remove these and solder the wires directly to the full erase head and the board. We've had the fault about eight times in the last few weeks. **D.S.**

Mitsubishi HS303

The problem with an HS303 was an intermittent clock. Every so often the clock display would blank out – if it reappeared it would be flashing, as though the power had been disconnected. Checks showed that all the power supply lines to the clock board were correct, but when we came to the clock chip the "init" pin was at 10·5V instead of 4·7V. This pin is fed from the 12V rail via the tantalum capacitor C8F2 – the idea is that the capacitor charges at switch on, supplying the chip with a reset pulse. The capacitor was found to have a varying leak – when the voltage at this pin was high enough the i.c. would be held in the reset condition, blanking out the display. A new capacitor put matters to right. **D.S.**

Ferguson 3V23

The tuner/timer board seems to be responsible for various obscure faults in this model. In a recent case the machine did everything except rewind and fast forward – it wouldn't even acknowledge these commands. We connected an oscilloscope to pin 16 of the serial-to-parallel converter IC38 to check whether the serial code was arriving from the keyboard. It was. The 8-bit parallel outputs were also correct, i.e. in accordance with the truth table. These go via inverters in IC33 to the data selector i.c.s, so checks were carried out in this area. We found that bit D3 was permanently low after IC33 – it should be high in the rewind and fast forward modes. Five of the bits, which carry remote tuner/timer commands, go to the tuner/timer board as well as to the data selector i.c.s. The next logical step therefore was to disconnect this board by pulling out the interconnecting plug. Magic – we now had rewind and fast forward. The fault on the tuner/timer board was a short-circuit in one of the TA57 transistor array i.c.s. **M.P.**

Ferguson 3V35/3V36

We've had a few faulty Ferguson 3V35/36s recently. In the first one the cassette couldn't be ejected. After studying the operation it became apparent that the flap on the front of the machine wasn't opening to let the cassette out, though the eject mechanism was doing its best to push the cassette through, flap or no flap. We eventually discovered that the cog which operates the flap had tripped out of mesh. This apparently happens on these machines for no apparent reason, and the cog has been modified in production to prevent the fault.

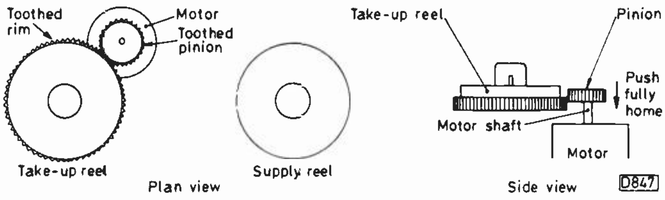


Fig. 2: Pinion wheel trouble with the Mitsubishi HS700.

Unfortunately in its efforts to eject the tape the machine had, unknown to us, bent the loading switches. This had no immediate effect, but a couple of weeks later a call came that the machine "switched off on prerecorded tapes". Sure enough it worked perfectly on my cassette and all the customer's cassettes, but switched off after a few seconds when a prerecorded tape from the local library was inserted. This cassette couldn't be blamed since it apparently worked on a neighbour's machine – and they'd had the same trouble with another cassette from the library.

On removing the top of the machine I found that the take-up spool wouldn't rotate with the prerecorded cassette in position, hence the switch off. This in turn was because the cassette wasn't going down the last quarter of an inch – it fouled the loading switches that had been bent by the previous fault. Why this cassette and not the others? The cassette was found to be about a millimetre longer, front to back, than the others – it was of the type where the flap is a different colour from the rest of the cassette.

The next machine was a 3V35 with a noisy take-up clutch. Replacement cured this – it appears to be of the same type as that used in the 3V29/30.

Finally, if someone attempts to insert a cassette in one of these machines when it's switched off (at the operate button) and uses sufficient force a small plastic pip can be broken off. We've had only one instance of this so far, but the problem is sufficiently common for Ferguson to have modified these machines in production – more than twice the force is now required to cause damage. One hopes that users will check that the machine is switched on before this point is reached. **D.S.**

Ferguson 3V29

The colour was good with playback of a prerecorded tape, but on its own recordings the chroma was very noisy and broke up into horizontal lines. A check on the signal at the input to the colour converter (pin 16 of IC401) showed that it was of excessive amplitude. Clearly the preceding a.c.c. stage (between pins 1 and 17) was operating at maximum gain. A check at pin 3 then revealed that there were no burst gate pulses, and on moving back we found that L407 in the ringing circuit was open-circuit. **M.P.**

Ferguson 3V29

This machine had really fast search – in fact it was faster than the rewind speed. The supply to the reel motor goes via Q2, which is in turn controlled by Q16. This transistor receives commands at its base via diodes D15/16/17. Both transistors were being turned on hard – in fact the voltage at the base and emitter of Q16 was about 15V. The diodes were tested first but proved to be o.k. That left Q16 which was found to have a 1kΩ leak from collector to emitter. **M.P.**

All About Field Strength

Harold Peters

The set produced a snowy picture, the old Labgear field-strength meter read the incoming signal as 700μV and the BBC's field-strength map showed us to be on the 60dB μV/m contour. In the workshop the signal generator had to be set at 1·5mV to produce the same effect. Was it a poor signal, a dud tuner or both? Nothing seemed to tie up, or didn't until we chanced upon the BBC Engineering Information Department's sheet 2017, "Good TV reception, the professional way", which cleared up a lot of misconceptions for us. The following article is based on information given in this sheet.

What to Expect from the TV Set

To produce a good picture, today's colour set needs a clean input signal in excess of 1mV but not above 5mV. Below 1mV, snow begins to appear and gets progressively worse. Above 5mV, intermodulation between the sound and vision signals and adjacent channel signals produces patterning.

A plot of the signal-to-noise performance of typical receivers is shown in Fig. 1. The curves are the average taken from several samples. For a noise free picture, a ratio of 40dB at the standard viewing distance (four times picture height) is expected. Since most people view at a greater distance than this, they will find a signal-to-noise ratio of 36dB perfectly acceptable.

You will notice that the older type of set that uses a diode vision detector is less noisy than the current generation of TV sets that use synchronous detectors. Notice also that colour noise appears earlier than luminance noise. This is due to the double superhet effect with the chroma signal – the 4·43MHz chroma demodulators beat with the higher frequency component of the incoming signal, converting this to a more visible and annoying lower frequency. This h.f. noise is not visible in the luminance signal as it's removed by the 4·43MHz subcarrier trap. The chroma noise problem is worsened by the fact that only a small proportion of the total transmitter power is used for the chroma signal. You are in fact watching a very low power transmission radiated from the same mast as the luminance signal.

Some useful key points are shown in Fig. 1. Teletext errors begin to show at 150μV, the colour drops out at 35-50μV, and sync is lost at 10-15μV. Faults apart, the only adjustment that materially affects performance is the a.g.c. crossover control. This sets the signal level at which a.g.c. is applied to the r.f. amplifier stage in the tuner. Most of a set's self-generated noise is produced in the tuner's mixer stage, so to minimise this the r.f. amplifier is run at full gain until the crossover point at 1mV is reached. As the input signal rises above 1mV, the r.f. gain must be held in check by the a.g.c. circuit in order to prevent mixing taking place as well as amplification. Most r.f. stages overload and start to intermodulate (mix) at about 30mV, but what is not always appreciated is that this is *the sum of all the signals received,* the r.f. stage being wideband tuned. In the average receiver situation, this means the presence

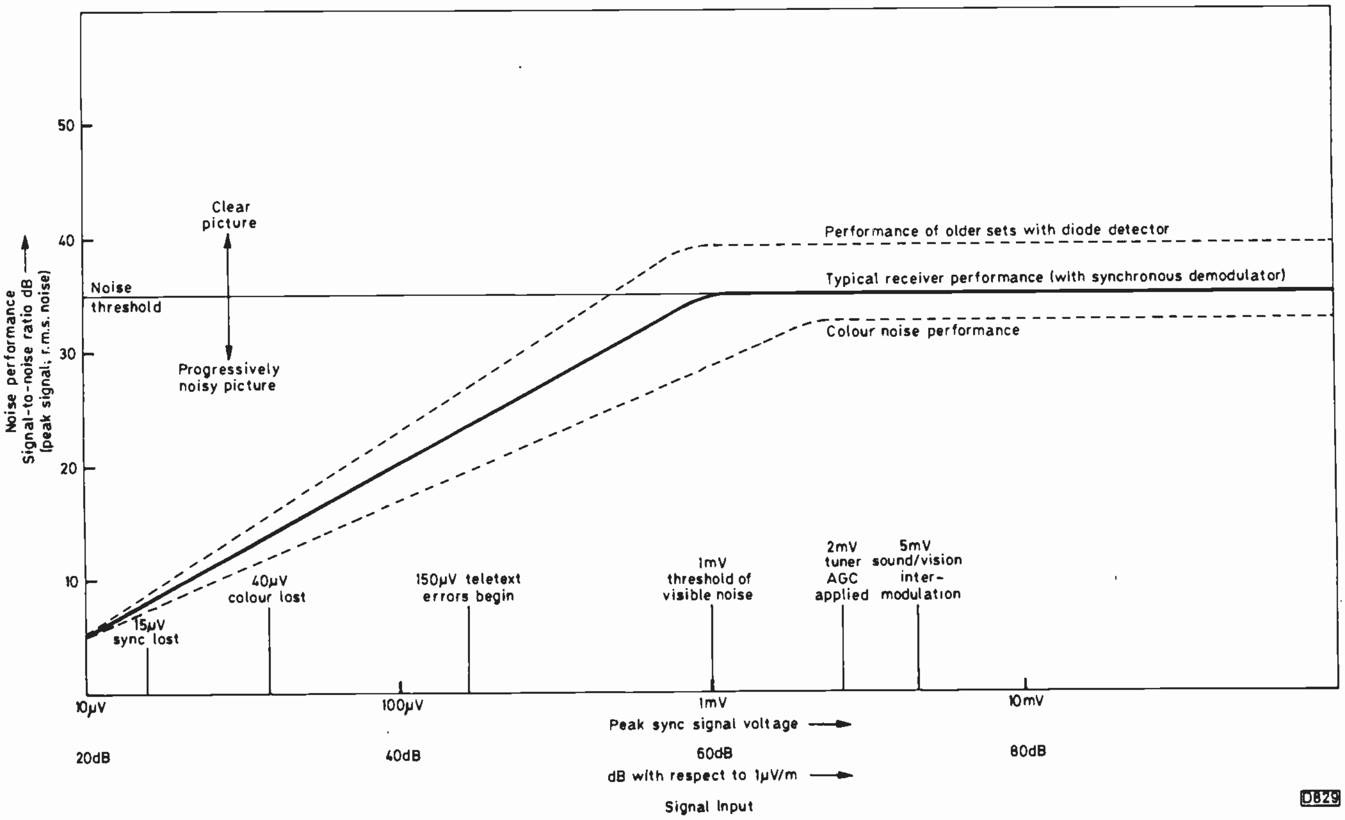


Fig. 1: Receiver noise performance at various signal strengths.

of four programmes with vision and sound: 30mV is the sum of four 5mV vision signals and four 2mV sound signals, so overloading will take place at some 5mV of wanted signal. The more signals there are, the earlier the a.g.c. crossover has to be set. With the advent of VCRs and TV games units, the ideal setting is coming to be around 2mV. But 2mV of what?

Measuring the Signal

Today's average colour set has as many as seven automatic control circuits whose action depends on some part of the composite vision signal, so there's little point in applying a known amount of plain r.f. signal from the generator. The answer you'll get will not be the same as that shown by the picture. During the line sync period however the transmitter is radiating at full power regardless of the scene (see Fig. 2). This is the reference point to which all signal levels are referred: thus the 1mV (etc.) we've been quoting is "the r.m.s. value of the sync tips of a composite vision signal appearing across a terminated load". In our case the terminating load, i.e. the TV set, presents an impedance of 75Ω.

Signal generators, even if you can modulate them with a video signal, are misleading because their output is calibrated in e.m.f. – the voltage that appears across the unterminated (open-circuit) output terminals. To get this output into the set you have to connect a coaxial lead and then connect the set as the termination, so the true output drops to half (−6dB) of what is shown by the output indicator, i.e. for the set to receive 1mV of signal the generator needs to be set at 2mV (see Fig. 3). The Philips series of pattern generators adopts a more realistic approach: their attenuators, though a little vague, do indicate the signal level appearing at the set.

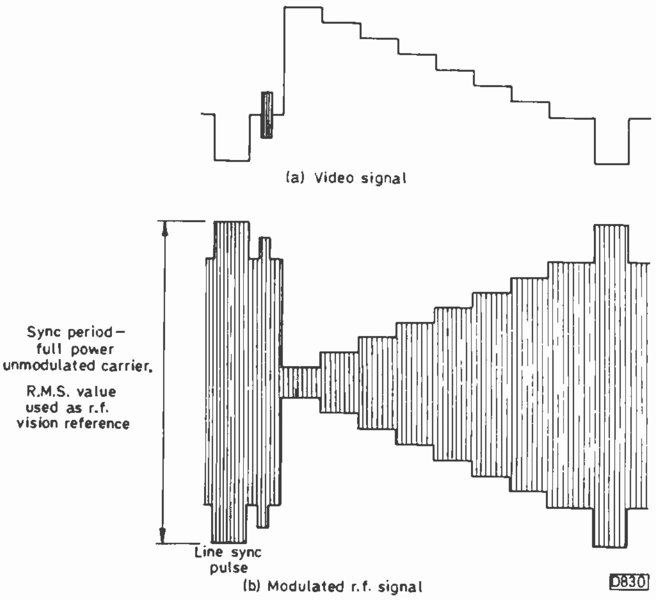


Fig. 2: The sync pulse is the reference point to which all signal levels are referred. Note that 1mV r.m.s. = 2·83mV peak-to-peak seen on an oscilloscope.

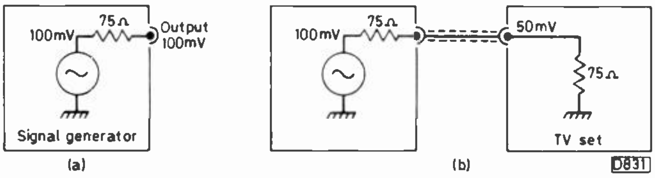


Fig. 3: Signal generators usually indicate their output as an e.m.f. at a certain impedance, as shown at (a). In use, the generator will be terminated by the TV set. The e.m.f. then becomes a voltage of half the value (−6dB) stated on the generator.

Field Strength

Having dealt with workshop signals, we'll consider the situation outside.

Broadcasters have a totally different approach to signal levels. Their interest is in ensuring that there is an adequate level of signal available at your location. This open-circuit field strength is measured in microvolts per metre (μV/m) of free space – in other words the amount of signal picked up by a one metre long rod suspended in the signal path. It takes no account of the tuning effect of the rod, so some conversion is needed.

The BBC practice is to make measurements using a log-periodic aerial, whose response is substantially flat, mounted on top of a 10m pole, i.e. at the chimney level of an average house. The measurement is made using an accurate millivoltmeter, and all known errors are corrected. The boundary of a primary service area is the 60dBμV/m contour on the map, i.e. 60dB above 1μV/m, or 1mV/m to us (see Table 1). As propagation varies throughout Bands IV and V, there is a variation from 58dB μV/m on ch. 21 to 64dB μV/m on ch. 68.

Table 1: Basic dB μV/m to voltage conversion.

dB μV/m	Voltage	dB μV/m	Voltage
20	10μV	70	3·2mV
30	32μV	74	5mV
40	100μV	80	10mV
48	250μV	88	25mV
54	500μV	90	32mV
60	1mV	94	50mV
68	2·5mV	100	100mV

Relating Field and Signal Strengths

Field strength is related to signal strength by the factor λ/π, where λ is the wavelength. On average this works out as follows:

0·2 (−14dB) in Band IV (aerial group A);

0·15 (−16dB) at the lower end of Band V (aerial group B);

0·12 (−18dB) at the upper end of Band V (aerial group C/D).

The Manor Supplies signal strength meter.

To this has to be added the aerial's gain, which is typically 11dB for a standard Yagi array. We then have to subtract the downlead loss (10m of low-loss cable introduces a loss of −3dB) and another 6dB since the field strength is an open-circuit e.m.f. while signal strength is the voltage at the set.

The following two examples will make this conversion business clear. You'll then be able to use the BBC table (see Table 2) with ease.

(1) A London BBC-2 signal at a standard installation. Field strength 3mV/m.

$3\text{mV/m} \simeq 70\text{dB}\ \mu\text{V/m}$, i.e. 70dB above $1\mu\text{V/m}$.	+70dB
Receiving aerial gain (standard Yagi)	+11dB
Downlead loss (10m cable)	−3dB
Conversion factor 0·2 (ch. 33)	−14dB
Less 6dB for set termination	−6dB
	58dB

i.e. 58dB above $1\mu\text{V/m}$, or $790\mu\text{V}$ input at the set.

(2) A weak Channel 4 signal in Norfolk. Field strength $500\mu\text{V/m}$.

$500\mu\text{V/m} = 54\text{dB}\ \mu\text{V/m}$	+54dB
Fringe Yagi array	+17dB
Downlead loss	−3dB
Conversion factor 0·12 (ch. 65)	−18dB
Less 6dB for set termination	−6dB
	44dB

i.e. 44dB above $1\mu\text{V}$ or some $200\mu\text{V}$ at the set.

Satellite TV

The same principles apply to satellite signals, but the quantities are different. Since the incoming signal is collected by a dish, which has area rather than length, square metres replace metres. And because the transfer of the signal from the dish to the set doesn't suppose the use of 75Ω coaxial cable, watts are used instead of volts. The term field strength is replaced by P.F.D., or power flux density, and the dB ratios are $10 \times \log P1/P2$ instead of $20 \times \log V1/V2$ as before. P.F.D. is thus expressed in dB W/m^2.

Think of the signal collected by a perfect dish of area 1m^2 (1·12m diameter) and you'll see how convenient it is to stick to the chosen units. You'll want to be able to relate these s.h.f. signals to the u.h.f. ones with which you're familiar, and once more a worked example will make this clear.

The Russian Gorizont 7 satellite, which took over recently from Gorizont 4, has a P.F.D. in this country of about -120dB W/m^2, in other words one picowatt per square metre. Not a lot! Now watts $= V^2/R$ (or Z), and Z, the transfer impedance of a dish, is given as 377Ω (120π) per m^2 of free space. So we have $1\text{pW} = V^2/377$. Crossmultiply, $V = \sqrt{(377 \times 10^{-12})}$ or $19{\cdot}4\mu\text{V/m}^2$ which looks a lot better!

