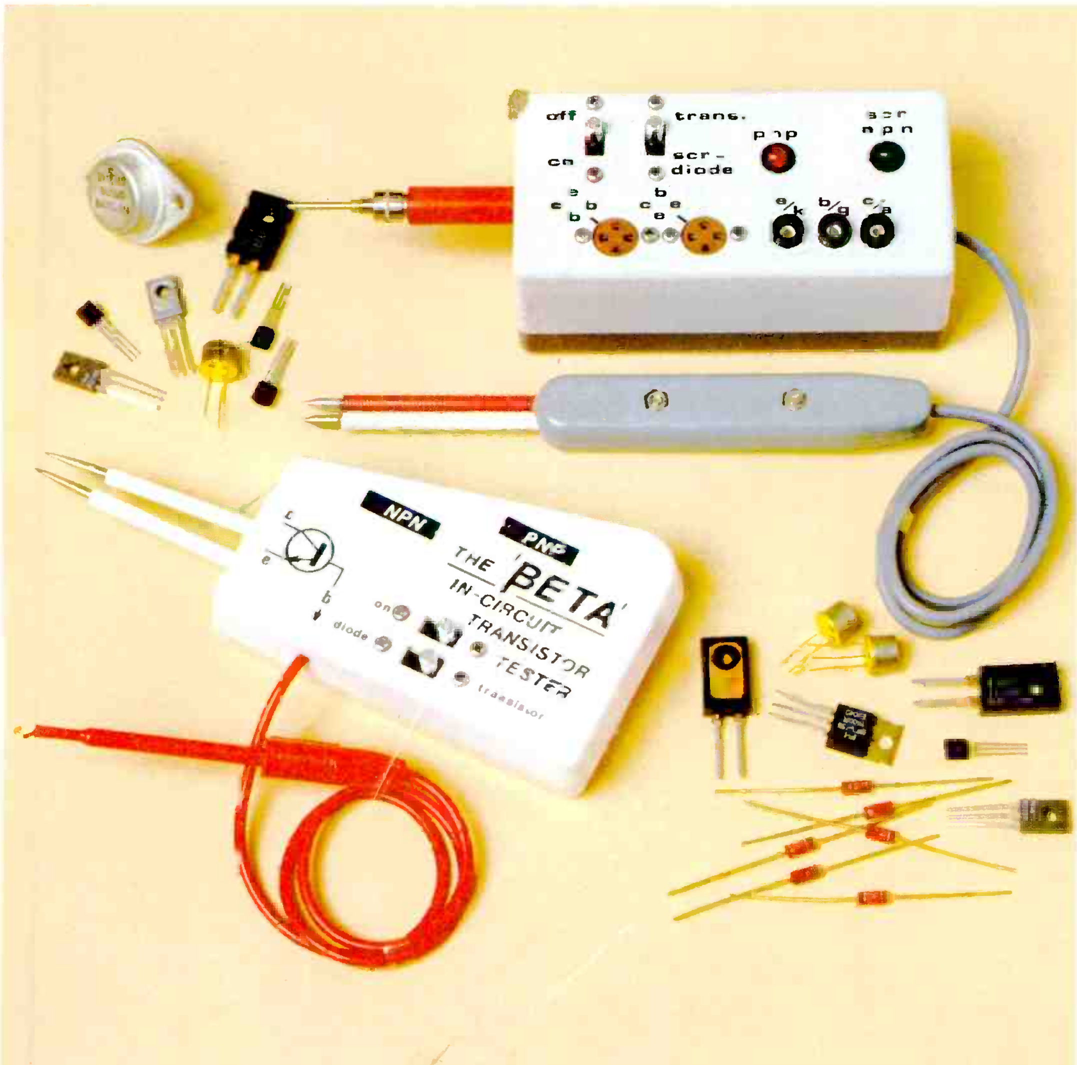
JUNE 1983

Australia $1.80: New Zealand $2.10: Malaysia $5.50 ; R. £1.15 (inc. VAT)

90p

TELEVISION

SERVICING·VIDEO·CONSTRUCTION·DEVELOPMENTS



IN SITU TRANSISTOR TESTER

TV RENTAL • VCR CLINIC

Servicing Features : THORN 9600 CHASSIS & TOSHIBA MODEL C800B

SAVE ON THE PRICE OF YOUR COLOUR PRINTS!