Similarly the OTS signal P.F.D. of -118dB W/m^2 works out at $24{\cdot}4\mu\text{V/m}^2$ and the projected BBC/ITV DBS signal P.F.D. of -103dB W/m^2 works out at $137{\cdot}5\mu\text{V/m}^2$.

EIRP

Satellite signal strengths are often given in terms of E.I.R.P. (effective isotropic radiated power), in other words how many watts beamed our way leave the satellite. To relate E.I.R.P. to P.F.D. you have to subtract the path loss, which is proportional to the square of the distance between yourself and the satellite, plus 0·5dB for losses on route (more if it's raining hard). So the lower the satellite is to the horizon, the greater the path loss.

Noise

Noise performance is even more important with satellite TV than it is at u.h.f. Everything in the chain contributes to it – even the dish, which picks up noise from the ground and from outer space to pass on to the set. For satellite purposes, noise figures are given in degrees Kelvin. Zero °K is absolute zero, and the reference temperature of 290°K corresponds to a room temperature of 17°C.

To convert noise in °K to dB, the following formula is used:

$$\text{dB} = 10 \log (°\text{K}/290 + 1).$$

From this, 1dB corresponds to 75°K and 3dB to 290°K. Noise figures, if given in dB, would give a very optimistic indication of performance. Hence the use of °K.

Because of the use of f.m. for satellite video transmission, the signal-to-noise ratio required is much lower than for our a.m. u.h.f. signals. For results comparable to the 36dB previously quoted, a satellite signal need have only a 10dB carrier-to-noise ratio. Pictures are in fact quite watchable down to a ratio of 6dB, when colour is lost. What counts, as with f.m. stereo radio, is the noise threshold. This is the level above which no further improvement can be seen or heard. Also the fact that f.m. noise is triangular, i.e. worse at the higher frequencies (which accounts for the hiss going when you switch the radio from stereo to mono).

With f.m. TV, up to 3dB improvement can be obtained by reducing the receiver's bandwidth from 30MHz to 15MHz at the expense of some loss of definition and the appearance of "sparklies" on transients, an effect with which video engineers will be familiar.

So with an expected DBS receiver gain of around 110dB and a predicted BBC/ITV satellite signal strength of -103dB W/m^2, it looks as if there will be some 7dB to play with. Allowing for an aerial efficiency of about 55 per cent., most of us should get by with an 0·6m diameter dish. The moral seems to be to save your old dustbin lids – they might come in useful.

Measuring Signal Strength

When it comes to readily available equipment for measuring signal strength we come into a grey area, a need crying out to be filled. Most aerial riggers known to the writer treasure their ten year old Labgear meters like gold. The broadcasters' gear is well beyond our reach and is totally uneconomic unless used full time.

On the face of it all you have to do is to calibrate the a.g.c. voltage of a standard i.f. strip and you'll get an indication proportional to the incoming signal strength. Not so. The average i.f. strip takes about half an hour to settle down, during which time any meter linked to the a.g.c. line will show a gain reduction of as much as 6dB. This can be tolerated in the workshop if the warm-up time occurs before work starts, but a better tool is the writer's panoramic monitor (see *Television*, November 1971) which shows the instant state of all four vision and sound carriers in the local group simultaneously.

The Siemens S43202MC signal strength meter has the right idea, at around £1,500. It has a small oscilloscope

Table 2: Terminated signal voltages in known signal fields.

Field strength in dB referred to 1μV/m. Signal strengths are terminated voltages assuming a downlead length of approximately 10m, taking account of the λ/π field strength/signal strength conversion factor.

Aerial	Gain dB	Field strength/signal strength conversion						
		65dB	70dB	75dB	80dB	85dB	90dB	95dB
Group A								
Log-periodic	8·5	330μV	590μV	1mV	1·9mV	3·3mV	5·9mV	10mV
Standard Yagi	11	440μV	790μV	1·4mV	2·5mV	4·4mV	7·9mV	14mV
High-gain Yagi	15	700μV	1·2mV	2·2mV	3·9mV	7mV	12mV	22mV
Fringe Yagi	17	880μV	1·5mV	2·8mV	4·9mV	8·8mV	15mV	28mV
Group B								
Log-periodic	8·5	250μV	440μV	780μV	1·4mV	2·5mV	4·4mV	7·8mV
Standard Yagi	11	350μV	630μV	1·2mV	2mV	3·5mV	6·3mV	11mV
High-grain Yagi	15	550μV	980μV	1·75mV	3·1mV	5·5mV	9·8mV	17·5mV
Fringe Yagi	17	690μV	1·2mV	2·1mV	3·9mV	6·9mV	12mV	22mV
Group C/D								
Log-periodic	8·5	200μV	350μV	630μV	1·1mV	2mV	3·5mV	6·3mV
Standard Yagi	11	280μV	500μV	890μV	1·6mV	2·8mV	5mV	8·9mV
High-gain Yagi	15	440μV	790μV	1·4mV	2·5mV	4·5mV	7·9mV	14mV
Fringe Yagi	17	560μV	1mV	1·8mV	3·1mV	5·6mV	10-mV	17mV

tube to display the detected vision or sound signal, with a gap in the display in which a vertical bar can be moved up and down by adjusting an attenuator calibrated directly in dB above 1μV. When the test set is on tune, the bar is at its maximum, and is then set to lay alongside the sync tips with the attenuator. The cursor then gives the terminated signal strength into the set in accordance with the definition we gave earlier. The electronics consist of a high quality tuner/i.f. strip, to which a.g.c. is applied, and a stable oscillator whose output is fed via a variable attenuator and displayed in the gap. Thus drift in the i.f. strip doesn't affect the calibration.

At the other end of the scale, an inexpensive kit is marketed by Manor Supplies. This consists of an a.g.c. indicator with a conventional i.f. strip. The meter reads from 100μV minimum to 10mV maximum on a logarithmic scale. An LED provides indication that a vision carrier is present – it lights up in the presence of field sync pulses, which are detected by a TBA550 i.c. Tuner a.g.c. is applied at over 10mV for overload protection. There's also the Unaohm EP730FM field strength meter which provides a c.r.t. panoramic display. Its cost is around £640 plus VAT. A test report by Eugene Trundle will appear in these pages shortly.

If you don't need a field strength meter, what other methods are available to enable you to calibrate a reciever or test set? As mentioned before, there is the Philips series of pattern generators – never spot on, but never far out. If you can get to meet any of the broadcasters' field strength measuring teams, they will usually be able to pinpoint a place close by where they've measured the field strength with precision. Alternatively you can check a batch of new receivers whose a.g.c. crossover point is given in the manual. Connect a meter to the tuner's a.g.c. line, check that the manual specifies a crossover at say 2mV of input signal, then feed the output from a signal generator to the aerial socket, increasing the input until the meter connected to the a.g.c. line just begins to record a measurement. That's the crossover point, and implies that you are feeding 2mV to the set. Take the average of as many sets as you can – factory people are always in a hurry, and this is a touchy adjustment to make.

It should seldom be necessary to those other than aerial riggers to know the signal level. Your main interest lies in checking that with 800μV applied at the aerial input a 34dB signal-to-noise ratio (or a just snow free picture) is obtained on the c.r.t. The cheapest way of doing this is with a pattern generator of known output and a suitable Belling-Lee attenuator in series. There remains the need for something rugged for aerial riggers – and in due course a simple way of checking the 12GHz output just behind an 0·6 or 0·9m dish.

Sensing out Faults

Tony Thompson

Just in case anyone's forgotten, our five senses are sight, hearing, taste, smell and touch. We use the first two constantly without giving them a second thought. As for taste, I can think of no occasion when I've licked a set into submission! It's a different matter with touch and smell however. The heated casing of a tripler, for example the Thorn 9000 type, will tell the tale to the fingertips of an engineer: as for the smell, that's an experience in itself – a really bad one will make your eyes water. This is not a very subtle piece of smell diagnosis, but with practice you'll find that you can sniff out too warm carbon and wirewound resistors, and sometimes leaky capacitors. Other wirewound components make their distress known as the varnished wire heats.

This sort of thing can save time in comparison with the testmeter before all else approach to servicing, enabling us at least to locate the area of the fault before delving in too deeply. In other cases our senses can provide confirmation, where our instruments and intellect already suggest to us the location of the fault.

Most experienced engineers do this sort of thing automatically. But to think about it can sharpen our minds and make the approach more useful. For the less experienced, attention to the signals our senses provide gives an insight into fault conditions rarely obtainable from technical college instruction.

Sense of Touch

The sense of touch is a great asset in TV servicing, but before I go any further a word of warning to the less experienced. Don't stick your fingers into a dead set without disconnecting it from the mains supply by removing the plug, and remember that an open-circuit dropper or h.t. wirewound resistor can leave smoothing and reservoir electrolytics fully charged, lying in wait for your finger. If in doubt, discharge the points you're likely to touch, using a resistor of say 1kΩ to chassis. It's not a good idea to bridge across with a screwdriver – amongst other things, the electolytic won't like the spark you'll make.

With these words of warning in mind, let's suppose you are confronted with a dead set. The fuses seem o.k., so you disconnect, discharge as necessary, and feel along the dropper sections or wirewounds with your fingers. If current has been flowing, you'll sense the warmth. If there's been excessive current, you'll burn yourself – so tap lightly. Where a dropper is known to be a continuous winding but one section is cold while the next along is warm, you've got your culprit. In cases where the dropper has split windings and one set seems normal whilst another is cold, at least you've a clue where to start. It won't pinpoint the fault to a defective dropper section, but will tell you that for reasons yet to be determined there's lack of h.t. or l.t. here. The fact that droppers are often responsible for the dead set condition is something to bear in mind.

Still on the subject of power supplies, a bridge rectifier with common encapsulation should not feel more than warm. One that's hot after the set has been on for only a short time is likely to have a short-circuit diode. Single h.t. rectifier or heater chain dropper diodes should also take time to warm up and should never attain a temperature that's uncomfortable to touch.

Imagine a potential divider network where the junction between the two resistors reads either very low or zero voltage. If a resistance check is inconclusive you may go on to unsolder components, including transistors, to remove parallel paths. There is no way round this unsoldering, though it should be limited to as few items as possible in order to save time and to avoid damaging delicate print and components. Before you attack with the soldering iron however, lick your fingertip and touch the upper resistor. In power circuits even a carbon resistor should be slightly warm if it's conductive, though the test is inconclusive in itself.

A wirewound resistor that's passing current will be just warm. A too-warm resistor of either type tells you that there's a leak at the junction, especially if the bottom one is cold. In this event it's profitable to disconnect bypass electrolytics for resistance checks or to suspect the valve or transistor being fed. A cold upper resistor on the other hand could well be open-circuit, or maybe of greatly increased value.

This example of the potential divider is just one of a number of checks that can be quickly carried out by hand, and I readily admit that diagnosis of this sort is likely to contain a goodly sprinkling of very likelies, probablies and possiblies. This doesn't detract from the usefulness of the exercise however. The chief benefit lies in saving time, enabling you to get to the source of the trouble before seeking additional information. There are also some instances where sensing methods reign supreme.

Line Output Stage Checks

Triplers have already been mentioned, but there's more to add on this subject. A tripler should run cool: a hot spot, especially localised on the casing, is a sign of trouble. A warm spot on the other hand cannot definitely be regarded as showing up a fault. This is a grey area where experience must be your guide. There are several variables such as the design of the tripler, its location within the set and the time it takes to warm up. It's fair to say that a tripler which heats up in a few minutes at most is likely to be faulty. Remember that, though rare, an internally shorting c.r.t. can result in a heavy current flowing via the tripler, giving the quick-heat symptom.

The best check is to disconnect the c.r.t.'s final anode connector, drape it carefully away from sensitive areas and the chassis, then run the set. This avoids placing a strain on the line output transformer etc. A neon tester held near the connector (don't touch!) will light up if there's an a.c. field present, confirming the tripler's demise. Keep the tester away from the line output transformer's field or you'll get a false reading.

The line output transformer is another touch-sensitive component. Take the no e.h.t. condition. If the line output stage uses valves, you'll have already ascertained whether they are being driven by making top cap spark checks and perhaps by switching off and touching the valve envelopes.

Where the line output valve and the boost diode are both cool, a finger check on the line output valve's screen grid feed resistor is a good test – it's likely that the stage is not being supplied with h.t. if all these items are cool.

If the valves etc. feel more or less o.k., try touching the transformer. I repeat – disconnect the set before doing any of this. If the transformer is cool, it's likely to be all right. Note the word cool, not cold: transformers vary, as do their operating conditions, but a warm transformer, especially one that warms up rapidly, is a bad sign.

This test works the same with transistor line output stages – touch the output transistor, which should be warm but definitely not hot. A very hot one suggests an internal short-circuit. In cases where all three major items in the line output stage – transistor, transformer and tripler – are overheating, the most likely cause of the trouble is the tripler, since a short-circuit transistor or shorting transformer will place no strain on the tripler (there are occasions when a faulty transistor will upset the transformer). When in doubt, it's always worth disconnecting the tripler at its input from the transformer: an internal fault can cause excess current in the stage even when the tripler's e.h.t. output is to all intents and purposes disconnected – triplers usually feed networks that remain in circuit when the c.r.t.'s final anode is disconnected.

What Valves Can Tell Us

There are some other useful points to remember about valves. We can always "test" a valve of the output type for evidence of stress: the sight of a dull, spreading redness on the anode structure is the telltale sign here. In such cases it's prudent to look before you touch, to prevent sore fingertips. Such problems are often apparent even before the set's back has been removed, as the overheating valve will singe the dust on its envelope.

Video output valves run hot or very hot. If cool they are either at fault or not receiving an anode or screen grid supply, or just possibly the cathode circuit is open. This also applies to colour-difference output valves, though these should run warm. A cool one gives the clue.

Valves used for other functions, i.e. in the i.f. stages and as oscillators, don't lend themselves so easily to this kind of testing, the results at best being inconclusive.

Remember that valves are active devices of an inherently fragile nature, and are thus the most likely cause where a fault occurs, particularly in a hard working output stage. Modern valves don't seem to be as reliable as those in days gone by.

Transistor Video Output Stages

With transistor RGB output stages, fingertip checks on the heatsinks or, where possible and perhaps more accurately, on wirewound load resistors, aids diagnosis. These items should all be warm.

Listening for Faults

There are many ways in which our hearing helps with fault finding, the obvious one being no sound. Take field collapse. If you can hear the field output transformer buzzing and can increase this buzz by adjusting the height control, you've immediately narrowed down the cause of the collapse to a few items at the output end of the field timebase – the scan coils, secondary components around the transformer, or an open-circuit connection between the two. All this without lifting a test prod!

Sound distortion at low volume levels, clearing as the volume is increased, points towards a faulty loudspeaker – one with an off-centre speech coil. Gently pressing the cone whilst the set is working will prove the point.

Audible whistles from wound, cored components such as line output transformers can be very annoying, though nowadays it's mostly the case that components other than the line output transformer whistle – at an annoying submultiple of the line frequency. Gentle pressure on suspects with an insulated prod will help to identify the offending part: tighter core clamping or a dab of sealant may then help. Otherwise the cure must be replacement. The effect is due to magnetostriction: the core buzzes in sympathy with the coil's field. It follows that air-cored components cannot suffer from this malady. Some mains transformers are notorious for buzzing, which the customer often mistakenly attributes to the loudseaker.

A dead set with a heavily buzzing mains transformer is a warning of possible excessive load on the h.t. supplies or, less likely, a leak such as a faulty electrolytic in the power supply.

In Conclusion

We use our senses in many diverse ways when fault finding: the back of the hand brushed across the c.r.t. face to sense the presence of e.h.t.; sniffing for ozone when we suspect corona discharge; touching i.c.s to see if they are warm when they shouldn't be (other than specific output types, they should remain fairly cool – a hot one is definitely a sign of trouble); taking the temperature of a decoupling capacitor which we know should be cold; or looking for the split in the casing of a mains filter capacitor that's saying "change me, don't waste your fuses". Ours is a sensitive trade. Use yours to the full, read the signs, and maybe you'll be the next one to apparently possess an ability that others speak of reverently as a gift.

Book Notice

BEGINNER'S GUIDE TO VIDEOCASSETTE RECORDERS by Eugene Trundle, published by The Butterworth Group, Borough Green, Sevenoaks, Kent TN15 8PH at £4·50.

Q & A: VIDEOCASSETTE RECORDERS by Eugene Trundle, published by The Butterworth Group (address above) at £2·65.

Our friend Eugene Trundle, who writes regularly for this magazine, has been busy! I read the beginner's guide through from start to finish and found it an excellent technical introduction to the subject. It cleared up a number of points about which I'd been uncertain, which is always to me proof of a book's usefulness. Don't be put off by the "beginner's guide" bit – it goes into the subject in enough depth to meet the needs of technicians.

The Q and A doesn't go into the subject in quite the same depth, being intended for "salespeople, bosses, prospective VTR owners, equipment reviewers and technical people whose present knowledge is in other fields". It's main concern is nevertheless the techniques used in VCRs.

Both books cover the three formats at present in use. I have no hesitation in recommending them to readers who want to get their teeth into the subject. **J.A.R.**

Letters

GRUNDIG GREMLINS

Mick Dutton provided a comprehensive list of faults experienced with the Grundig CUC series chassis in the February issue (page 202). One component not mentioned however was R646 (270kΩ) in the power supply – it's the equivalent of R165 in the later Thorn TX9 chassis, mentioned in my letter last month. In the Grundig chassis it goes open-circuit, with the result that the chopper transistor goes short-circuit at switch on.

On the theme of Grundigs, the h.t. smoothing resistor R607 (91Ω, 17W) in the 1510 has a habit of disintegrating. It also forms part of the excess current limiting arrangement (see Fig. 1). This works as follows. The mains rectifier thyristor Ty604 is triggered at its gate via the *RC* network R615/C611. In the event of excess current the voltage at the junction of R607/R608 will fall and transistor Tr612 will conduct, short-circuiting the gate and cathode of the thyristor which is thus cut-off. The circuit is designed to trip at approximately 8Hz, R608 going open-circuit in the event of a sustained overload.

Our experience has been that in the event of failure of R607 it's necessary to replace the following items for a no-comeback repair: Ty604, Di604, Tr612, R614, Di614, the main smoothing block C607/608/616/617 and of course R607.

Some time back we had this fault and replaced the components listed above. The set was given a soak test but after two hours R607 again disintegrated. The fault was eventually traced to the screened wire that couples the line drive to the gate of the flyback thyristor Ty501. This wire is routed below the power resistors, and had carbonised at this point, thus upsetting the operation of the thyristor line output stage. Since then it's been our policy always to check this length of wire visually and if in any doubt to replace it.
Brian Francis, Tech. (C.E.I.),
Plympton, Plymouth.

SHARP C2072

A Sharp Model C2072 came in for repair recently, the symptoms being as follows: during bright scenes the colour would disappear, accompanied by a loud whistling at a frequency which seemed to be below the usual 15·625kHz. There would also be severe line pairing and picture break-up, particularly at the edges. The symptoms would still appear, but much less frequently, if the contrast and brightness controls were turned down to give a dark, washed-out picture.

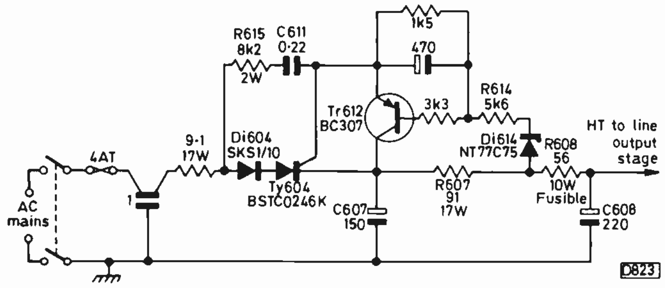


Fig. 1: H.T rectifier circuit, Grundig 1510 series.

The customer told us that the set had started to go wrong about a year ago, but he could restore the picture to normal by either changing channels or turning the brightness down. As the problem had become progressively more frequent, he decided to have the set repaired. Another engineer had quoted £95 to replace the chopper and line output transformers, the tripler, and the chopper and line output transistors, but the customer decided to seek a second opinion.

We recalled that similar symptoms occur with the Thorn 9000 chassis when the 90V supply smoothing capacitor C715 deteriorates. The Sharp C2072 is not quite the same – it uses a series chopper circuit to produce a 120V h.t. line – but it seemed worthwhile trying the h.t. smoothing capacitor C717, which is a 47 μF radial electrolytic rated at 200V. We extracted it and sure enough the telltale sign of a faint white powdery deposit was present near one of the leads. A replacement 47 μF, 250V electrolytic immediately restored normal operation. Incidentally the faulty capacitor read all right on the meter – the best course is to check by substitution. We wondered what the other engineer would have done after replacing all those innocent components!
T. Barrett,
London E17.

VIDEO AMPLIFIER TRANSISTORS

I've received several letters asking about the transistors used in the video amplifier circuit shown in my article in the February issue (Fig. 1, page 189). Any small-signal npn/pnp/npn transistors will do, but those actually used were two BC548s and a BC558.
Harold Peters,
Oulton Broad, Suffolk.

METER REPAIR?

Many years ago, when Lisle Street was occupied by tarts and electronics shops rather than Chinese restaurants and blue movie shows, I bought a "faulty" meter for £1 from the collection of odds and ends on display outside one of the shops. It seemed to be in working order apart from reading 25 per cent low on all ranges. I was using it recently to check a faulty rear lamp on a vehicle parked on a slope: unfortunately the vehicle ran a foot or so down the slope and over the meter. The back of the case was shattered and the internal battery was squashed. Apart from that there appears to be little damage – and what's more the meter now reads accurately!
D.B., Tunbridge Wells.

BEOVISION BLANKING MODIFICATION

Those readers who keep their old 2600 and 3200 series Beovision colour sets going may be interested in the following method of improving the field flyback blanking. The problem arose when I noticed teletext signals flashing at the top of the picture. It seems that the use of more lines for teletext results in their showing up on receivers that have either slow flyback or inadequate blanking. Rather than trying to speed up the flyback, I thought it would be better to attempt to improve the blanking.

The original circuit is shown in Fig. 2. After inversion by the strapped triode sections of two ECL84 valves the flyback blanking pulses are fed via a screened cable to the "earthy" ends of the tube's first anode decoupling capaci-

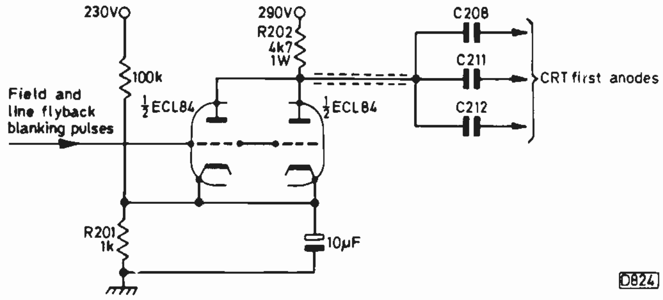


Fig. 2: Flyback blanking in the B and O 2600/3200 chassis.

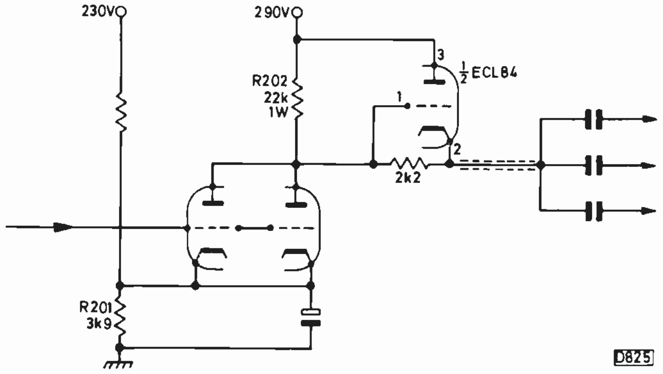


Fig. 3: Modification to remove teletext signals.

tors. One way of increasing the amplitude of the pulses would be to increase the value of the anode load resistor R202. Unfortunately this slows down the circuit's recovery time on the positive-going edges of the pulses, since the capacitance of the cable etc. has to charge via the anode load resistor. The result is a brightness gradient on the left-hand side of the screen.

Fortunately there's a third, unused ECL84 triode section – it's in the middle ECL84 of the colour-difference output trio. The circuit can easily be modified, on the back of the panel, to that shown in Fig. 3. Using a cathode-follower in this way ensures a quick pull up, the initial pull down being via the 2·2kΩ resistor. Sufficient blanking pulse amplitude is obtained to blank out the offending teletext lines. There are no tracks going to pins 1, 2 and 3 of the cathode-follower, so the necessary connections can be made without having to "hack and bodge".

Note the change in the value of the bias resistor R201 from 1kΩ to 3·9kΩ.
Keith Cummins,
Shirley, Southampton.

LOPT TESTER

I've made up the line output transformer tester featured in your February issue (page 180), having etched a board and using components from the junk box. It works well, but the emitter-follower transistor Tr3 got warm – the whole board took 38mA on load (connected to a trans-

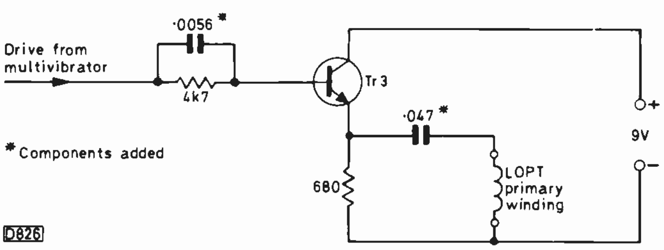


Fig. 4: LOPT tester modifications.

former), 8mA off load (with Tr3 cold). Adding an 0·047μF output coupling capacitor as shown in Fig. 4 provided the cure, the board taking 9mA on load with the transistors cold and the output reading unaffected. The addition of this coupling capacitor also saves Tr3's emitter resistor from being shorted out by either a faulty transformer or accidental contact between the line output valve anode/transistor collector lead and the negative lead of the 9V battery – this does Tr3 no good, and sometimes stops the circuit oscillating until switched on a second time.

Adding a small capacitor across Tr3's base resistor increases the output reading a little – the value I used was 0·0056μF.
H. Owens,
N. Ferriby, Yorks.

HOMES WANTED

Due to shortage of space, I must jettison from my collection of vintage and semi-vintage TV sets and radio receivers three Murphy V310s and a V320. The V320 and one of the V310s are workers, the other two requiring new line output transformers. Any takers?
W. J. Knight,
532, Rochester Way, London SE9 1SQ.

SATELLITE/CABLE TV

I've been following recent editorials concerning satellite and cable television with very great interest. These two transmission systems make strange bedfellows, the first being the ultimate in providing wide geographical coverage, the second a strictly limited method of distribution. Much publicity has been given to their marriage recently, a TV service in one UK town receiving the satellite signals and passing them on to viewers via cables. Despite all the ballyhoo about the high technology involved, a dispassionate consideration of the scheme must lead one to the conclusion that it's the definitive example of the use of a sledgehammer to crack a walnut. Since the programme matter apparently consists of taped or filmed offerings, the object of the exercise could have been achieved at a tiny fraction of the cost by simply installing a VCR and maybe telecine equipment at the cable company's distribution centre. Indeed even more money could have been saved by ignoring cables altogether and employing a low-power local TV transmitter. Other reports have mentioned a pirate TV station, whose backers seem to wish to dispel the contrived belief that only the combination of a government agency and huge finance can make such services possible.

The objections to the use of cheap, purely local TV transmitters are two-fold. On the one hand the establishment wishes to preserve the present BBC/IBA control of public broadcasting. Satellites provide a means of getting round this, distributing technically foreign programmes. On the other hand all programmes sent out via the existing terrestrial transmitter network are in effect free to the viewer once he's bought his set and his licence, whereas cable distribution makes it possible to charge him for every minute of screen time he watches. There's nothing much wrong with this, provided it's optional and doesn't affect the quality of the present services. The danger is that if cable TV ever achieved the coverage desired by its promoters, it might well corner the market in popular TV material, leaving off-air viewers very much poor relations. It must not be forgotten that very large areas of the country will never be served by cable, due to the sparse or scattered population.

The BBC would in this event hope to raise its licence revenue so that it could fight back, but what of ITV? Already saddled with the burden of financing Channel 4, faced with the growth of VCR use, and anxious to maintain viewing figures so as to sustain advertising revenue, the independent companies could find themselves very hard pressed. For the BBC and the IBA, either separately or jointly, to finance a superfluous DBS service is in these circumstances as appropriate as a bankrupt third-world nation operating its own prestige air line. High technology is all very well, but not for its own sake. The BBC and the IBA have virtually complete coverage with their present transmitter network: they should swallow their pride and forget about DBS services.

Chas E. Miller,
Woodseaves, Staffs.

This Little Ting Here

Les Lawry-Johns

I suppose we all get a trifle confused over the various Bush models and chassis, and it's not till we take a closer look that our spirits rise or fall. So when these two rather elderly men puffed into the shop carrying a 22in. Bush colour set I immediately thought it was a late 823 chassis.

"There's a white line across the screen" said the tall one.

"No it isn't, it's a red line" said the short one.

"Fret not" I assured them, " 'twill be put right in a trice."

The Bush Z718

I whipped the back off and my spirits fell. Seeing the swing down panel across the rear section I thought it was a T20. Then I saw the two line output transistors on the right-hand side and realised it was a Z718. My spirits fell further.

"Umm, it won't be put right in a trice."

"Don't worry. We've all the time in the world" said the tall one.

"Sure it's only a little ting" said the short one.

"That's because you don't have to find the little ting" I growled.

"Oh you'll find it in no time at all" he continued. "We'll just have a cigarette while you're doing it. Just carry on John."

Honey Bunch smiled and chatted to them about the weather while I delved into the field timebase. The transistors appeared to read right on a cold check, except for one of the output transistors, VT7. It gave a low reading from collector to emitter, the same on reversing the prods. Out came VT7, off its heatsink. In went a new 16905. Switch on and we had a nice, full-sized raster.

"There" said the short one, "didn't I tell you it was just a little ting you'd find in no time at all?"

I growled to myself something about what would happen to his little ting if he wasn't careful, then plugged in the aerial. No signals, just noise. None of the touch sensors were alight, so I touched the first one and dropped down the flap to tune it in. Wind the red pointer up and down but there was nothing except for a few flutters to reward my efforts. I then touched sensor two and with slight adjustment BBC-2 showed a news sheet. I felt better. Touch sensor three and the news sheet remained, even when I ran the number three red pointer up and down. It was still there in positions four and five, even though the pointers were in different positions. Position six could be tuned and I ran it up to BBC-1. Select sensor two and BBC-1 is still present.

"You didn't tell me this lot was up the creek" I moaned.

"It's not up the creek" said the short one, "it's just a little ting here."

Whilst I was trying to read the tuner voltages on the connecting plug, looking for the tuning voltage in particular, he was spinning the little wheels and thus making me angry.

"See John, you have to get all these little pointers on the same line. Then they work."

I was fast loosing my cool.

"All right then, if that's all there is to it you can take the set away now."

"No need to get upset over such a little ting."

The tall one saw how the wind was blowing and intervened.

"Leave it to Mr. Johns, Paddy. It's not working right and he'll sort it out if we leave him alone."

"Yes, leave it to him to tink out."

I chose my words carefully. "That's what I'm here for, tinking tings out all day long".

Honey Bunch fled to the kitchen. I heard her talking to Ben. "He's out there tinking. He'll need a bath tonight or he'll be tinking tomorrow too." It didn't help. My logic, fragile at the best of times, had gone.

I removed the three nuts and took out the touch tuner panel, then accused the ETT6016 of buggering about. I took it out, having earthed myself to the live mains, and sustained a bleeding hand. "Calm down now. Try to think logically like ET does."

That little brass image still looks down at me, his finger pointing. Always pointing. Saying "you're not doing it right Les. Get the voltages right." But I didn't listen. I fitted another ETT6016 and what do you know – the neons started to work. They lit up when touched, and I was sure I was there. I wasn't.

Although they lit when touched, only six was tunable – and tuned the other five for God's sake.

Shorty moved in again. "It's this little ting here", pointing to the a.f.c. button. Out he moved, and ET's finger continued to point at me.

I checked the voltages against those given in the circuit. There should have been 188V at 9R39 on the touch tuning panel (Fig. 1). The reading was more like 30V – I'd previously taken this to be the tuning line, but it wasn't, it

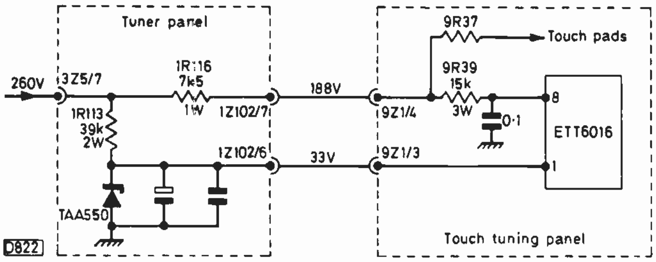


Fig. 1: Supplies to the touch tuning panel.

was the supply to the ETT6016. I traced the line back to the tuner panel, where I promptly got confused between 1R113 and 1R116. Like a fool I first accused 1R113, but it was 1R116 that was open-circuit of course. Replacing it restored normal channel selection and tuning.

Shorty looked at the faulty resistor. "Just a little ting . . ."

Having disposed of the comedy duo, we can consider the circuit briefly. 1R116 takes 260V at one end and drops 72V, providing a 188V supply at the other end for 9R37 and 9R39, the latter feeding the ETT6016. Hence the crazy behaviour when this supply is absent. I should have gone straight to it. Like you would, but I don't tink like you.

Sparko's Return

I was just settling down for five minutes' read of the magazine when the door crashed open and in fell Mr. Sparks. Till that moment he'd been carrying his Thorn 8500. "Nice of you to drop in" we greeted him.

"Get this bloody set off my foot, Len" he bawled.

First it's John from Paddy, now it's Len from Sparko. What it is to be well known.

So I lifted the set off his foot and he hopped around like a wounded kangaroo.

"Why do I have to bring this bloody thing to you each time? Why can't you call out like civilised people do?"

"Because I'm too lazy and don't want to work too hard, that's why. Now what do you want me to do for you?"

"Just fix it for me Len. I don't care how much it costs as long as it's not more than a fiver."

I ignored that because Sparko never argues about the bill. Mind you he does like to stop and watch and murmer every now and again "thank gawd it's not me with my hand in there."

So we took the back off, plugged the set in, and switched on. A blurred picture with no sound appeared. We switched off and checked the speaker, which was o.k. We then removed the power panel which, as you know, is where the MJE340 audio output transistor VT701 lives. It had base-emitter leakage, so out it came. I looked in my little drawer marked MJE340 and took one out. It was of entirely different construction, and I stared at it in disbelief. The one from the set was of the TO126 type, like the BD131. The one in my hand was of the TO220 type. The base and emitter leads were reversed, so it had to go in on the reverse side of the heatsink to get the connections right. When fitted, the sound was loud and clear, so the voltage rating was right. Later investigation proved that the transistors in the drawer should have been marked MJE340K (30W rating). Ho hum.

The blurred picture didn't respond to adjustment of the focus control, so the e.h.t. rectifier unit came under suspicion (the built in resistor goes high in value). Smiling at Mr. Sparks, we removed the suspect unit and fitted a new one. The focus was now good and the sound loud and clear. "Did you say a fiver Sparko?"

"Just joking Len."

Hallo Stan!

Hardly had Sparko left than Mr. Murray walked in. He's been coming in for seventeen years.

"Hallo Stan, how's your luck?"

"My name's Hilda Mr. Murray . . ."

VCR Servicing

Part 27 **Mike Phelan**

The 3V24's capstan servo has provision for still frame and slow motion, the latter by remote control. We'll look at normal record and playback operation first.

Capstan Servo

A block diagram of the capstan servo is shown in Fig. 122. It's a dual-loop arrangement, i.e. with both speed and phase control. The speed control loop uses a VC1029, as in the drum servo, but this time operating at 126Hz. If the capstan speed increases, the voltage at pin 10 of the VC1029 falls. There's no inversion in the motor drive amplifier, so the capstan motor speed falls to compensate for the initial rise. Stable conditions are obtained at about 3·8V. The phase control loop is mainly contained in IC1, where the 32·768kHz oscillator is shared with the drum servo.

On record, the only need is for close control of the speed. So the phase control loop compares the 21Hz trapezoid derived from the crystal oscillator with the 21Hz pulse train obtained by dividing the FG signal by six. Test point TP5 is included to enable the trapezoid and pulse to be viewed simultaneously. The error voltage of about 4·5V at pin 25 goes positive to decrease the motor's speed, because the inverting input of IC15 is used. C101, C102, R223 and R224 form the loop filter.