NOW ONLY 12p EACH

with the Television Colour Print Service

While prices go up elsewhere, Television makes a bargain offer in its Colour Print Service. Now you can have as many films printed as you like, including Giant Superprints, at only 12p a print. There is no developing charge and just 25p towards postage and packing.

At this new price, the magazine Colour Print Service, already used by hundreds of thousands of readers, is as fast and efficient as ever. Here's all you have to do to enjoy its advantages.

Send any make of colour print film, including disc film, inside the envelope enclosed with this issue. Or fill in the coupon below and send with your colour print film in a strong envelope to: **Television Colour Print Service, FREEPOST, READING RG1 1BR. No stamp is required.**

SEND NO MONEY

We are so confident in the reliability of our service and the quality of our prints (each one date-stamped with the month and year of developing) that you don't pay until you've seen them.

LUXURY COLOUR PRINTS

You will be amazed at the beautiful colours and sheen finish of these prints. They have elegant rounded corners and are borderless to give you maximum picture area. And with the Giant Superprints, you get 30 per cent more picture area than the standard enprints *at no extra cost!*

UNBEATABLE VALUE

All you pay for the Colour Print Service is 12p for each good print received plus 25p towards postage and packing. The most you would pay us for processing and printing a 24-exposure film for example is £3.13. Compare that with the price you would pay in the shops.

FREE ALBUM PAGES

With each film we process, you receive an album page voucher. Collect and return three vouchers, and you receive a set of FREE album pages to fit into our specially designed album for any size of print up to 4in. by 6in.

HOW YOU BENEFIT

You benefit in three ways. Firstly, you pay nothing for the actual processing—only for prints and postage and packing. Secondly, you enjoy a personal service with every care taken over each individual order. And thirdly, you pay only for what you get—with no credit vouchers as with many other companies. An invoice comes with your prints, so it is a straight business transaction.

48 HOURS IN-LAB SERVICE

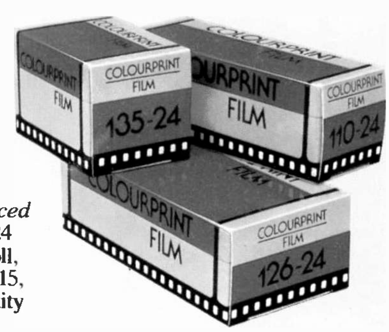
Your films will be processed within 48 hours* of receipt, but please allow for postal delays.

The price of this offer is limited to the U.K.

*C41 Process cassette and cartridge film only.

FILMS AT REDUCED PRICES

Always keep your camera action-ready. Order replacement films *at our specially reduced prices:* 110/24, 126/24 or 35/24 at £1.20 a roll, or three for £3; disc/15, £1.30 each (no quantity discount).



Offer excludes Black & White, transparency, sub-miniature, C22 & Agfa CNS film.
Superprints can only be produced from Kodacolour II, C41 cassette, cartridge and disc film not half frame. Prices correct at time of going to press.

If you have any queries, contact our Customer Service on Reading (0734) 597332.

Use this label if you have no envelope, or pass it to a friend. It is used to pack your prints.

To: Television Colour Print Service
FREEPOST, Reading RG1 1BR

● Please print my film Superprint size ☐
Standard Enprint size ☐

If film is being ordered ● Please send me ____________
of 110/24 ☐ of 126/24 ☐ of 35/24 ☐ of disc/15 ☐

● Tick box(es) as required.

From: Television Colour Print Service
FREEPOST, READING RG1 1BR

Mr/Ms ____________

Address ____________

____

____________ Postcode ____________

TELEVISION

June 1983

Vol. 33, No. 8
Issue 392

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

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

BINDERS AND INDEXES
Binders (£4.50) and Indexes (45p) can be supplied by the Post Sales Department, IPC Magazines Ltd., Lavington House, 25 Lavington Street, London SE1 0PF. Prices include postage and VAT. In the case of overseas orders, add 60p.

BACK NUMBERS
Some back issues are available from the Post Sales Department, IPC Magazines Ltd., Lavington House, 25 Lavington Street, London SE1 0PF at 85p inclusive of postage and packing.