On playback the oscillator and divider produce a 25Hz trapezoid which is gated by the amplified pulses from the control head. The pulses are passed through monostable multivibrator IC6 which provides a delay of about 20msec.

In record and playback (also audio dub) two sections (S1 and S2) of IC14 are closed because pins 5 and 6 are high (inverter X40's output is high). S3 and S4 are both open. The loop filter is thus in operation. In stop, fast forward and rewind, X42 turns the motor off. In search fast forward, search rewind, slow and still D40 or D41 conducts, S3 and S4 close, and X40 opens S1 and S2. This removes the phase error voltage from the motor drive input, connecting the latter to the junction of R225 and R226 instead to give the correct free-running speed. This point is also connected to the junction of C101 and C102 in the loop filter to maintain the charge on these capacitors – otherwise the lock-up time on returning to normal play would be excessive. If the off-tape control pulses are lost during playback (or audio dub) D39 conducts, producing the same effect, i.e. S3/4 closed and S1/2 open. Severe hunting would occur if it were not for this.

Fig. 123 shows the control pulse detector circuit. During playback and audio dub, C99 and D38 d.c. restore the pulses, biasing X38 on. The after-load switch is closed, biasing X9 on. C100 charges to 9V, holding X39 and D39 off. The servo then works normally. If the control pulses are interrupted, due to mechanical shock for example, C100 discharges, X39 turns on, D39 receives forward bias and the servo switches to the free-running condition. We don't want this part of the circuit to operate in record, when servo control is essential. This condition is met by supplying the emitter of X39 from the PB 9V line.

Though the motor is stopped via X42 in the stop, fast forward and rewind modes we want the free-run condition to maintain the charge on the loop filter. The after-load switch is open in these modes, so X9 is off. X39 is still powered from the PB 9V line however, so D39 conducts to give the free-running condition.

Still and Slow Drive

The still and slow capstan drive system is shown in Fig.

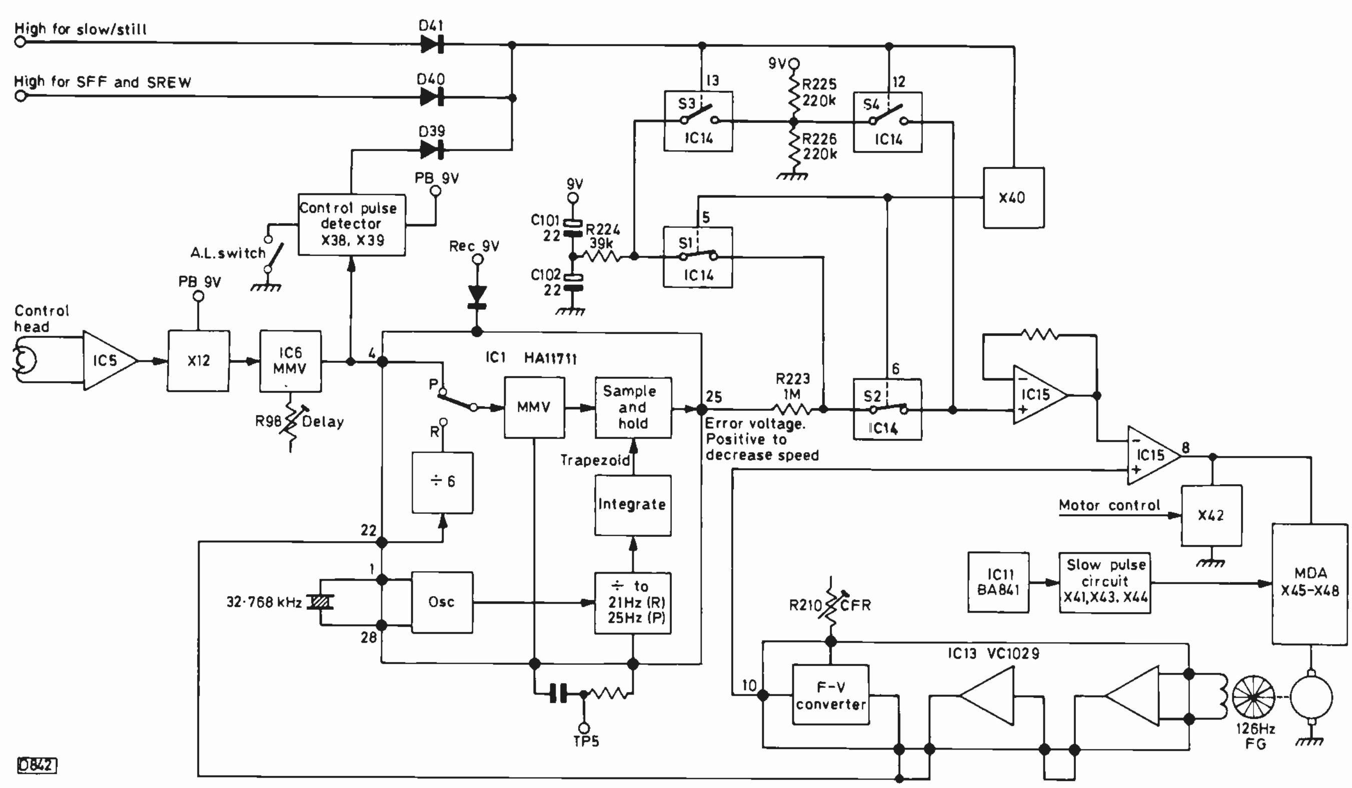


Fig. 122: Block diagram of the capstan servo.

124. It may look a bit complicated, but is not too bad if split into two sections. As in the previous machines we've dealt with, a BA841 i.c. is used for slow motion/still frame capstan control, though the circuit is less complex than that used in the 3V23.

In modes other than playback, record, audio dub and shuttle search, X42 is on, removing the control voltage from the motor drive amplifier by turning off D45. This turns X45 on and the Darlington X47 off, stopping the motor. X46 and X48 are used in slow/still as a brake, normally being off. D46 ensures that X47 is off when X46 is on, otherwise the 12V rail would be shorted out.

When D45 is off, we can drive the motor with a slow pulse as in the 3V23 – a large amplitude pulse to overcome the inertia, followed by a smaller pulse. D33, D34, X33 and X34 form an OR gate to supply 9V to the slow-pulse network in the slow or still modes. Pin 30 of the BA841 is the FF2 output – we don't use FF1 here. Pin 30 goes high to move the motor, low to stop it. During normal running it's high, so that X41 is on and X43 is off: the path to chassis via X41 forward biases D45 and X45, closing the servo loop.

The internal workings of the BA841 have been dealt with in previous articles on the 3V23 and 3V16. Suffice it to say that flip-flop FF2 is set by the drum FF signal and reset by the control head pulses, so that the tape stops at an exact position with reference to the latter. The process is repeated four times, as the tape position at the start of the process is indeterminate. For slow motion further single pulses are generated to drive the capstan, the interval between the pulses being set by the slider control on the remote hand unit.

When still is selected (or the camera trigger is released), X42 turns on, stopping the motor, and FF2 resets. FF2 next sets, turning X41 on and X43 off so that R229 supplies X45 with some 9V. The motor starts. X44 is off at this point, because when FF2 sets X36 is turned on, triggering the monostable connected to pin 26 of IC11. This gives a high at pin 27 after 18msec, turning on X44 and reducing the drive pulse to 2·3V due to the network

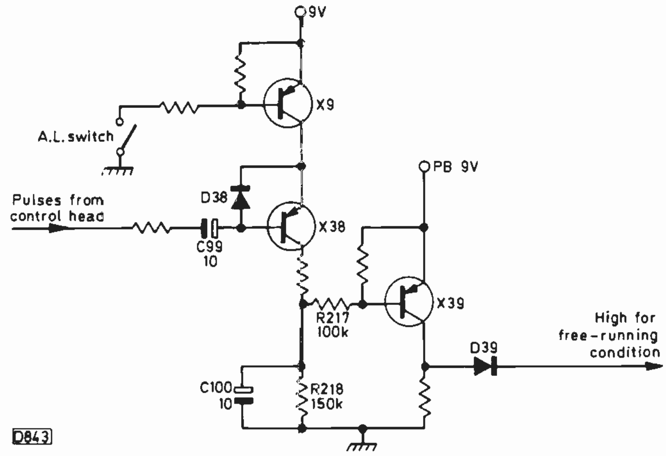


Fig. 123: The control pulse detector circuit.

R229/R243. The pulses at the collector of X36 are also applied to the vibrate circuit in the drum servo to minimise sideways movement of the picture in slow motion. The tape moves until a control pulse arrives from the tape. This resets FF2, turning X41 off and X43 on, X46 and X48 conducting to brake the motor. R189 and R191 adjust the width of the slow pulse.

Pin 37 of the BA841 provides dummy field sync pulses, as in the 3V16, one of the pulses being user adjustable to minimise jitter.

Edit Start System

Before leaving the capstan servo to look at the reel servo we must explain the edit start system. If you read the articles on the 3V23, you will recall that when record pause is selected the tape winds back by approximately 30 fields and then stops. When restarted, the capstan goes into the playback mode to lock to the previous recording's control pulses, the record capstan reference (FG) being synchronised to the control track pulses by resetting the counter before the record mode is entered. In addition, if

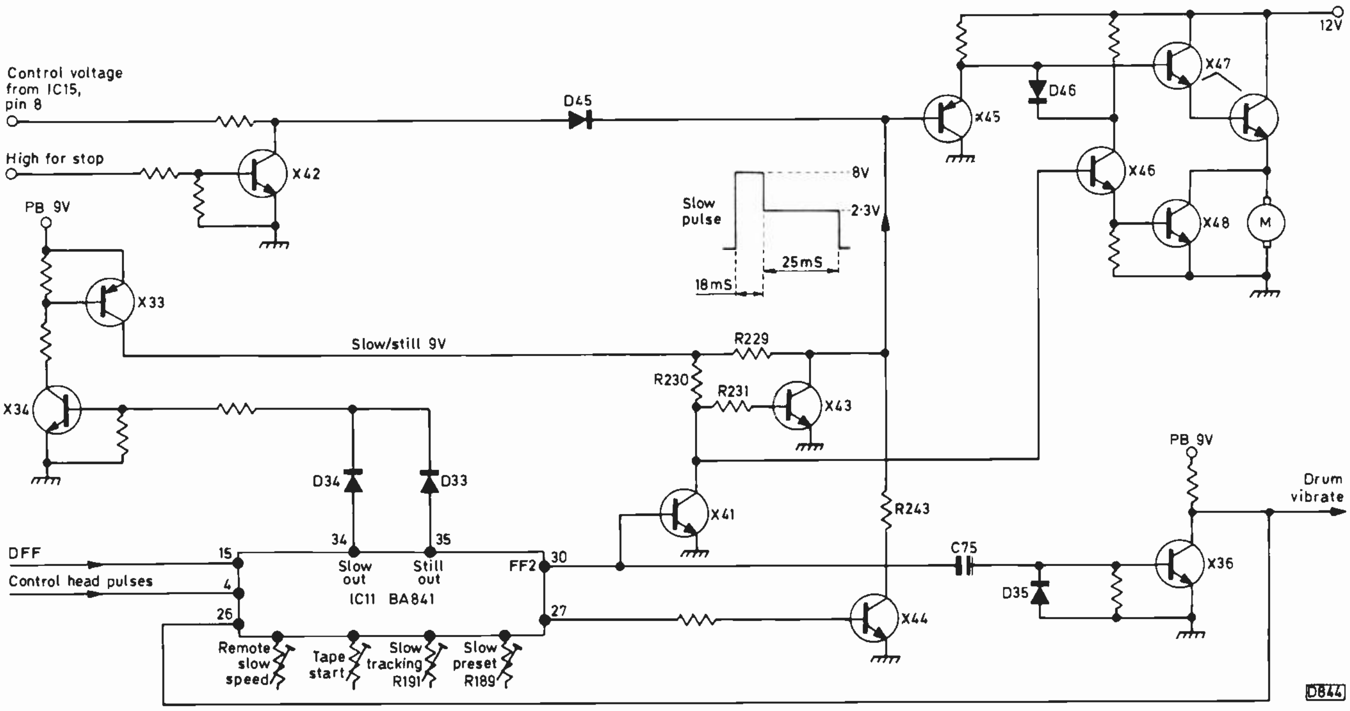


Fig. 124: Still and slow drive system.

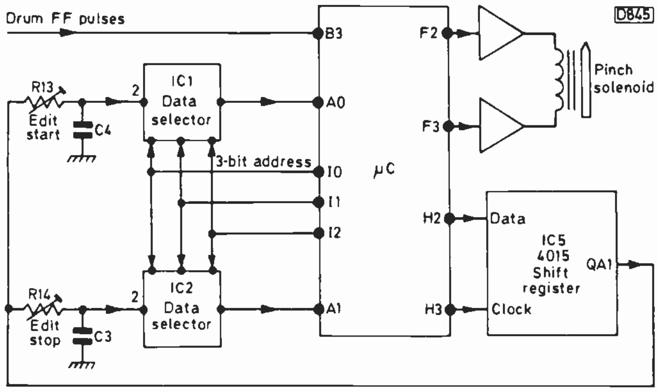


Fig. 125: The edit start system.

the signal is interrupted, as will happen with channel change or possibly when editing out adverts, the drum servo relocks to the sync before the machine recommences recording. The system is complicated but gives perfect edits.

A very much simpler system is used in the 3V24 (see Fig. 125). The circuit may not make much sense at first glance – there appear to be only two extra presets and capacitors. It works like this. If the tape is stopped at a precise point in time with reference to the incoming signal (say when the drum FF changes state, as this is locked to the field sync) and is restarted at the same point, the control track pulses should be evenly spaced – they are derived from the field sync pulses. Adjustments are required because pinch wheel movement takes a finite time. This movement must be kept to a minimum, typically 0·1mm clearance from the capstan to the pinch wheel in pause.

On the next positive-going excursion of the drum FF signal after record pause has been selected, IC5 produces a high at QA1. The microcomputer i.c. sorts this out. It coincides with the end of the ch. B head trace. Because of the presence of R14 and C3, input 2 of IC2 does not go high immediately. When it does, the data fed to A1 tells the pinch solenoid to release.

On pressing the play button or operating the camera trigger to restart the tape, the opposite sequence occurs – the microcomputer waits for the drum FF to go positive, QA1 then goes low, C4 discharges through R13, the input to IC1 goes low, the output to A0 changes and the pinch solenoid is re-engaged.

R13 and R14 are adjusted for the same delay at stop and start, subject to variables such as solenoid inertia and variation in the high and low logic threshold levels for IC1 and IC2.

We'll deal with the reel servo next month.

The B & K 467 CRT Tester/Reactivator

Eugene Trundle

Fear of tube failure has been a dominant worry ever since the start of domestic TV services, and was if anything stronger in the monochrome-only era. It's probably been the main reason for the British habit of TV rental – only recently has there been a trend away from this. It's true to say that in 1984 few TV sets, either monochrome or colour, justify tube replacement on economic grounds. The reasons for this are the increasing cost of transport and labour, the diminishing (in real terms) price of new sets, and the fact that good second-hand sets are plentiful. I for one am reducing my expensive stockholding of spare tubes!

Over the years there have been any number of boosters, jackers, reactivators and rejuvenators, call them what you will, all serving the purpose of staving off the day of the picture tube's demise. Constructional projects and reviews of such devices have often appeared in these pages. All work on the same basic reactivation principle – passing a heavy forward current through the diode formed by the tube's cathode and control grid in order to disturb and break up the cathode's emissive surface. The operation can be likened to removing the skin of a rice pudding by bringing it to the boil! The process is rather crude, and needs to be carefully controlled to avoid stripping the emissive coating from the cathode's nickel surface.

Many early reactivators were rather heavy-handed in this respect. Some were probably responsible for killing almost as many tubes as they rejuvenated, especially when used by clumsy or inexperienced hands. Boosters vary in their degree of sophistication: I've come across most types, both gentle and brutal, in my servicing career.

The advent of colour saw the introduction of new types, basically similar but with gun-switching facilities and often clumsy base connector boxes to cater for the different pinning arrangements used in different tubes. Many of these early boosters could not easily cater for the new tube types introduced in recent years – I never did find one that could do much for a Sony Trinitron tube, even with a suitable base socket in use.

Our faithful workshop reactivator gave up the ghost some months ago, and we took the decision to pension it off rather than patch it up again. Eleven years' service is not a bad record, and we've certainly had our money's worth during this time. Whilst looking at what's now available I found that the choice is somewhat limited. The main contenders come from Leader and B and K – Japanese and American respectively. The latter is far more expensive, but after enquiring among several satisfied users I decided to try it out.

Features

The 467 is much more sophisticated than other tube testers/reactivators. The array of dials, lights, buttons and knobs is reminiscent of a helicopter's flight deck, and impresses the customer no end! The instrument is built into a tough polyethylene attache case, with carrying handle and lead storage. The operating panel is revealed when the lid is opened. There are three moving-coil meters at the top, one for each gun of the tube under test. The operating controls and indication lamps are grouped beneath these meters in a logical layout – setting controls on the left, checking and restoring controls on the right. A pocketed flap in the lid holds the operating instructions and set-up charts. Behind this there's a foam-moulded storage tray for the various base adaptors for monochrome and colour tubes.

The three meters enable the emission and warm-up times of the three guns to be assessed simultaneously. Each meter serves two purposes, so that the heater, control grid and mains voltages can also be read accurately. The heater voltage (0-14V) is set by a switch and a potentiometer: 2A is available at up to 7V, 600mA beyond. Neon bulbs provide interelectrode leakage indication and, unusually, a continuity check to the focus electrode. Another uncommon feature is the "life test" which gives a prognosis at the press of a button. There's a remove-short facility for shifting grid-cathode leaks, and the rejuvenation process is available in two forms – a gentle clean-and-balance operation, or the more thorough type of routine. Each of these is a special timed process, as we shall see.

Testing Methods

There's not space here to provide a detailed account of the instrument's unique operating principles, so I'll confine myself to a brief description of the main functions.