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

this month

OUR NEXT ISSUE DATED JULY WILL BE PUBLISHED ON JUNE 22

THANDAR PORTABLE TEST BENCH

A wide range of high performance instruments, at prices that are hard to beat, puts professional test capability on your bench.

COUNTERS–TF200 10Hz to 200MHz; **TF040** 10Hz to 40MHz; **PFM200A** 20Hz to 200MHz (hand-held model); **TP600** prescales to 600MHz; **TP1000** Prescales to 1GHz.

MULTIMETERS–TM351 0.1% 3½ digit LCD; **TM353** 0.25% 3½ digit LCD; **TM355** 0.25% 3½ digit LED; **TM354** 0.75% 3½ digit LCD (hand-held model); **TM451** 0.03% 4½ digit with autoranging and sample hold.

OSCILLOSCOPE–SC110A 10MHz, 10mV sensitivity, 40mm CRT with 6mm graticule divisions.

THERMOMETERS–TH301 –50°C to +750°C, 1° resolution; **TH302** –40°C to +1100°C and –40°F to +2000°F, 0.1° and 1° resolution. Both accept any type K thermocouple.

GENERATORS–TG100 1Hz to 100kHz Function, Sine, Square, Triangle Wave; **TG102** 0.2Hz to 2MHz Function, Sine, Square, Triangle Wave; **TG105** 5Hz to 5MHz Pulse, Free Run, Gated or Triggered Modes.

LOGIC ANALYSERS–TA2080 8 channel 20MHz; **TA2160** 16 channel 20MHz.

ACCESSORIES–Bench rack, test leads, carrying cases, mains adaptors, probes, thermocouples etc.

Send for our latest catalogue and price list.
Thandar Electronics Ltd,
London Road, St. Ives,
Huntingdon, Cambridgeshire PE17 4HJ.
Telephone (0480) 64646. Telex 32250.

thandar
ELECTRONICS LIMITED PUTTING THE BEST WITHIN YOUR GRASP

TH12

Switch to the biggest wholesaler of quality late model used TV's

- Thousands of Quality Sets always in stock
- Colour/Mono/VCR's and Audios available
- Murphy/Pye/Philips/Sony/National Panasonic and other big names
- We are big – we buy in bulk – we offer you the keenest prices
- Cash and Carry or we will deliver
- New and used stands always in stock

VISIT OUR NEW SHOWROOM TODAY OR RING US ON 0562 743735

TRADE ONLY

CAMPION THOMPSON
ELECTRICAL WHOLESALERS

Incorporating MTV

Campion House, Franchise Street, Kidderminster, Worcestershire DY11 6RE.

TVs TVs TVs

PANELS PANELS PANELS

DECCA 18" 20" 22" 26"	from £25	BUSH A823 22" 26"	from £25
PHILIPS G8 22" 26"	from £25	HITACHI 18"	POA
PHILIPS 570 18"	from £35	THORN 3500 20" 22" 26"	from £25
PYE CT200 18"	from £35	THORN 8800 22"	from £30
PYE CHELSEA 18"	from £40	ITT CVC8 22"	from £40
NAT. PANASONIC 18"	POA		

The above prices are for working TVs, Non workers usually available Please ring for prices.

QUANTITY DISCOUNT FOR 10+

Panels for most makes available with 3 month guarantee.
Add £1.70 per panel for postage + 15% VAT.

(Also see N.J. Electronics advertisements, all your TV spares panels etc. under one roof).

CONTRAST U.K.
82/83/84 STORFORTH LANE TDG. EST. CHESTERFIELD, DERBYSHIRE S41 0SW
Tel. Chesterfield (0246) 209081

COLOUR TV SETS

Philips G8, Pye 222, Decca 30 series, ITT, Pye Chelsea, Thorn 3500/8000, GEC, many others including JAP.

Working hybrids from £15.
Working solid state from £25.
Non-working sets, working panels and tubes available.

Quantity Discounts

Delivery by arrangement.

SOUTHBRIDGE TV CENTRE
120, Selhurst Rd., London, S.E.25.
Tel: 01-771 3535.

TRANSISTORS, ETC.

Type	Price (£)
AC107	0.48
AC117	0.38
AC126	0.36
AC127	0.54
AC128	0.46
AC128K	0.55
AC141	0.65
AC141K	0.70
AC142	0.60
AC142K	0.65
AC151	0.31
AC152	0.36
AC153	0.42
AC153K	0.52
AC154	0.41
AC176	0.45
AC178	0.51
AC179	0.55
AC187	0.56
AC187K	0.65
AC188	0.52
AC188K	0.61
AC193K	0.70
AC194K	0.74
ACY17	1.20
ACY19	0.95
ACY28	0.98
ACY39	2.02
AD140	1.79
AD142	1.90
AD143	1.78
AD149	1.42
AD161	0.66
AD161/162	1.22
AD162	0.71
AF114	1.32
AF115	1.26
AF116	1.28
AF117	1.32
AF118	0.98
AF121	0.68
AF124	0.38
AF125	0.38
AF126	0.36
AF127	0.86
AF139	0.58
AF147	0.52
AF149	0.45
AF178	1.35
AF179	1.36
AF180	1.35
AF181	1.33
AF186	1.48
AF202	0.27
AF239	0.73
AF240	1.40
AF279S	0.91
AL100	1.30
AL103	2.55

Type	Price (£)
AU103	2.40
AU107	2.75
AU110	2.40
AU113	2.60
BC107*	0.16
BC108*	0.15
BC109*	0.16
BC113	0.22
BC114	0.22
BC115	0.24
BC116*	0.25
BC117	0.30
BC118	0.24
BC119	0.34
BC125*	0.30
BC126	0.30
BC132	0.20
BC134	0.22
BC135	0.21
BC136	0.22
BC137	0.30
BC138	0.35
BC140	0.36
BC141	0.44
BC142	0.35
BC143	0.38
BC147*	0.12
BC148*	0.12
BC149*	0.13
BC152	0.42
BC153	0.38
BC154	0.41
BC157*	0.13
BC158*	0.12
BC159*	0.14
BC160	0.52
BC161	0.58
BC167B	0.15
BC168B	0.14
BC169C	0.15
BC170*	0.15
BC171*	0.15
BC172*	0.14
BC173*	0.22
BC174A & B	0.26
BC176	0.22
BC177*	0.20
BC178*	0.22
BC179*	0.28
BC182*	0.15
BC182L*	0.15
BC183*	0.14
BC183L*	0.14
BC184*	0.15
BC184L*	0.15
BC185	0.36
BC186	0.25
BC187	0.27

Type	Price (£)
BC192	0.56
BC204*	0.39
BC205*	0.39
BC206*	0.37
BC207*	0.
BC208*	0.37
BC209*	0.39
BC211*	0.36
BC212*	0.17
BC212L*	0.17
BC213*	0.16
BC213L*	0.16
BC214*	0.18
BC214L*	0.18
BC225	0.42
BC237*	0.16
BC238*	0.15
BC239*	0.22
BC251*	0.25
BC252*	0.26
BC253*	0.38
BC261A*	0.28
BC262A*	0.28
BC263*	0.26
BC267*	0.20
BC268*	0.28
BC286	0.40
BC287	0.49
BC291	0.27
BC294	0.37
BC297	0.36
BC300	0.62
BC301	0.38
BC302	0.86
BC303	0.64
BC304	0.44
BC307*	0.17
BC308*	0.14
BC309*	0.18
BC317*	0.15
BC318*	0.15
BC319*	0.19
BC320	0.17
BC321A&B	0.18
BC322	0.28
BC323	1.15
BC327	0.16
BC328	0.18
BC337	0.17
BC338	0.17
BC340	0.19
BC347*	0.17
BC348A & B	0.17
BC349B	0.17
BC350*	0.24
BC351*	0.22
BC352A*	0.24
BC360	0.59