In the emission test mode the tube's three guns are individually and sequentially addressed by a clocked digital logic system. Each gun is pulsed about twenty times a second, the peak current for each gun being indicated on its own meter. This pulsing technique allows a digitally-programmed first anode voltage regulator to set the cut-off point for each gun, even with a common anode assembly or the first anodes strapped together. During the tracking test, in which the gun characteristics are compared, the duty cycle of each gun is reduced and the resulting beam current indicated on the corresponding meter. Provided the best and worst guns have an acceptable emission ratio (less than 1·5:1), the meter indications will stay within the yellow tracking segments.

The life test is a useful feature. It works by reducing the heater current by fifteen per cent – achieved by switching primary taps on the mains heater transformer. If the emission of all guns remains satisfactory under these conditions, it can be assumed that the tube has at least a year or two's life left.

Interelectrode leakage is indicated by five neons, one each for the cathodes, heater and commoned grids. Because of the sequential gun-addressing system, the position of any leak, including intercathode ones, can be ascertained. Shorts between grid and cathode are blown clear by a capacitor discharge initiated by the remove-shorts button. A further neon is used in the focus electrode continuity test. This detects an open-circuit by reducing the first anode voltages and looking for an increase in the current flowing via the focus electrode. The increase is sufficient for the neon to strike, and by observing the emission meters during this test an open-circuit focus electrode in a strapped triple-gun assembly can be detected.

Reactivation

So we come to the B and K 467's main feature, its rejuvenation process. To prevent rupturing the cathode and thus ruining the tube, the current flowing during and also the duration of the "blasting" process must be precisely controlled. Two levels of reactivation current can be used, a low one for the clean/balance process, which can be safely used with any tube regardless of its condition and value, and a high one for rejuvenation.

So far so good, but cathodes can vary enormously, not only regarding contamination and wear but also in physical shape and size. Modern tubes use tiny quick-heat cathodes with a small emissive surface, whereas most monochrome and delta-gun tubes have large cathodes with a considerable coated surface area. Plainly each case calls for a different degree of blasting, and the problem is to ensure that justice is done in all cases without over cooking things.

The 467 achieves this by making the cathode itself the arbiter of its treatment. The heater current is first automatically increased to bring the cathode to an abnormally high temperature. The heater is then turned off and the rejuvenation current is simultaneously applied. A heavy current flows initially, but as the cathode temperature drops so the current falls, soon decaying to zero. This means that a large, robust and thermally inert cathode will get (and withstand) a sustained rejuvenation cycle, whereas the more fragile Trinitron and quick-heat cathodes will be restored without being wrecked.

Use and Performance

To test any monochrome or colour tube, reference is first made to the set-up chart. This lists virtually all known tube types and gives the approximate heater voltage and adaptor socket number. Once the correct adaptor has been fitted the test procedure is fairly simple, involving initial setting of the heater, grid and first anode voltages, followed by the emission test and then push-button checks on the tube's various conditions. This becomes routine after using the instrument a few times, and I soon learnt the adaptor types and procedures for the limited number of tube types I have cause to test. It was necessary to order one optional extra adaptor, for the small Trinitron tubes, but all the other tubes I encounter are catered for by the six adaptors that come with the instrument.

The auto-timing feature made me feel more at ease when rejuvenating tubes, and as far as I can see the only way to wreck a tube would be to continually repeat the rejuvenation process until the cathode finally died – this would call for a conscious and determined effort! The instrument will not do anything for heater-cathode leaks (neither will any other I know of), but on the one occasion that I encountered a cathode-grid leak the remove-shorts procedure revealed all – in the red picture, since the short was in the red gun.

I was very pleased with the results of the reactivation process. Given that the tube has all three heaters alight and no mask or screen defects, a useful and long-lived boost can almost always be obtained – unless the tube is completely worn out or has been previously over cooked by another reactivator. Certainly this is the first instrument I've come across that can give a new lease of life to a Trinitron tube: I've dealt with several of these successfully, and only one (about twelve years old) subsequently died. I believed (and still do!) that Trinitron tubes are manufactured with some sort of anti-jack characteristic in their cathode coatings . . .

The life test and tracking check facilities enabled me to get a pretty good idea of the condition and performance of the tube under test, and a reasonable indication of how long it could be expected to last. This is particularly useful for those testing ex-rental or second-hand sets before buying them. I chose not to use the little guarantee cards packed with the tester for dispensing to the happy owners of tested and rejuvenated tubes!

As with any tube tester, it's important to unplug the set under test from the mains supply, and in particular to discharge any e.h.t. from the anode cavity of a tube being treated. The test procedure necessarily turns on the guns, whereupon a conductive path is established to the tube's final anode. This conductive path will raise the instrument (and the operator!) to whatever e.h.t. level was stored in the Aquadag coating. Nasty . . .

I dismantled the instrument to assess its quality and the workmanship. The bottom deck consists of a fibreglass board containing a pair of 7400 series logic chips, ten transistors, lots of resistors and an army of diodes and rectifiers. Surprisingly, a lone valve sits on this board, a 12BH7A double triode. Elsewhere are a couple of heavy mains transformers and the potentiometers, pushbuttons and meters associated with the operating panel.

From long experience of commercial tube testers I find that the weak spots are the set-heater potentiometer, the function switch and particularly the multicore test cable and its terminations. I carefully examined all these items in the 467. The heater potentiometer is very beefy, rated at 12W, so I wouldn't expect any problems here. The function switch has scores of connections and would be difficult to change, but it looks reliable – a similar switch in my old tester has given no trouble during its many years' use. The test lead is terminated in a way that prevents stress or fatigue at either end, while the multipin flying plug (into which the base adaptors fit) looks rugged – it needs to be! I suspect that the most commonly used base sockets will eventually wear out, but these are available as spares at about £8 plus VAT each.

I'm told that all spares are available, in or out of guarantee, from the importers (address at end). They also carry out guarantee service during the first year and operate a free updating service (on request) for new tube types as they appear. As new base adaptors become necessary, these will be made available from the same source.

Conclusion

In conclusion, the instrument is now a feature of our workshop. Three hundred and sixty pounds plus VAT is a lot of money, and there's less here than in £360's worth of new colour TV set. There are many reasons for this however – and you can't rejuvenate tubes with a CTV! It may be difficult to justify the expense in a situation where the instrument won't get a lot of use, say in a one-man-band concern. In a busy workshop where a lot of servicing is carried out however my opinion is that the instrument is worth every penny! In an organisation such as mine it will probably pay for itself in a very few months. One of the crosses I have to bear is taking decisions on whether to continue maintenance contracts on old sets. The possession of this instrument has lately tipped the balance in favour of renewing many border-line contracts I might not have agreed to continue before. Let that speak for itself!

The B and K Model 467 is available to the trade at around £360 plus VAT from Radio Supplies Components Ltd., PO Box 27, Hartlepool, Cleveland TS24 7BR (telephone 0429 75750) and from various wholesale distributors.

TV Fault Finding

Reports from Richard Roscoe, John Coombes, Tony Thompson and M.S. Barakat

A Plague of Portables

Down here beyond the Tamar, the tempo of service life alters subtly as the days lengthen and temperatures rise. Triplers and line output transformers are packed up and put away ready for next winter's onslaught of dampness and mains surges. In their place are set out the weapons for the summer campaign: fuses, diodes, thyristors, mains droppers and smoothing capacitors to deal with our warm weather foe – the annual Plague of Portables.

Each year swarms of summer visitors, or "Emmets" if you're stuck behind one in a country lane, descend on our county carrying with them all they think they'll need for a fortnight of fun. Along with the caravan, kids, dinghy, dog, brolly, bucket and spade, a large number of them bring the portable from the bedroom or kitchen. Unfortunately they rarely bring the instruction book, which they've never read anyway, so connecting the set to the car battery the right way round is a matter of luck for them – and work for us. Hence the fuses, diodes, etc.

Some get through this first hurdle only to falter at the next. They find that the set hasn't taken kindly to being torn from its warm, comfy shelf, pitched into a bucking caravan with a motley assortment of household items, driven 400 miles and then plugged into an alien power supply. Years of reliable service are wiped out at a stroke in an orgy of dry-joints, drifting tuner potentiometers, dirty presets or other, more expensive, acts of vengeance. The latter also come our way, usually on the last day of the family holiday. Like the Ferguson Colourstar portable we had to deal with recently.

It was a Model 3756, with 14in. screen, and had gone dead the night before. This proved to be because the 1·6A mains fuse had blown, which is not an uncommon occurrence with these TX9 sets. Often there seems to be no cause, and Thorn have introduced several modifications to combat the problem, including an improved reservoir choke (L65), type 90D3-028-002, and over-voltage sensing zener diode (W85), type 02V4-718. So we decided to try a new fuse and if all seemed well advise the customer to consult his local dealer. We needn't have worried. The fuse popped off immediately, and a meter check at the mains bridge rectifier showed that two of the diodes were short-circuit. In went four new 1N4007s just to be safe. This caution was wasted because the next fuse went the same way. This time the regulator thyristor SCR1 (Y1044) was short-circuit, so in went a replacement for that. Bang went the next fuse.

By this time we were getting a bit worried. Apart from anything else, we'd only one 1·6A fuse left! So we did what we should have done in the first place and checked the resistance between the h.t. line and chassis. Not surprisingly there was a short, so we began to disconnect likely culprits. It wasn't the line output transistor, and it wasn't the crowbar thyristor. It turned out to be W77 (BY210-400), the "efficiency diode" in the power supply. Having made doubly sure that there were no further measurable shorts we tried our last fuse. Success! The set burst into life after the customary TX9 heart-stopping pause.

Another colour portable we've seen quite a bit of is the Hitachi CPT1471/CPT1473. They've all had the same fault. Indeed it's one of the few things akin to an old-

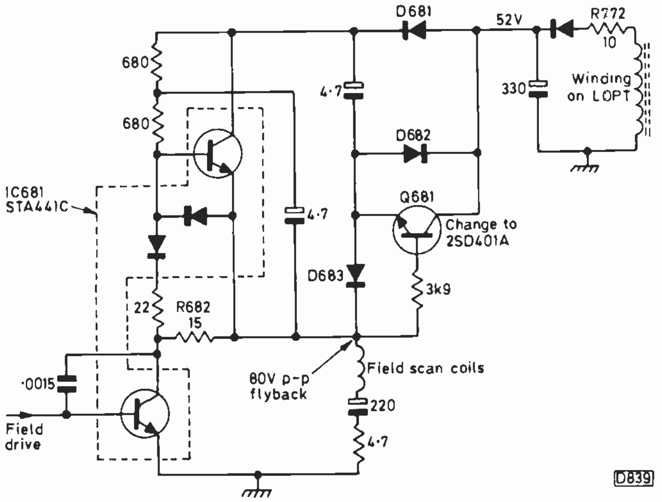


Fig. 1: Field output circuit, Hitachi CPT1471/CPT1473.

fashioned stock fault we've come across lately. The symptom is no results, sometimes intermittent but usually permanent. The first thing to do is to check Q681 (2SC1213A) in the field output stage (see Fig. 1). If this is faulty the following steps will have to be taken. Replace Q681 with the more robust 2SD401A. Also replace the switch-mode power supply chip IC901, type STR6020, part number 2366451 (it's a safety component). Hitachi say that when faulty this chip can produce excessive output, which leads to the demise of Q681. In addition, we would strongly recommend replacing R772 (10Ω), even if it seems all right. This is the surge limiter in the rectifier circuit that produces the supply for the field output stage and is also a safety component, part number 0119514. Hitachi comment that if R682 (15Ω) fails the STA441C field output chip will also have failed, but we haven't had one go yet.

The bulk of the summer portables we have to deal with are little monochrome ones of course. They come with all kinds of weird and wonderful names on the front, though their backsides tend to be much the same – not unlike their owners we sometimes think. One of the more interesting faults we've had recently concerned a GEC 2114 Junior Fineline which had normal sound but a blank, noise-free raster. Now the fact that the sound signal, which is tapped from the collector of the final i.f. transistor, was all right would tend to throw suspicion on the video circuitry. Everything here was o.k. however. As the more experienced of you will know, the intercarrier sound signal often gets through despite the i.f. strip proper being faulty. In this instance voltage checks proved that the final i.f. transistor was not conductive, due to its 120Ω emitter resistor R122 being open-circuit. **R.R.**

Amstrad CTV2000

We've had another case of no sound or raster with one of these sets. The STR451 switch mode power supply chip IC502 should produce 103V at pin 2. The fault was due to C509 (0·0033μF, 1·6kV) which is connected to one end of the chopper transformer's secondary winding (T501). **J.C.**

ITT CD652

This set (CVC25 chassis with CMC60 remote control system) was stuck on channel one. We checked through the i.c.s in the control circuit and found that the command went missing between IC3 and IC4. Replacing these two i.c.s failed to provide a remedy so I decided to check round IC3 with a meter. Unfortunately no pin voltages are given on the circuit, so guesswork is required. Pin 9 was found to read 16V, which was clearly wrong (see Fig. 2). The 1MΩ resistor R21 is fed from a zener diode stabilised 8·2V rail while C5 is connected to an 18V line. So either C5 was leaky or IC3 was at fault. We'd already eliminated IC3, so a check was made on C5 which was found to read 80kΩ. Replacing this restored all functions to normal. **M.S.B.**

GEC C2110 Series

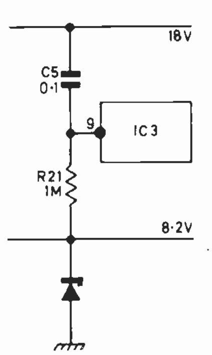
This 20in. solid-state set had come in for repair through the trade, the symptom being low gain. The picture had a washed out look, like me first thing in the morning... There was no observable graininess however, so I didn't suspect the tuner. Also the sound was o.k. One clue came when I removed the aerial, because instead of the expected visible and audible noise there was a blank raster and silence. Something was clearly amiss in the i.f. strip, so the next step was to check transistor voltages. This brought us to the emitter of the final i.f. transistor TR102 (BF197) where the reading was way out at more than 9V instead of 2·8V. The cause was found to be a severe leak in C113 (see Fig. 3). Replacing this restored full contrast and an excellent picture. **T.T.**

Thorn 9000 Chassis

This set had flyback lines all over the picture and a distinctly tubey look about it. Increasing the contrast tended to produce slight smearing. The next thing I noticed was that the brightness control had been set well down to keep the level correct. This led to a check on the c.r.t. voltages, where the first anodes were found to be at around 1kV instead of 700V. The cause was R722 (2·2MΩ) in the first anode supply potential divider network having gone high in value. Incidentally, if you get one of these sets with the complaint of flashovers (a hell of a crack at that) and the e.h.t. is correct it's probably the tripler – the casing tends to break down. I've had similar trouble with the 8500 recently. **T.T.**

GEC C1401H

For a grainy picture with noisy sound, first check whether the programme indicator light is a little dark. If so check for 33V at connector F5. If there's no voltage at this point R334 (10kΩ) is probably open-circuit. **J.C.**



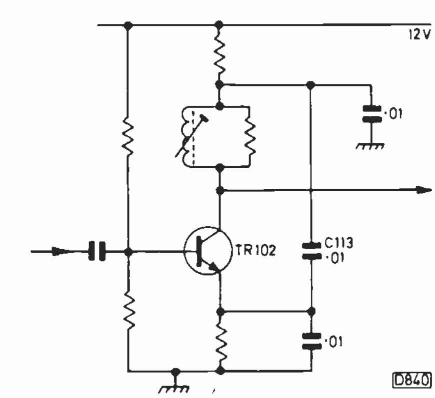


Fig. 2 (left): Channel sticking, ITT Model CD652.
Fig. 3 (right): Final i.f. stage, GEC C2110 series.

Long-distance Television

Roger Bunney

January was disappointing with regard to reception though dramatic in respect of winter fury. We have news of at least four aerial structures being damaged. During hurricane force winds Arthur Milliken (Wigan) lost his complete system (though his XG21s may be repairable). Both Cyril Willis (Ely) and Robin Crossley (Dunstable) report bent poles, but perhaps with most dramatic report comes from David Martin at Shaftesbury, Dorset. A guy on his 30ft mast snapped: this was followed by collapse of the mast when an anchoring bolt sheered, and destruction of the aerials. Fortunately the structure missed nearby buildings.

Tropospheric reception has been poor, which is hardly surprising in view of the weather. The Quadrantids meteor shower produced increased signal pings throughout Band I, with isolated bursts in Band III, January 4th being particularly active. Much of the MS activity occurred during the day, allowing positive identification of many of the signals. There's been some Sporadic E activity, the log being as follows:

8/1/84	TSS (USSR) chs. R1, 2; ORF (Austria) E2a.
9/1/84	TSS R1.
11/1/84	NRK (Norway) E2.
12/1/84	RAI (Italy) 1A, B; JRT (Yugoslavia) E3; RTVE (Spain) E2, 3, 4; RTP (Portugal) E3.
16/1/84	RTVE E2, 3, 4.
18/1/84	JRT E3, 4, RTSH (Albania) C; ORF E2a; RTVE E2; TVP (Poland) R1, 2; TSS R1.
2/2/84	RTP E3.

A glimmer of light during the winter gloom has come from Jim Maden (S. Africa) who confirms that ZTV (Zimbabwe) ch. E2 Gwelo is still in operation – he's received the station recently via SpE.

Following recent 405-line transmitter closures, Band I is relatively clear for many enthusiasts. This is especially so in E. Anglia now that Tacolneston Ch. B3 is off air.

A further sixty experimental amateur 50MHz transmitting licences have now been offered. Reports on any interference from this source on chs. E2/R1 during the coming season would be appreciated. Simple filtering should remove most problems, but those experiencing difficulties (or solving them!) are asked to write in!

News Items

France: The fourth channel Canal Plus has started to transmit an identification slide and a half hour film giving details of the service. Paris, Rhône-Alpes, Provence and the Côte d'Azur will be the first areas to receive signals. A twelve-hour daily service is expected to start on November 1st, with mainly films.

S. Africa: A TV service (BOP-TV) has been started in Bophuthatswana. Details: ch.E37 vertical, 200W e.r.p. directional, modified PM5544 test pattern.

Spain: The authorities have closed down the pirate Band III transmitter at Fuenjirola, South Spain. It had been relaying the GBC (Gibralta) service.

Australia: The Aussat DBS is due to be launched next year. The two main spot beams will be used for the national ABS service. Lower-level broad beams will be used as a means of distributing commercial services to local stations.

Radio Amateurs: Mention has been made in previous columns of the possibility that the spectrum 50–52MHz will be allocated to ham use. No specific date for such an allocation has been officially announced and in a letter the RSGB general manager/secretary David Evans writes that "any view expressed as to a future allocation to UK amateurs at 50MHz is purely speculation".