Type	Price (£)
BC377	0.29
BC394	0.39
BC440	0.52
BC441	0.59
BC461	0.78
BC477	0.30
BC478	0.25
BC479	0.33
BC547*	0.13
BC548*	0.13
BC549*	0.15
BC550	0.24
BC556	0.23
BC557*	0.16
BC558*	0.16
BC559*	0.17
BCY10	0.30
BCY30A	1.05
BCY32A	1.19
BCY34A	1.02
BCY72	0.27
BD115	1.35
BD123	1.50
BD124	1.85
BD130Y	1.56
BD131	0.58
BD132	0.68
BD133	0.70
BD135	0.37
BD136	0.38
BD137	0.40
BD138	0.42
BD139	0.46
BD140	0.50
BD144	2.24
BD145	0.75
BD150A*	0.51
BD155	0.90
BD157	0.51
BD158	0.75
BD159	0.68
BD160	2.69
BD163	0.67
BD165	0.66
BD166	0.88
BD175	0.90
BD177	0.58
BD178	0.92
BD181	1.94
BD182	2.10
BD183	1.34
BD184	2.30
BD187	1.20
BD188	1.25
BD189	0.71
BD222	0.91
BD225	0.91
BD232	0.91
BD233	0.62

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

Type	Price (£)
BF222	0.51
BF224 & J	0.22
BF240	0.32
BF241	0.31
BF244*	0.51
BF245*	0.45
BF254	0.48
BF255	0.58
BF256L*	0.49
BF257	0.47
BF258	0.52
BF259	0.54
BF262	0.73
BF263	0.88
BF270	0.47
BF271	0.47
BF273	0.33
BF274	0.34
BF336	0.63
BF337	0.65
BF338	0.68
BF355	0.72
BF362	0.49
BF363	0.49
BF367	0.29
BF451	0.43
BF457	0.46
BF458	0.49
BF459	0.52
BF594	0.16
BF596	0.17
BF597	0.27
BFR39	0.30
BFR40	0.29
BFR41	0.30
BFR50	0.29
BFR52	0.33
BFR61	0.29
BFR62	0.28
BFR79	0.30
BFR80	0.29
BFR81	0.30
BFR88	0.42
BFT41	0.48
BFT43	0.55
BFW11	1.02
BFW30	2.58
BFW59	0.19
BFW60	0.20
BFW90	1.65
BFX29	0.38
BFX84	0.42
BFY50	0.38
BFY51	0.37
BFY52	0.36
BFY53	0.36
BFY90	1.98
BPX25	1.62

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

Type	Price (£)
MPSU05	0.66
MPSU06	0.76
MPSU55	1.26
MPSU56	1.32
MPSU60	0.82
MPU131	0.59
OC26	1.90
OC28	1.49
OC29	1.60
OC35	1.25
OC36	1.25
OC42	0.90
OC44	0.68
OC45	0.63
OC70	0.65
OC71	0.73
OC72	0.73
OC81	0.83
OC81D	0.95
OC139	1.30
OC140	1.35
OC170	0.80
OC171	0.82
OC200	3.90
OC201	3.95
OC202	2.40
OC205	3.95
OCP71	1.98
ON236A	0.94
R2008B	2.72
R2010B	2.79
R2322	0.75
R2323	0.85
ST2110	0.49
ST6120	0.48
TIC44	0.25
TIC46	0.35
TIC47	0.45
TIP29A	0.47
TIP30A	0.50
TIP31A	0.55
TIP31C	0.67
TIP32A	0.56
TIP32C	0.72
TIP33A	0.77
TIP34A	0.84
TIP41A	0.72
TIP42A	0.80
TIP2955	0.77
TIP3055	0.58
TIS43	0.44
TIS73	1.36
TIS90	0.23
TIS91	0.28
ZTX108	0.14
ZTX109	0.16
ZTX213	0.2
ZTX300	0.16
ZTX304	0.26

Type	Price (£)
ZTX500	0.18
ZTX502	0.22
ZTX504	0.28
2N404	1.30
2N696	0.46
2N697	0.46
2N706A	0.33
2N708	0.29
2N914	0.32
2N916	0.46
2N918	0.54
2N930	0.29
2N1164	10.29
2N1304	1.40
2N1305	1.29
2N1306	1.49
2N1307	1.32
2N1308	1.53
2N1711	0.47
2N1893	0.52
2N2102	0.71
2N2217	0.55
2N2218	0.38
2N2219	0.42
2N2221A	0.26
2N2222A	0.41
2N2369A	0.40
2N2401	0.80
2N2484	0.35
2N2570	0.74
2N2646	0.82
2N2784	1.15
2N2869	2.08
2N2894	0.45
2N2904*	0.40
2N2905*	0.39
2N2906*	0.36
2N2926G	0.15
2N2926O	0.14
2N2926Y	0.14
2N2955	1.12
2N3053	0.48
2N3054	0.86
2N3055	0.72
2N3250	0.52
2N3254	0.58
2N3391A	0.38
2N3633	0.60
2N3703	0.17
2N3704	0.19
2N3705	0.17
2N3706	0.18
2N3707	0.18
2N3708	0.17
2N3715	1.70
2N3771	2.09
2N3772	2.08
2N3773	2.90
2N3794	0.40

Type	Price (£)
2N3819	0.47
2N3820	0.72
2N3866	1.08
2N3904	0.20
2N3905	0.20
2N3906	0.20
2N4036	0.94
2N4123	0.17
2N4124	0.17
2N4126	0.17
2N4236	2.20
2N4289	0.32
2N4292	0.32
2N4416	0.85
2N4444	1.90
2N4921	0.80
2N5042	1.65
2N5060	0.28
2N5061	0.30
2N5064	0.63
2N5086	0.49
2N5087	0.50
2N5208	0.59
2N5294	0.66
2N5296	0.68
2N5298	0.71
2N5322	1.16
2N5449	0.18
2N5457	0.46
2N5458	0.40
2N5459	0.58
2N5494	0.85
2N5496	1.05
2N6027	0.55
2N6107	0.71
2N6122	0.60
2N6178	1.07
2N6180	1.39
2N6211	2.74
2SB3378P	4.28
2SC458C	0.78
2SC643A	2.25
2SC930D	1.50
2SC1061	1.45
2SC1172Y	3.55
2SD234	1.48
3N128	1.60
40250	0.98
40251	1.14
40327	0.67
40361	0.48
40362	0.50
40410	0.94
40429	0.88
40530	0.79
40595	1.39
40603	1.13
40636	1.25
40654	0.89

Alternative gain versions available on items marked*.

For matched pairs add 20p per pair.

LINEAR IC's

Type	Price (£)
CA810QM	2.50
CA3005	1.85
CA3012	1.45
CA3014	2.23
CA3018	0.71
CA3020	1.89
CA3028A	0.80
CA3028B	1.09
CA3045	3.75
CA3046	0.70
CA3065	1.74
CA3068	1.90
CA3130S	1.57
FCH161	2.40
FCJ101	3.32
LM309K	1.98
LM380N-14	1.65
LM1303N	1.03
MC1307P	1.82
MC1310P*	1.84
MC1312P	2.34
MC1327P*	1.86
MC1330P	0.83
MC1350P	1.22
MC1351P	1.42
MC1352P	1.42
MC1357P	2.92
MC1358P*	2.30
MC1458G	1.43
MC1496L	1.15
MC3051P	0.58
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MFC4060A	0.98
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MIC1P	1.10
ML231	3.57
ML232	3.57
NE555	0.72
NE556	1.34
NE566	1.95
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SAA1025	10.35
SAS560A	2.01
SAS570	2.01
SC9503P	1.40
SL432A	2.52
SL450	5.10
SL901B	4.75
SL917B	6.50
SL918A	5.95
SN72440N	2.21
SN76003N	3.32
SN76013N	2.52
SN76023N	3.02
SN76023ND	2.52
SN76033N	3.32

Type	Price (£)
SN76023ND	2.52
SN76033N	2.20
SN76110N	1.20
SN76115N	1.62
SN76116N	1.78
SN76131N	2.10
SN76226N	2.60
SN70227N	1.61
SN76228N	1.80
SN76502N	1.92
SN76530P	0.97
SN76533N	1.38
SN76544N	1.85
SN76546N	1.85
SN76570N	1.81
SN76620AN	0.99
SN76650N	1.48
SN76660N	0.64
SN76666N	0.96
TA7073P	3.51
TAA263	2.20
TAA300	3.85
TAA320	1.10
TAA350A	2.48
TAA370A	3.18
TAA435	1.70
TAA450	3.39
TAA521	1.10
TAA522	2.09
TAA550	0.35
TAA560	1.93
TAA570	2.20
TAA611A	1.67
TAA611B	2.85
TAA621AX1	4.75
TAA630Q	3.91
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TBA395*	2.58
TBA396	2.40
TBA400	2.20