New EBU Listings

The height of the Maasser el Chouf, Lebanon mast has been increased from 45m to 70m. Transmissions are on ch. E4 at 60kW e.r.p.

Considerable reductions in e.r.p. are given for various Syrian Band I transmitters – Abou-Kamal and Nabi-Saleh (both ch. E3) 400W instead of 400kW and Hassake (ch. E4) 95W instead of 35kW. I suspect that previously supplied information was incorrect – similar changes are given for a number of Band III transmitters.

1984 Meteor Showers

The main 1984 meteor shower dates are as follows:

Quadrantids	January 1st–6th.
Lyrids	April 19th–25th, peaking on the 21st/22nd.
May Aquarids	May 1st–10th, peaking on the 5th/6th.
Delta Aquarids	July 15th–August 15th, peaking on July 28th/29th.
Perseids	July 25th–August 20th, peaking on August 11th/12th.
Orionids	October 16th–26th, peaking on the 20th–23rd.
Taurids	October 20th–November 30th, peaking on November 1st–10th.
Leonids	November 15th–20th, peaking on the 17th–18th.
Geminids	December 7th–15th, peaking on the 13th.
Ursids	December 19th–24th, peaking on the 22nd.

Our thanks to George Spalding, Director of the BAA Meteor Section, for supplying these dates.

Ryn Muntjewerff

DX-TV reception by Ryn Muntjewerff at Beemster, Holland, has often been reported in this column. Ryn started – as so many do – after accidentally noting distant signals on his domestic TV set – in his case bull fights from Spain in the summer of 1961. After further reception he installed a roof-mounted mast and achieved some of the the first DX reception at u.h.f. In the spring of 1970 he erected a 22·5m mast for tropospheric reception, leaving a wideband array (chs. E2-R4) mounted on the roof for SpE reception.

Due to the exposed location, Ryn has lost several aerial systems, mainly as a result of the U-bolt/clamp section of the diecast housing of bell-type rotors snapping. To prevent this trouble Ryn now uses an alignment bearing on top and an internal sleeved pipe inside the mast atop the rotor.

His achievements in Band I have been remarkable, with reception from Australia (ch. 0), Korea (AFKN Seoul ch.

A2), Malaysia (ch. E3) and southern Brazil (Port Allegre ch. A2) – in total some 47 countries. His farthest u.h.f. reception has been from Pajala, Sweden (SR-2 on ch. E34).

At present he has double stacked group A, C and E Fuba XC391 arrays on the mast plus horizontally and vertically mounted Wise 24-element wideband Band III arrays and a nine-element Fuba v.h.f./f.m. array. Three-element ch. E3 and ch. E4 arrays are mounted vertically and horizontally on the house along with a nine-element ch. E2-R4 BDXC system.

Satellite Location/Bearing Service

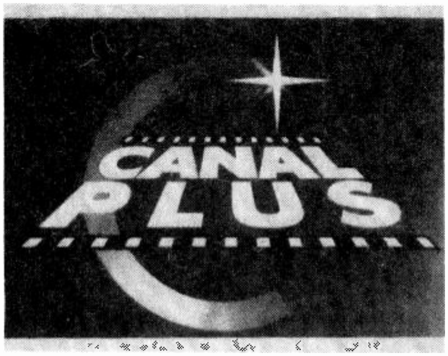
Neville Cresdee (14 Arminers Close, Clayhill, Gosport, Hants PO12 2HB) is now providing, on a commercial basis, print-outs for given locations showing all available TV carrying satellites. Here at Romsey for example some 48 craft are visible: at 4GHz, signals from some 20 craft should be resolvable using a small dish. These craft are underlined in the print-out, the more powerful satellites, such as the Gorizont series, being underlined in red. Explanatory notes, including satellite leasing information, come with the print-out. The service costs £10 and if there's sufficient interest additional information such as E.I.R.P. levels will be included.

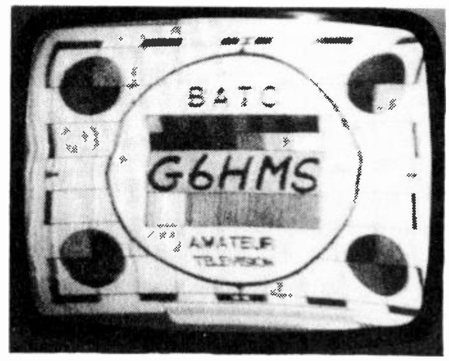
From our Correspondents . . .

A letter from Brussels reports that both BBC TV services are now carried by the Coditel, Brutele and Radio-Public cable networks. The Coditel network provides 18 channels at 67 Belgian Francs annually. UK TV quality is "most satisfactory", though there have been occasional problems with the sound due to the need to change it from 6MHz to 5·5MHz. Reception of UK teletext has still to be tried. Our contact also reports that the TV5 ECS downlink service is in Secam, with an f.m. sound carrier at 6·5MHz. The terrestrial ECS downlink transmissions on ch. E56 in Brussels carry colour bars and the identification "CNCT Bruxelles".

Isik Yildirim (Turkey) is receiving signals from the 99°E Ekran satellite, though rather weakly, using a Fuba XC391D aerial and AKV145 junction box amplifier, a Teldis masthead amplifier and a standard v.h.f./u.h.f. Crown portable TV receiver. The latter has been fitted with an f.m. demodulator, and the results to date have been encouraging. It's now apparent that the side radiation from the Ekran satellite is very low in comparison with the high signal levels received in S. Africa from the rear.

Ronald Exeter (Bishopton), whose DX signal detector/alarm was featured last month, uses mostly home-built equipment for DX reception. His receiving system consists of a home-built tuner and parallel vision-sound i.f. strip, a tunable intercarrier sound channel, a vision detector and a quartz-locked resync and blanking unit based on a ZNA134 chip. The output is fed to a VCR for remodulation back to u.h.f. and finally goes to a Barco PAL/Secam colour set. The detector also drives a CMOS logic board for recording on the VCR – the resync unit maintains VCR servo locking, which would otherwise be upset by "messy" DX signals, while the blanking is inserted to prevent the VCR's clamp pumping in the presence of interfering beat signals. An experimental SAWF i.f. strip is under development: results obtained so far show that a weak ch. R1 vision signal (49·75MHz) can be viewed even when a very strong ch. E2 vision signal (48·25MHz) is present.





Left: The identification slide now in use by the French fourth channel Canal Plus. Centre: ATV reception by Ryn Muntjewerff (Holland) from Saintes, a distance of 871km. Power just 2W. Right: ATV reception by Robin Crossley (Dunstable) from G6HMS at Lincoln.

Mel Thurlbourne is back at Leighton Buzzard after several months' duty and DXing in the Falklands. Whilst there he received signals on chs. A2 and A3, but nothing in Band III or at u.h.f. SpE signals from Argentina have been identified: other signals await identification from photographs. Argentina had delivered ch. A7 PAL N transmission equipment for the intended Port Stanley TV service.

Robin Crossley recently moved to Dunstable, which by all accounts is a much improved location. He's using a wideband, 92-element Triax array at u.h.f., an eight-element Jaybeam ABM8 array for Band III, a four-element Band II array and crossed dipoles for Band I. Belgian f.m. radio is always present, in stereo, and an f.m. radio pirate (Skyline Radio) is heard daily on 103·6MHz at a distance of some 45 miles.

Amateur Television

Since I first started to mention ATV in this column several letters have arrived asking about reception. Transmissions are usually between 434-438 MHz, which in general terms is below the efficient operation of a group A or wideband array. For a start however it would seem best to press the normal DX-TV system into service. Experience shows that a stacked bowtie aerial system such as the Wolsey Colour King or Triax BB grid provides reasonable performance (in terms of gain and directivity) down to 435MHz. A group A Yagi could be adapted by using 13in. reflector elements – something of a compromise as regards efficiency, though this should provide reception of local ATV signals. If interest develops, a 435MHz array can be obtained – units are available in the Jaybeam and Tonna ranges. Since many ATV signals will be at a low level, a masthead amplifier is advisable – most wideband u.h.f. amplifiers will provide amplification at 435MHz.

One problem is that the use of a standard u.h.f. array and a wideband amplifier can result in overloading, particularly with local group A broadcast signals. Suitable bandpass (or bandstop) filtering should minimise this problem – the overloading usually occurs in the tuner's r.f. amplifier rather than at the masthead. I've used both Labgear and Wolsey wideband u.h.f. amplifiers satisfactorily at 435MHz.

Tuning over 434-438MHz is usually done with a standard u.h.f. tuner, possibly modified, or a frequency converter. Many u.h.f. tuners will cover the ATV band with no modification. The ET021, ELC1043 series, ELC2060 and the ELC2000 series will generally reach down to 435MHz at minimum voltage on the tuning line. If a particular tuner won't reach 435MHz, a slight increase in the length of the mixer and oscillator tuned lines should be all that's required by way of modification. Many Japanese and Far Eastern portable sets tune down to 435MHz, as do certain VCRs. In view of the cheapness of surplus tuners, it's reasonable to obtain one and tweak it for maximum output at 435MHz.

The use of frequency conversion is simpler but more expensive. Upconverters that accept the 435MHz band and provide an output in the ch. 37/38 spectrum are available at about £30. They generally use bipolar transistors and if confronted with high-level group A signals can cause cross-modulation. I experienced this problem – the four local group A signals were at 40mV each. Use of a simple two-pole bandpass filter for 435mHz resolved the problem. Commercial converters are housed in diecast boxes and are untuned. ATV products are available from the following firms: Wood and Douglas, Aldermaston, Nr. Reading; Microwave Modules, Aintree, Liverpool; Fortop, Warrington, Stoke on Trent.

A standard system I receiver can be used. For those living near the south coast there's the bonus of French ATV signals, though a system L receiver (or converter) will be required. Many French amateurs switch to negative-going video when in contact with UK stations however.

The emphasis is on test card/pattern transmission, though increasing enthusiasm for computer graphics is evident. Call signs, often with details of the transmission site, are given: otherwise the "locator" is shown – this is a code number that refers to a European reference grid and is sufficient to identify the approximate source of a transmission. Camera operation is also extensive.

Communication with ATV operators is usually done at 144·75MHz, the main calling frequency in the UK. If you're not licensed and don't have a 144MHz transceiver, the cheapest way of monitoring this frequency is to use a Daiwa SR9 receiver. This has continuous coverage at two metres with provision for crystal control – crystals can be obtained for 144·75MHz and for each side of the calling frequency at a spacing of 25kHz. It's not essential to hear the ATV talkback, but this is helpful in deciding whether there's any activity and if so where it's from.

I'd be pleased to assist with any queries on ATV reception (include a s.a.e. for a speedier reply). Anyone with a strong interest in the subject should join the British Amateur TV Club (BATC) which publishes a regular journal and also three guide books. For membership details send a 9 × 4in s.a.e. to Mr. B. Summers, 13 Church Street, Gainsborough, Lincs. In good openings, signals should be received at up to 500 miles. Let us know how you get on, with details of equipment, aerials etc.

Service Bureau

Requests for advice in dealing with servicing problems must be accompanied by a £1·00 postal order (made out to IPC Magazines Ltd.), the query coupon printed below 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.

FERGUSON 3V22

A buzzing noise in the background on the sound has developed, increasing to a higher level when recorded programmes are played back. This sound is not so prominent with a commercial prerecorded tape. Tuning doesn't improve matters, except at the expense of the picture.

Remove the top and left-hand side of the machine, unsolder the two white leads from the servo (left-hand) panel, swing this out and clean both slide switches. Make sure that the switch bars *don't* go into the holes in the switches when replacing the board. If E-to-E buzz persists, try reducing the E-E level (bottom board).

TYNE 5224

The problem is line output transformer arcing – it's been rewound three times during the last six months. The last time the fault occurred R502 (820kΩ, 2W) associated with the tripler was found to be open-circuit.

It seems that either the h.t. is excessive or the line output transformer tuning is incorrect. Adjust P301 for 135V at C348 and if necessary replace C353 (5,100pF, high-ripple pulse type).

THORN 1525 CHASSIS

There's a weak picture that goes negative when the brightness control is advanced. I've tried boosting the tube's heater voltage but this hasn't helped. Can't find any references to this chassis.

The 1525 chassis is a variant on the well-known 1500. The symptom is not uncommon and is usually due to a fault in the video output stage. Suspects, in order of likelihood, are as follows: the video output transistor VT9 (a BF337 can be used); its collector load resistors R40 (2·2kΩ) and R41 (5·1kΩ); and the supply decoupler C38 (12μF).

PHILIPS N1700

There is continuous flutter on prerecorded and recently recorded tapes, though the machine has recently been serviced, with a new pressure roller and belt amongst other things.

If the flutter is on sound, check the adjustment of R3 (capstan servo ripple) in the U320 module, using a scope or AVO and diode probe. If the flutter is on the picture, check that the tape is not wrinkling due to dirt on the guide near the audio/sync head and for severe wear in the latter – also check the head bearing for wear or lack of oil. Finally adjust R2 (head servo ripple) in module U219. If neither ripple can be reduced to zero, the capstan or head motor could be faulty.

THORN 8000 CHASSIS

The problem with this set is vision buzz on sound. Is there a stock fault to check?

This chassis is not the best performer as regards vision buzz. First check C140 (47pF) in the quadrature tuned circuit, then carefully tune the coil (L110) for minimum buzz. If the buzz persists, check the intercarrier sound chip's supply decoupler C133 (80μF) and the ceramic input filter CF101. Finally try a very small (less than half a turn) adjustment of L102 in the i.f. passband filter circuit.

SONY KV1810UB

The trouble is pincushion distortion. The two controls VR585 (amplitude) and VR586 (bias) have been adjusted for optimum results, but there's still a half-inch bow-in at each side of the raster. VR585 is at one end of its travel.

The usual cause of this fault is that the coupling capacitor C585 (4·7μF, 100V) between the field output stage and the pincushion correction circuit has dried up.

THORN 3000 CHASSIS

There's a good, clean monochrome picture but this becomes increasingly noisy as the colour is turned up. At the correct colour control setting the noise gives the impression of a poor level signal from the aerial, but the signal strength here is first class.

If the colour is locked, check transistor VT110 and the a.c.c. smoothing capacitor C173 (2·5μF) on the i.f. panel. If necessary, check the chroma amplifier transistor VT309 and the blanking diodes W316/7 on the decoder panel.

BUSH BM6514

The set is all right when first switched on, but the picture and sound deteriorate after ten-fifteen minutes, leaving a grainy picture and poor sound. Touching the aerial socket with a screwdriver restores the signals, but only for five-ten minutes.

The tuner is almost certainly faulty. Before replacing it, remove the sides and check carefully for dry-joints and solder blobs. A magnifying glass would help.

FERGUSON 3V31

Is it possible to convert the clock in this VCR to operate on a twelve-hour cycle?

You will have to gain access to the 08 display panel. Locate the display control chip IC401 (μPD552C-079) and then link pins 40 and 41.

QUERY COUPON

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TELEVISION APRIL 1984

COMPUTER USE

I intended to use a Sinclair ZX Spectrum with my Grundig 1645GB colour portable (GSC200 chassis). This set gives an excellent off-air picture but won't resolve the Spectrum computer's colour, giving a perfect monochrome display instead. A large-screen Philips set with manual tuning gives a very good colour display however.

Sweep tuning is sometimes a mixed blessing. If this is the trouble and the fine tuning buttons won't get a grip on the chrominance signal, some other means of getting the signal into the set will have to be found. First try an attenuator (say 6dB) in the aerial lead. Alternatively adjustment of preset RV on the vision i.f. module may achieve the desired result.

TEST CASE

256

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

A great deal of on the job training takes place in our workshop on an informal basis, depending on the workload and the suitability of the items in for repair. These days the emphasis is mainly on VCR servicing – we find that a "hands on" session is much more valuable (though more time consuming!) than a verbal or written description of symptoms, diagnosis, practical repairs and adjustments.

A suitable recent case consisted of a fairly new Sony SLC6UB VCR. Although it's a Betamax machine, the story to be told would apply equally to other types and models. The symptom reported was that the picture was rolling and juddering vertically. This was bad on library tapes, and intolerable with self-recorded tapes. E-to-E and direct r.f. picture reproduction were faultless. After a test to confirm that the symptoms were as described, the machine was given to a trainee to ponder over – with the proviso that he checks with his colleague before doing anything drastic, either mechanically or electrically.

Off he went with his scope, making a start at the video output socket. By examining the field rate waveform here he found that the E-to-E signal was perfect whereas the off-tape signals had bad deficiencies in the field sync pulse train and during the first few lines of the picture. These lines were of low amplitude and noisy compared with the video signal during the rest of the field period. None of the playback waveform was as clean and sharp as the off-air signals, and further checking showed that during playback of the machine's own recordings the field sync signals were virtually obliterated by noise.

After some thought our trainee decided to check the r.f. envelope pattern (from the head preamplifiers) during playback, and demanded an alignment tape for the purpose. This was refused as the remains of a chewed up alignment tape (a sad story we won't recall here) had only recently been enshrined. He was told that he was on the right lines and given a known good prerecorded tape with colour bars.

Access to the relevant test points on the RF4 board is not easy on this model as the AD6 and RF4 panels have to be half-cocked over the whizzing head drum. When the waveform was displayed however a significant dent in the envelope pattern at the left of each head's trace was seen. Knowing that the field sync pulse comes at the start of each head sweep, our trainee correctly surmised that this was the cause of the symptoms. Adjusting the tracking control made little difference to the envelope shape – it reduced in amplitude without changing shape much when the control was adjusted.

Careful head, drum and tape guide cleaning made little improvement, and after consulting the adjustment manual and with the approval of his colleague our man cautiously adjusted the tape entry guides, after carefully marking their initial positions by scribing, then counting turns. The result of all this was disappointing. Screwing the guides up and down gave a "Christmas cracker" effect at the left-hand side of the signal envelope, with corresponding mistracking bars on the monitored picture, but the envelope's round shoulder shape remained. The senior technician had a good idea all along what the trouble was – have you? We'll come back to it again next month.

ANSWER TO TEST CASE 255

– Page 271 last month –

The incredible situation described last month concerned a 22in. Tandberg colour set: the parts of the display that should have been red were blue, those that should have been green were red and the blue bits (!) came out green. Merely setting it out like this, and knowing that the tube's cathodes were being driven by the correct signals, gives the clue to the whole thing – especially in view of the fact that a purity error was present.