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TBA520*	2.98
TBA530P	2.24
TBA540*	2.88
TBA550*	3.13
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BA102	0.36
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BA110	0.80
BA111	0.70
BA115	0.17
BA116	0.56
BA121	0.85
BA129	0.45
BA145	0.19
BA148	0.19
BA154	0.06
BA155	0.17
BA156	0.12
BA157	0.25
BA158	0.28
BA159	0.40
BA164	0.14
BA182	0.27
BA201	0.13
BA202	0.14
BA203	0.14
BA216	0.08
BA219	0.11
BA243	0.45
BA317	0.06
BA318	0.07
BAV10	0.10
BAV21	0.18
BAW62	0.06
BAX13	0.07
BAX16	0.10
BAX17	0.19
BAY72	0.16
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BB105B	0.33
BB105G	0.30
BR100	0.40
BY100	0.35
BY103	0.35

Type	Price (£)
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BY118	1.10
BY126	0.20
BY127	0.21
BY133	0.35
BY140	1.40
BY164	0.75
BY176	2.80
BY179	0.83
BY182	1.14
BY184	0.44
BY189	5.30
BY190	4.90
BY206	0.26
BY238	0.25
BYX10	0.30
BYX38/600	0.70
BYX70/500	0.53
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ITT210	0.63
ITT827	0.80
MCR101	0.48
MR854	1.10
OA5	0.88
OA10	0.58
OA47	0.20
OA81	0.19
OA90	0.13
OA91	0.15
OA95	0.20
OA200	0.13
OA202	0.13
OA210	0.89
TIL209	0.14
TIL211	0.18
TV20	2.25
IN914	0.06
IN916	0.06
IN4001	0.06
IN4002	0.07
IN4003	0.08
IN4004	0.08
IN4005	0.09
IN4006	0.10
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/A258	0.25
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/A258	0.22
/A260	0.22
/A262	0.22
/A265	0.22
/P268	0.22
E298ZZ	
/05	0.25
/06	0.22
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/P230	0.72
VA1015	0.92
VA1026	0.79
VA1033/34/38/39/40/53	all 0.20
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VA1077	0.31
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ECL80	0.82
EF80	0.60
EF183	0.75
EF184	0.75
EH90	0.94
EL34	3.08
EY51	1.20
EY86/87	0.67
PCC84	0.61
PCC85	0.79
PCC89	0.74
PCC189	0.94
PCF80	1.20
PCF86	0.87
PCF200	2.32
PCF801	0.74
PCF802	1.20
PCF805	3.37
PCF808	3.80
PCL82	0.93
PCL83	5.25
PCL84	0.65
PCL86	1.27
PCL805/85	1.00
PD500	3.75
PFL200	1.40
PL36	1.20
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PL84	0.79
PL504	1.56
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PL802	5.60
PY81/P810	0.60

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	200V	0.32		400V	0.47
	400V	0.40		600V	0.53
	600V	0.50		800V	0.60
	800V	0.58		1000V	0.87
3A	100V	0.52	6A	100V	0.66
	200V	0.55		200V	0.68
	400V	0.61		400V	0.74
	600V	0.67		600V	0.80
	800V	0.80		800V	0.86
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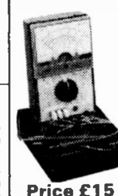

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PCB SERVICE

The Readers' PCB Service continues in operation – details as given on page 265 of the February issue. Boards for the Frequency Counter-Timer project are now available, also for the In-Circuit Transistor Tester.

Prospects for Cable

This cable business gets more and more curious – largely because the whole idea was blown up out of all proportion to start with. Let's just backtrack for a moment. The provision of programmes via cable is almost as old as broadcasting itself. At the present time some two and a half million people in the UK are served by cable TV. The problem is that such services are very restricted, being limited (with a few experimental exceptions) to the relay of off-air transmissions in areas where reception is difficult. In Europe, cable systems have proliferated in areas where programmes from different countries can be offered, while in the USA a tremendous boost was given to cable operations by the advent of satellite programme distribution. This rapid expansion of US cable operations seems to have been the factor responsible for the idea that cable could become a big thing in the UK. The Minister of Information Technology became enthusiastic about the prospects, and in January 1982 the government's Information Technology Advisory Panel produced a report on the subject. This came to the conclusion that "a major programme of cable installation was desirable", and that there were "powerful economic and industrial arguments for encouraging cable systems in the United Kingdom." The arguments presented in the report didn't seem all that powerful or convincing to many observers, and to this one the report seemed to be a very confused presentation of various technical, economic and industrial aspects of the subject. The Hunt Committee was then set up to report on technical standards and methods of exercising control, and produced its report on schedule last September. This was to be followed by a government White Paper which was expected early this year but was finally published on April 27th. It seems that the Home Office and the Department of Industry had spent a couple of months arguing about the right balance between ensuring that broadcasting standards are maintained and the industrial advantage to be gained by encouraging cable laying at the earliest opportunity. Between Hunt and the White Paper, the city had been assessing the prospects and getting more and more gloomy.