What our quack doctor had done of course was to grossly twiddle the purity rings, to a point where the beam landing was taking place on the wrong phosphor dots. Thus the red beam was bombarding the blue dots and so on. Thorough degaussing, alternating with purity adjustment, eventually produced correct purity. Adjustment of the drives and cut-off points then put the grey scale to rights. The root of the trouble seems to have been the proximity of the TV set to some large metal mass – our customer deals in scrap metal.

Our hope is that his friend with the screwdriver doesn't graduate to VCRs. The thought of taking our turn after him with say a Sony C9 is a daunting one. I hear that he mends lorries, oil tanks and chairs as well, which certainly indicates versatility . . .

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Everything you need to polish approx. 25* tubes to a high standard. Detailed instructions on how to do the polishing. All you require is an Electric Drill.

Practical instructions available to buyers of kit, please enquire for details.

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***Depends on depth and area to be polished.**

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SN 29848	2.25
SN 57108AN	1.95
SN 76001AN	1.60
SN 76003	2.20
SN 76013N	2.50
SN 76013ND	2.50
SN 76023N	2.20
SN 76131N	1.35
SN 76226DN	1.60
SN 76227N	1.20
SN 76532	2.00
SN 76550	0.29
SN 76546	1.80
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TA 7073AP	3.20
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TA 7076P	3.30
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TA 7093P	2.90
TA 7108P	2.44
TA 7117P	3.20
TA 7120P	1.61
TA 7129AP	3.20
TA 7130P	1.38
TA 7137P	2.00
TA 7139P	2.75
TA 7146P	2.00
TA 7157P	3.20
TA 7171P	3.20
TA 7172P	3.30
TA 7176AP	3.00
TA 7193P	5.20
TA 7202P	3.30
TA 7203P	3.30
TA 7204P	2.16
TA 7205P	1.40
TA 7208P	2.70
TA 7210P	5.60
TA 7222P	1.70
TA 7223P	3.50
TA 7227P	5.10
TA 7310P	1.70
TA 7313P	2.80
TA 7609P	4.00
TA 7611AP	2.90
TA 75902P	2.03
TAA 320A	1.30
TAA 470	2.30
TAA 550	0.39
TAA 691	1.95
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TBA 510	1.20
TBA 520	1.50
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TCA 800	2.00
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TDA 2530	2.20
TDA 2532	2.70
TDA 2540	2.20
TDA 1365	5.75
TDA 2541	2.30
TDA 2560	2.05
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TDA 2581	1.30
TDA 2582	1.80
TDA 2593	2.70
TDA 2600	5.00
TDA 2611A	1.15
TDA 2640	1.80
TDA 2653	2.10
TDA 2680	2.10
TDA 2690	2.20
TDA 3560	5.10
TDA 3561	6.50
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TDA 4600	2.10
UPC 41C	3.50
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UPC 555H	0.80
UPC 556H3	1.70
UPC 557H	0.92
UPC 566H3	3.50
UPC 574J	0.55
UPC 575C2	1.49
UPC 577H	3.50
UPC 585C	1.49
UPC 741G	0.95
UPC 1009H	2.41
UPC 1017G	2.50
UPC 1018C	1.19
UPC 1023H	0.63
UPC 1024H	0.63
UPC 1025H	3.70
UPC 1026C	1.60
UPC 1028H	2.40
UPC 1031H2	2.40
UPC 1032H	0.98
UPC 1035C	2.50
UPC 1037H	1.62
UPC 1041H	1.28
UPC 1042C	2.60
UPC 1043C	2.60
UPC 1156H	2.40
UPC 1158H	0.78
UPC 1161C3	1.58
UPC 1163H	0.98
UPC 1167C2	1.58
UPC 1168C	2.75
UPC 1170C	1.75
UPC 1171C	1.62
UPC 1173C	2.14
UPC 1176C	2.43
UPC 1177H	2.60
UPC 1178C	2.14
UPC 1180C	3.00
UPC 1181H3	1.62
UPC 1182H	2.70
UPC 1183H	2.30
UPC 1185H2	3.50
UPC 1186H	0.98
UPC 1187V	1.70
UPC 1188H	3.60
UPC 1190C	2.00
UPC 1191V	1.70
UPC 1197C	1.70
UPC 1198H	1.41
UPC 1200V	1.97
UPC 1204C	1.63
UPC 1208C	2.00
UPC 1211C	4.00
UPC 1212C	1.34
UPC 1213C	1.53
UPC 1215V	2.70
UPC 1216V	1.99
UPC 1217G	3.59
UPC 1218H	3.00
UPC 1222	2.00
UPC 1223	3.70
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UPC 1227	2.00
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UPC 1245	2.20
UPC 1250	2.40
UPC 1350C	4.50
UPC 1353C	2.80
UPC 1356C2	3.00
UPC 1358H	3.00
UPC 1360C	3.50
UPC 1361C	3.70
UPC 1363C	3.50
UPC 1365C	5.00
UPC 1366C	3.00
UPC 1367C	3.00
UPC 1368H	4.00
UPC 1370C2	4.00
UPC 1373H	1.11
UPC 1377C	4.50
UPC 1378H	4.00
UPC 1382C	1.97
UPC 1384C	5.70
UPC 1447W	0.98
UPC 1470H	0.90
UPC 2002V	2.80

DIODES

BA148	0.18
BA159	0.10
BB103	0.20
BB105B	0.20
BY127	0.11
BY133	0.11
BY176	1.35
BY184	0.40
BY187	0.69
BY190	0.60
BY210-800	0.29
BY223	0.95
BY226	0.27
BY227	0.31
BY295	0.25
BY296	0.25
BY298	0.25
BY299	0.25
BYX10	0.21
BYX36-600	0.50
BYX71-350	0.50
BYX71-600	0.99
BYX55-600	0.33
BR100	0.35
OA47	0.10
OA90	0.08
OA91	0.08
SKE5F	1.40
IN60	0.08
IN4001	0.05
IN4002	0.05
IN4003	0.05
IN4004	0.06
IN4005	0.07
IN4006	0.07
IN4007	0.07
IN4148	0.03
IN5402	0.13
IN5404	0.15
IN5406	0.17
IN5408	0.18
Y969	0.87

ZENERS

400MW	
2V4 to 75V	0.10
1.3W	
2V7 to 91V	0.18
100V to 200V	0.19
15 WATT	
BZV15C12R	1.18
BZV15C24R	1.18
BZV15C30R	1.18

BRIDGE RECT.

B40	0.80
BY164	0.50
BY179	0.70
W005	0.25

TRANSISTORS

AC127	0.30
AC128	0.30
AC153K	0.36
AC176	0.30
AC186	0.30
AC187	0.30
AC188	0.30
AD149	0.88
AD161	0.45
AD162	0.45
AF139	0.48
AF239	0.60
AU113	2.60
BC107	0.10
BC108	0.11
BC109	0.10
BC116	0.13
BC140	0.30
BC141	0.30
BC142	0.22
BC143	0.27
BC147	0.09
BC148	0.10
BC149	0.09
BC154	0.11
BC157	0.10
BC158	0.11
BC159	0.11
BC170	0.13
BC171	0.10
BC172	0.13
BC173	0.12
BC174	0.12
BC182L	0.09
BC183L	0.09
BC184L	0.09
BC207	0.09
BC212L	0.09
BC213L	0.11
BC237	0.10
BC238	0.10
BC250	0.11
BC251	0.11
BC252	0.10
BC253	0.11
BC301	0.31
BC302	0.31
BC303	0.33
BC307	0.13
BC308	0.13
BC327	0.11
BC328	0.13
BC337	0.11
BC338	0.13
BC350	0.12
BC365	0.30
BC413	0.11
BC460	0.48
BC461	0.52
BC462	0.53
BC463	0.53
BC527	0.13
BC528	0.13
BC546	0.10
BC547	0.09
BC548	0.09
BC557	0.10
BC558	0.10
BD131	0.30
BD132	0.36
BD135	0.30
BD136	0.30
BD139	0.33
BD140	0.60
BD150A	0.70
BD207	0.90
BD221	0.40
BD228	0.35
BD233	0.53
BD234	0.38
BD238	0.38
BD239	0.42
BD253B	0.65
BD416	0.42
BD534	0.33
BD595	0.55
BD596	0.55
BD681	0.58
BD807	0.50
BDX32	1.70
BF127	0.30
BF137	0.30
BF180	0.29
BF181	0.27
BF182	0.28
BF185	0.32
BF194	0.10
BF195	0.11
BF196	0.13
BF197	0.13
BF198	0.16
BF199	0.18
BF200	0.34
BF240	0.16
BF245	0.30
BF256L	0.40
BF258	0.27
BF259	0.32
BF264	0.40
BF273	0.13
BF274	0.11
BF337	0.32
BF338	0.32
BF355	0.56
BF458	0.48
BF459	0.51
BFR79	0.26
BFY50	0.24
BFY51	0.23
BFY52	0.23
BU105	1.40
BU108	1.60
BU124	0.98
BU126	1.60
BU137	1.40
BU204	1.40
BU205	1.40
BU208	1.55
BU208A	1.90
BU208D	2.30
BU326	1.80
BU407	1.40
BU426V	1.70
BU526	1.62
BUW81A	2.55
E1222	0.35
FT3055	0.65
MJE340	0.50
MJE520	0.45
R2008B	1.70
R2009	1.90
R2010B	1.90
R2028	1.90
R2029	1.90
R2030	1.90
R2265	1.90
R2305	0.65
R2306	0.70
R2322	0.70
R2354B	0.78
R2396	0.80
R2441	0.83
R2461	2.00
R2477	0.78
R2501	2.00
R2540	2.10
SP8385	2.10
T9011V	0.80
T9016V	0.80
T9035V	0.82
T9038V	3.50
TIP29	0.38
TIP30A	0.34
TIP31A	0.34
TIP31C	0.48
TIP32A	0.34
TIP32C	0.48
TIP33B	0.75
TIP41A	0.46
TIP41C	0.58
TIP42A	0.45
TIP42C	0.68
TIP30A	0.34
TIP31A	0.34
TIP31C	0.48
TIP32A	0.34
TIP32C	0.48
TIP33B	0.75
TIP41A	0.46
TIP41C	0.58
TIP42A	0.45
TIP42C	0.68
TIP100	0.70
TIP130	0.70
TIP2955	0.74
TIP3055	0.55
TIS90	0.90
TIS91	0.24
2N3055	0.73
2SB350A	1.90

REGULATORS

78 Series 1 Amp 5V 12V 15V 18V 24V	0.60
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78L Series 100mA 5V 8V 12V 15V 24V	0.42
79L Series 100mA Voltages as above but negative output	0.70

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PYE IF GAIN	7.80

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G11 Non Remote Round Shaft	0.85
G12	0.85
G8 Plastic	0.85
G8 Metal	1.30
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3 Pole Single Throw Rank TCE, GEC	1.25
2 Pole +Nom Make Philips G11/G12 Remote	1.30
Thorn 1615 with Vol Control	3.50
3000 A1	0.55
3500 A1	0.55
Vert Gun Switch (A1)	0.25
Horiz Gun Switch (A1)	0.25

DELAY LINES

DL50	1.80
DL700	1.70
TAD80	1.70
Luminance (matches TBA560)	2.00

TUNER PRESETS

G8/G9	0.48
Thorn/GEC	0.48
G11	0.48

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Diode Split EHT lead	1.60
EHT Cap	0.75
10M Pack of EHT Cable	1.50

THICK FILM EHT RESISTOR

10MΩ	0.60
33MΩ	0.60
47MΩ	0.60

HEATSINKS

TO18	0.06
TO5 6mm	0.09
TO5 13mm	0.15
TO5 25mm	0.19
TO3	0.17
TO3 FINNED	0.60
TO220	0.34
TO126	0.34

WOUND COMPONENTS

G11 E.W. Coil	1.32
G11 E.W. Trans	1.15
Decca 100 E.W. Coil	1.32
Linearity Coil AT4042/02	1.15
Transductor 90°	1.65
110°	1.85

CRYSTALS

4.43MHz	1.80
8.86MHz	1.80
8.86MHz Miniature	1.75

VIDEO THICK FILMS

3500	1.45
Pye 713	1.90
Pye 731	1.90

FILTERS

6MHz	0.78
SW150	2.20
SW154	2.20

SUNDRIES

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5A	0.22
Min Insulated Croc Clip Red or Black	0.07
Standard Croc Clip	0.08
GEC Neon	0.15
3500 Cut out	2.00
Focus Spark Gaps	0.15
Rank Tuner Cams	0.08
5yds PVC Tape	0.12

THYRISTORS

KONIG 15/80 Universal	2.47
KDNIG 15/85 Universal	2.47
BR101	0.37
BR103	0.62
BRY39	0.56
BRY49	0.65
BRY55	0.60
BRY56	0.37
BT100	0.90
BT106	1.55
BT116	1.60
BT119	2.00
BT120	2.00
DEC1	1.70
DT112	1.85
OT121	1.55
2N4444	1.55

DISCOUNTS

ORDERS OVER £50 IN VALUE 5%

ORDERS OVER £120 IN VALUE 10%

(Order Value not including VAT)

VIDEO HEADS & CRTs EXCLUDED

AA117	0.090
AA119	0.090
AAY32	0.090
AC107	0.280
AC126	0.170
AC127	0.150
AC128	0.150
AC128K	0.230
AC141K	0.230
AC142K	0.220
AC153K	0.230
AC176	0.180
AC176K	0.200
AC187	0.150
AC187K	0.200
AC188	0.170
AC188K	0.230
ACY18	0.480
ACY19	0.480
AD142	0.600
AD149	0.450
AD161	0.220
AD162	0.220
AF124	0.250
AF125	0.250
AF126	0.250
AF127	0.250
AF139	0.220
AF239	0.220
AL112	0.700
AL113	0.800
ASZ15	1.000
ASZ17	1.000
AU106	1.000
AU110	1.100
AY102	1.800
AY106	1.800
BA145	0.100
BA148	0.100
BA154	0.060
BA157	0.120
BB101	0.130
BB103	0.160
BB105B	0.180
BB205B	0.240
BC107	0.070
BC108	0.070
BC109	0.070
BC115	0.100
BC118	0.110
BC140	0.190
BC141	0.190
BC142	0.190
BC143	0.190
BC147	0.055
BC148	0.055
BC149	0.055

BC157	0.055
BC159	0.055
BC182	0.060
BC182L	0.060
BC183	0.060
BC183L	0.060
BC184	0.060
BC184L	0.060
BC212	0.060
BC212L	0.060
BC213	0.060
BC213L	0.060
BC214	0.060
BC214L	0.060
BC237	0.070
BC238	0.070
BC300	0.160
BC301	0.180
BC302	0.180
BC303	0.180
BC327	0.060
BC382	0.060
BC337	0.060
BC328	0.060
BC557	0.060
BCY32	1.500
BCY33	1.500
BCY34	1.500
BCY42	0.200
BCY56	0.160
BCY70	0.160
BCY71	0.160
BCY72	0.160
BD115	0.260
BD124P	0.500
BD124	1.100
BD128	0.350
BD131	0.250
BD132	0.250
BD135	0.200
BD136	0.200
BD137	0.200
BD138	0.200
BD139	0.200
BD140	0.200
BD144	0.900
BD150	0.300
BD157	0.380
BD158	0.380
BD166	0.300
BD175	0.300
BD177	0.300
BD179	0.320
BD181	0.450
BD201	0.330
BD202	0.380
BD203	0.420
BD204	0.420

BD222	0.310
BD225	0.310
BD232	0.310
BD237	0.210
BD238	0.240
BD433	0.280
BD437	0.280
BD535	0.380
BD536	0.380
BD537	0.400
BD538	0.400
BDX32	1.000
BDX65	0.800
BF180	0.160
BF181	0.180
BF183	0.200
BF184	0.200
BF185	0.200
BF194	0.050
BF195	0.050
BF196	0.060
BF199	0.060
BF200	0.160
BF257	0.180
BF258	0.180
BF259	0.180
BF336	0.200
BF337	0.200
BF338	0.200
BF362	0.300
BF422	0.210
BF458	0.190
BF459	0.190
BFX29	0.200
BFX84	0.200
BFX85	0.200
BFX87	0.150
BFX88	0.150
BFY50	0.140
BFY51	0.140
BFY52	0.140
BFY56	0.250
BYF57	0.250
BFY64	0.250
BR100	0.140
BSX19	0.150
BSX20	0.150
BSX21	0.160
BSX26	0.160
BSX29	0.190
BZX76	0.180
BT106	0.900
BT109	0.900
BT116	0.800
BT119	1.000
BT120	1.000
BU104	1.000
BU105	0.800

BU108	1.000
BU110	1.100
BU111	1.400
BU126	0.700
BU204	0.750
BU205	0.700
BU208	0.750
BU208A	0.800
BU208D	1.200
BU326	0.850
BU406	0.850
BU407	0.750
BU408	1.000
BU500	1.100
BU526	0.800
BY126	0.060
BY127	0.080
BY133	0.080
BY164	0.220
BY176	0.850
BY179	0.350
BY182	0.320
BY184	0.320
BY187	0.320
BY196	0.200
BY206	0.110
BY207	0.110
BY223	0.720
BYX10	0.150
CA270	0.400
CA3086	0.250
CA3089	1.500
CA3240	0.900
C106D	0.230
MC1327	0.700
MJ2500	1.000
MJ2501	1.100
MJ2955	0.550
MJ3000	1.150
MJ3001	1.150
MJE29A	0.300
MJE30A	0.300
MJE340	0.250
MJE350	0.800
MJE520	0.300
MJE2955K	0.900
OA47	0.060
DA90	0.040
AD91	0.040
OA200	0.070
OA202	0.070
OC28	1.000
OC29	0.800
OC35	1.000
OC45	0.500
OC71	0.300

OC72	0.500
DC200	1.800
OCP71	1.000
ORP12	1.000
ORP60	1.000
ORP61	1.000
R2008B	0.800
R2010B	0.800
SAS560	1.100
SAS570	1.100
SN76003N	1.400
SN76013N	1.400
SN76023N	1.400
SN76033N	1.500
SN76110N	0.700
SN76115	0.700
SN76226	0.900
SN76227	0.800
T2800D	0.520
TAG06-60	0.420
TAG521-200	0.720
TAG4443	0.760
TAG4444	0.760
TAA550	0.160
TBA120S	0.450
TBA395	0.600
TBA396	0.600
TBA520	0.750
TBA530	0.750
TBA540	0.750
TBA560	0.700
TBA800	0.350
TBA810S	0.600
TBA820	0.750
TBA920	0.800
TBA950	0.800
TBA990	0.800
TCA800	0.800
TCA940	0.850
TDA1170	0.900
TDA1412	0.600
TDA2002	0.800
TDA2003	1.500
TDA2020	1.400
TDA2030	1.400
TDA2522	0.800
TDA2530	0.800
TDA2532	0.750
TDA2540	0.700
TDA2560	0.700
TDA2593	0.800
TDA2640	0.800
TDA2690	0.700
TIP29	0.150
TIP29A	0.220

TIP29C	0.250
TIP30	0.160
TIP31A	0.240
TIP32	0.240
TIP32A	0.240
TIP33	0.500
TIP34	0.500
TIP41A	0.220
TIP41C	0.250
TIP42A	0.220
TIP42C	0.250
TIP47	0.400
TIP48	0.400
TIP49	0.400
TIP110	0.470
TIP112	0.540
TIP115	0.450
TIP117	0.560
TIP120	0.430
TIP121	0.460
TIP122	0.470
TIP125	0.470
TIP126	0.560
TIP127	0.560
TIP2955	0.340
TIP3054	0.380
TIP3055	0.340
TIS61	0.150
TIS90	0.150
TIS91	0.180
2N.2904	0.200
2N.2905	0.200
2N.2906	0.180
2N.2907	0.180
2N.2926	0.080
2N.3019	0.280
2N.3053	0.180
2N.3054	0.350
2N.3055	0.320
2N.3055H	0.380
2N3440	0.580
2N.3442	0.850
2N.3771	0.850
2N.3772	0.900
2N.3773	1.000
2N.4031	0.250
2N.4036	0.250
2N.4037	0.250
2N.4443	0.760
2N.4444	0.760
2N 5061	0.200
2N.5294	0.300
2N.5296	0.300
2N.6106	0.400
2N.6107	0.400
2N.6109	0.400

3N.128	0.550
3N.143	0.650
IN.914	0.020
IN.4001	0.040
IN.4002	0.040
IN.4003	0.040
IN.4004	0.040
IN.4005	0.040
IN.4006	0.040
IN.4007	0.050
IN.4148	0.020
IN.5400	0.090
IN.5401	0.100
IN.5402	0.100
IN.5403	0.110
IN.5404	0.110
IN.5405	0.120
IN.5406	0.130
IN.5407	0.130
IN.5408	0.130
VOLTAGE REGULATORS	
7805	0.350
7812	0.350
7815	0.350
7818	0.350
7824	0.350
7905	0.350
7912	0.400
7915	0.400
7918	0.400
7924	0.400
78L05	0.280
78L12	0.280
78L15	0.280
74L18	0.280
74L24	0.280
LM309K	1.000
LM317K	2.200
LM317T	1.800
LM323K	4.200
LM723	0.320
78HGKC	5.700
78HD5KC	5.200
78GU1C	1.900
79GU1C	2.150
79HGKC	6.700
JAPANESE TRANSISTORS	
2SA73	0.300
2SA104	0.320
2SA198	0.220
2SA203	0.300

2SA473	0.370
2SB54	0.250
2SB77	0.320
2SB337	1.200
2SB405	0.220
2SC460	0.210
2SC495	0.600
2SC733	0.400
2SC1161	1.100
2SC1172Y	1.500
2SC1279	0.240
2SC1306	1.000
2SC1307	1.000
2SC1520	0.250
2SC1969	1.300
2SC2029	1.200
2SC2078	1.200
2SC2122A	2.000
2SC2952	0.270
2SD234	0.370
2SK135	4.000
MB3712	1.500
TA7205	1.500
UPC575	1.000
ICS SOCKETS	
8 pin	0.060
14 pin	0.080
16 pin	0.090
18 pin	0.120
20 pin	0.140
22 pin	0.160
24 pin	0.180
28 pin	0.200
40 pin	0.250

VALVES	
DY87	0.530
DY802	0.450
ECC82	0.400
ECC83	0.430
ECC84	0.400
ECC85	0.400
ECH81	0.490
ECH84	0.520
ECL80	0.570
ECL82	0.590
ECL84	0.570
ECL85	0.570
ECL86	0.490
EF80	0.310
EF85	0.340
EF89	0.430
EF183	0.450
EF184	0.530
EL34	1.900
EY86	0.310
EY87	0.310
PC97	1.000
PCC85	0.420
PCF80	0.580
PCF200	1.350
PCF801	1.100
PCF802	0.570
PCF806	1.150
PCH200	1.000
PCL81	0.540
PCL82	0.630
PCL84	0.500
PCL85	0.550
PCL86	0.550
PCL805	0.550
PFL200	0.850
PL36	0.800
PL504	0.950
PL508	1.900
PY81	0.700
PY88	0.480
PY500A	1.600
ZENERS	
400MV BZY88 Range 2V7 to 39V	0.060
1.3W Zeners BZX61 Range 2V7 to 39V	0.120
MEMORIES	
2114	0.750
2716	2.200
2532	2.900
2732	2.900
2764	5.000
4116	0.750
6116	3.000
LM324	0.300
LM380	0.600
LM381	1.000
LM709 Dil	0.300

LM723	0.320
LM741 Dil	0.150
LM741 Met	0.450
LM3900	0.250
NE555	0.150
NE556	0.400
BYX55/350	0.300
BYX55/600	0.300
BYX55/600	0.300
BYX55/800	0.320
BYX70/500	0.290
BYX70/500	0.310
BYX70/800	0.360
BYX71/600	0.800
LED	
LED 3mm RED	0.050
LED 3mm YELLOW	0.100
LED 3mm GREEN	0.100
LED 5mm RED	0.050
LED 5mm YELLOW	0.100
LED 5mm GREEN	0.100
BRIDGE RECTIFIERS	
1A/50V	0.160
1A/100V	0.180
1A/200V	0.190
1A/400V	0.210
1A/600V	0.230
1A/800V	0.280
2A/100V	0.350
2A/200V	0.360
2A/400V	0.420
2A/600V	0.540
2A/800V	0.580
3A/200V	0.660
3A/400V	0.680
3A/600V	0.780
6A/200V	1.000
6A/400V	0.800
25A/100V	1.600
ELECTROLYTIC	
4700UF-16V CAN	0.200
TRIPLERS	
LP1195 (4000Ser)	2.250

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Please allow 7 days for delivery.
All brand-new Components. All valves are new and boxed.

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Philips G8 520	£14.00	£23.00
Pye 223	£25.00	£35.00
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26" sets from	£10.00	
Mono sets from	£2.00	

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I.E. ITT, C.V.C. 25 & 30
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All prices subject to availability of stock
Quality discount available. Hundreds of sets to choose from.
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A55.14X A56-120X ______ £28
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A66.120X A66.140X ______ £34
A67.120X A67.150X ______ £33

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A47.25WR ______ £12.00 A61.120WR ______ £13.50
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Small charge for no exchange glass
All above plus VAT at 15%, Carriage £5
18 month guarantee on all tubes

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G11=9000 from **£38.00** plus VAT, including 20AX - 30AX

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MONO DUAL STANDARD PARCEL OF 20 **£1**
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BUSH 'A' & THORN 3,500

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I.F. Panel	1.75	2.50
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Field/Sound output		2.75
Convergence	1.50	3.75
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Tuner Mechanical	3.75	3.50
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Other working parts available

NO VAT just add £1.50 p&p per 1 item and 75p per each additional item

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SERVICE PAGES

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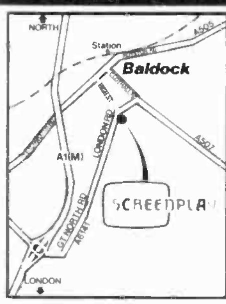

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Genuine RBM Units.

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(B) That you have enclosed the right remittance.
(C) That your name and address is written in block capitals, and
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Delivery £5 per tube. British Isles. No need to spend £5 returning old tube if you buy from us.

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TELEVISION

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Tel: 01-669 2611 **Telex: 893819 Eurlec**

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35 Sandy Lane South, Wallington, Surrey SM6 9RF

Thank you for the interest shown in last month's advertisement. We still have LVC 60 at prices shown, also a quantity of VC30, used but tested at **£2.50** each + 25p postage per item.

For those licensed amateurs sending live TV and who wish to upgrade the quality of recording, we are due to receive a number of JVC 6000/6060 and Sony 1810 Umatic recorders at a price between **£150-£250.** SAE for notification when full details available. (Mark envelope Umatic).

Note we are in process of buying in large quantity of Philips cassettes. No details yet, but an SAE will bring full details and 10% discount offer over advertised prices as soon as details available.

Half inch tape, high and low density on 7" Spools **£2.50** including P&P. (Not suitable for Philips format cassettes).

Bulk branded VHS cassettes still available, any length. Phone for details.

Professional equipment including cameras and edit suites still available.

We have one Philips series 80 TV studio, complete at a most realistic price. Please phone for details.

We have one further Philips projection TV, 60CP 2605 integral tuner, including new 72" screen **£750.**

NTSC - PAL Transfers, ring for quote.

VAT Reg. No. 335 7096 45.

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AERIALS AND ACCESSORIES. Terrific range of quality equipment including some off-beat items and some real clearance bargains. Keen prices. New catalogue 50p (refundable). WRIGHTS AERIALS, 43 Greaves Sike Lane, Micklebring, Rotherham.

2 METRE PARABOLIC DISHES

Glassfibre Construction
Suitable for 4 and 12 GHz **£290**
Polar Mounts and Feed Supports Available.
Send S.A.E. for Details

SP ANTENNA SYSTEMS,
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AERIALS AND ACCESSORIES

North Londons Specialist Aerial Supplier Wholesale and Mail Order.

VHF/UHF antennas, masts, brackets, cable, amplification and distribution equipment etc. All types of aerial hardware and software supplied. Single and multipoint systems planned and installed.
Send 50p for our new 1983 catalogue and price list.

S.C.S. AERIALS
(Aerial Distributors)
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Tel: 0992 50478.

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Next to the set fitting

B45H/G-UHF TV, gain about 20dbs, Tunable over the complete UHF TV band. **Price £8.70.**
BII-VHF/FM RADIO, gain about 14dbs, when on the off position connects the aerial direct to the radio. **Price £7.70.**
All boosters we make work off a PP3/006p/6F22 type battery or .8V-18V DC. **P&P 30p per order.**

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Elderly Test, P.A. and similar gear.
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4/84

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P&P 1 panel £1.50, 2 panels £2.00, 3 panels £2.50 etc.
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100's OF SETS ALWAYS IN STOCK – COMPETITIVE PRICES

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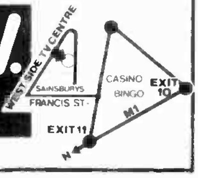

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IN 4003	4p
IN 4004	4p
IN 4005	4p
IN 4006	4p
IN 4007	5p
IN 4148×40	£1
IN 4448×40	£1
IN 4742	10p
IN 4722	10p
IN 4751	10p
IN 5235	10p
IN 5254	10p
IN 5349	10p
IN 5392	10p
IN 5393	10p
IN 5928B	10p
IAV 30	10p
IM 72Z55	10p
IR 106a	20p
IR 3051	10p
IS 164	10p
IS 921	10p
IS 3011a	10p
IS 3072a	10p
IS 5024a	50p
IS 5030	50p
ITT 210	10p
ITT 921	10p
ITT 923	10p
ITT 1075	10p
ITT 2001	10p
ITT 2002	10p
ITT 4150	10p
ZE 1.5	10p
ZF 3	10p
ZF 3.3	10p
ZF 4.3	10p
ZF 10	10p
ZF 11	10p
ZF 12	10p
ZF 15	10p
ZF 33	10p
ZF 43	10p
ZF 47	10p
ZF 82	10p
ZPD 3.9	10p
ZPD 4.7	10p
ZPD 5.6	10p
ZPD 10	10p
ZPD 47	10p
ZPY 8v2	10p
ZPY 12	10p
ZPY 16	10p
ZPY 24	10p
ZPY 43	10p
ZPY 47	10p
ZPY 56	10p
ZTE 2	10p
ZTK 22	10p
ZTK 33	10p
ZTK 33a	10p
ZW 13	12p
ZW 27	10p
ZW 4-3	10p
ZW 310	10p
ZX 68	30p
ZY 47	10p
ZY 72	10p
AA 112	10p
AA 113	10p
AA 119	8p
AA 143	10p
AA 144	10p
BA 102c	10p
BA 157	8p
BA 159	8p
BA 173	8p
BA 182	8p
BA 201	8p
BA 202	8p
BA 243	8p
BA 248	8p
BA 316	5p
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BZX 61c110	6p
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E 1580	25p
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TIC 106a	30p
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TIP 30	35p
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TIP 31	30p
TIP 31A/RCA 16334	35p
TIP 32	25p
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TIP 35B	50p
TIP 35C	70p
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TIP 36C	70p
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TIP 49	30p
TIP 57	30p
TIP 100	30p
TIP 112	30p
TIP 115	50p
TIP 117	50p
TIP 120	35p
TIP 125	35p
TIP 130	30p
TIP 131	25p
TIP 136	30p
TIP 140	50p
TIP 147	50p
TIP 640	50p
TIP 2955	35p
T 6032	30p
T 6036	40p
T 6040	40p
T 6047	40p
T 6049	40p
T 6051	40p
T 6052	40p
T 9004	40p
T 9005	40p
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16119 2A/40v.50Meg
5 for £1.

U 14727	15p
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BYX 38/300	25p
BYX 55/350	10p
BYX 55/600 (Bead)	10p
BYX 71/350	20p
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BYV 95B	10p
BVY 95C	12p
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BYZ 106	10p
BPW 41	15p
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BZV 15/18	30p
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SPECIAL OFFER
Decca-TTT etc.
FEO4/1/250AC/4
Mains filters
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Send for details. Prices **£54 to £112.**

10 Mixed TV & radio speakers **£5 + £2 post**

8Ω 4" speakers	£1
4700/10v × 10	50p
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1/600v	25p
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GEC Hitachi
V/Cap tuner, after 1979 Series £13
6 Push Button Unit for GEC 2100 Series Replacement for Touch Button Unit £12

10 Mixed TV & radio speakers **£5 + £2 post**

Mullard Broadband R.F. power modules

VHF. BGY33 **£15**
UHF. BGY22E
£5 PT4236C
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Pull up large aerial	75p
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Phillips snips	£2
2 way baby alarm/intercom with long leads	£5
Phillips universal battery tester/charger, fuse/bulb tester	£5
Volt/ohm test meters 1000 ohm/volt	£5
Eisenmann NICAD CHARGER 5.5V/150 ma	£2
12V Nicad pack, "AA"	£2.50
Hitachi TP 007 Battery pack 7.2v/1.6A	£7
"AA"/1.25V Nicad	£1
"C" Nicad	£2
"D" Nicad	£3
Duracell PP3	60p
¾" × ⅛" microphone/speaker	50p
Continental 2 pin plug with 5½ft mains lead (black & blue)	5 for £1
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Xcekute 5" bent nose plier	£3.50
De-solder pump + 2 nozzels	£5.20
Plastic box for i.c.s with anti-static pad 6"×3"×½"	75p
Can of handy oil 'mobil'	40p
Flat Red LED	12p
500gm 60/40 solder reel	£7
Clearweld glue pack	30p
Dual v/u meter -20 – +10db	£1
15 service manuals, Thorn 3504 & 3448, etc	£2.50
3 × C90 Cassettes	70p
Can Freezer	£1.75
K30 thermistor 232266298009	75p

75R/25 Watt	25p
18R/11 Watt	25p
120R/17 Watt	20p
Front End Music Center. VHF/MW/LW 13"×3½"	£5
Output Stage for music center	£5
Both items	£9
circuit supplied (as previous ad)	
SONY 1400KV Chroma Panel	£6
SONY 1400KV Tuner unit	£3.50
SONY 1400KV Touch button unit	£3.50
3 books, Electronic Systems/Guide to Print Circuits/1st Steps in TV	£1.40
Texas Viewdata Decoder VDP 12/80 Issue 3 with all IC's	£10.00

15 Bulbs	40p
Video lamps	20 for £5; 200 for £25
Antistatic Discloth	5 for £1
100 Diodes	£1.50
100 Fuses	£2.00
100 W/W Res.	£1.50
BF 199	20 for £1
BC 547	100 for £4
10 × 20 Turn 100k pots. Rank	£2
Thorn 9 volt power supply regulated	£3.00
BF 470	20 for £2
Metal BD 124	10 for £8
20 Slider Knobs	70p
6 Mixed UHF Aerial Isolating Sockets, some with long leads. Fit ITT, GEC, Philips, Pye	£1.00

Quantity Reductions

BY204/4	25 for £1.00
BY206	25 for £1.00
BD132/676a	20 for £2
W005 bridge	20 for £2
G11 touch button red	6 for £1
BY210/600	25 for £1.00
BY298 3 amp/fast/R	20 for £1.50
BD239	20 for £2.00
MR856	25 for £1.50
BU126	10 for £6.00
BU205	10 for £8.00
BU105	10 for £6.00
2SC2122A	10 for £8.00
BF458	10 for £1.00
BD136	10 for £1.25
BF224	20 for £1.40
OA90	40 for £1.00
BYX10	100 for £4.00
KT3 multicaps	10 for £7.50
50 High voltage 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
Video lamps	20 for £5, 200 for £25
Antistatic Discloth	5 for £1

Mixed Packs

50 Mixed AC series Transistor	£4.50
15 Thorn service manuals	£3
15 Panel mount rocker switch 250V/10A	£1.50
Mixed ribbon cables	£1.00
25 LED red/yellow/green	£1.50
20I/C Holders	£1.20
20 Large LED Red	£1.00
20 Small LED Red	£1.00
10×20 Turn 100K Pots	£1.00
100 Transistor	£2.50
20 Convergence Pots	80p
100 Sticks	£1.00
10 Thermistors	50p
20 Slider Pots	£1.00
30 Presets	50p
15 VDR + thermistors, degaussing, HT, etc.	£1.00
40 glass reed switch	£1
10 press to make switch	70p
40 Pots	£1.50
10 Gun Switches	50p
5 Tube Bases	£1.00
1,000 Diodes, Condensers, Resistors on Bandolier	£3.00
Lucky Dip 600 gram	£1.00
Jungle Bag 5Kg	£5.00
20 Knobs	£1.00
40 Pots, ¼"+6mm spindles for audio/TV	£3

SENDZ COMPONENTS
TO ORDER
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