There is of course no reason why people should be deprived of as wide a choice of programmes as possible, within the constraints imposed by economics and the need to maintain the established programme sources. Cable can provide this wide choice but is expensive. The original ITAP report didn't really seem all that concerned about wide programme choice however: it was more concerned with a starry-eyed view of cable providing a vast increase in information services, backed by arguments that the appropriate technology was now available and should be exploited in order to create jobs and establish leadership in an important new industry.

As expected, the White Paper confirms that cable networks providing extra channels are to be allowed, with a Cable Authority to award franchises to cable operators and ensure a degree of regulation, but little is now being said about the technological prospects and economic advantages. The starry-eyed technical wonder aspect has evaporated. In its place there seems to be greater acknowledgement of the practicalities of the matter, to wit that what people are likely to be prepared to pay for will be a few extra TV channels to increase their choice of programmes. Forget the ideas about linking homes to powerful computers, electronic shopping and all that sort of thing.

Who will benefit from the new services that look as if they will come on offer rather falteringly? We now come to the nitty-gritty. Some very interesting research on the business prospects has been carried out recently. For example, NERA International Inc. have produced a detailed report entitled "Can Cabling Britain be Profitable?" This studied four potential franchises and came to the conclusion that one was "very promising", two were "marginal" and one was "distinctly unattractive". Ah, you might suppose, that "distinctly unattractive" franchise must be some obscure place with all sorts of practical problems. Not at all! It was West London. Now if cable is a distinctly unattractive proposition in a high population density area like Hammersmith/Fulham/Chelsea/Kensington, you might wonder where it would be "very promising". The answer is Glasgow, and the reasons for this seem to be largely demographic, i.e. lots of kids. According to a report in the *Financial Times,* many "cable experts favour council estates and poorer, racially mixed districts over affluent neighbourhoods". Bruce Fireman of investment bank Charterhouse Japhet is quoted as saying that "Mayfair and Worthing will be the last parts of the country to be cabled." The Pearson Longman group did a study of Harrow, N.W. London, and found that the cost of cabling (at between £400 and £500 a house) would be far too high for a service to be economically viable. The general consensus seems to be that careful selection of franchise area and type of audience will be crucial to economic success, and that "it's a very risky investment" (Jeffrey Richardson, of management consultants Deloitte Haskins and Sells, quoted in *The Observer*).

In retrospect it seems sad though inevitable. More soap operas for areas with plenty of children will work all right, but all that brave talk about cable providing a revolution in information technology for the home is just not on. For the present, anyway.

Letters

N1700 SPEED CONVERSION

I have just completed the N1700 speed conversion described in your April issue – a worthwhile and cost-effective modification by Mike Phelan. The quality obtained at the reduced speed is very good. The modification gives only a fifty per cent increase in recording time however rather than doubling it. It appears that the discharge of the 0·047μF capacitor in Fig. 2 depends on the value of R21 and the series 680kΩ resistor, so to double the total resistance R21 should be increased to 1·9MΩ – say 1·8MΩ 5 per cent.

On my machine the motor and control circuitry are operating at near the limit at half speed – if R21 is made 2·2MΩ, the capstan motor stalls and restarts at about four second intervals on replay but works smoothly on record.

With the slow-speed modification the best replay is obtained with the tracking control displaced a little to the left of its normal position, probably because of the overlap and consequent over writing of the edges of adjacent tracks. This will displace the best reading position a little with respect to the original record head position.

Ian Burgon,
Grantham, Lincs.

NO TO GIMMICKS

Is it really necessary for certain video/TV manufacturers to resort to gimmickry to sell their products? I refer in particular to stereo TV and the recently announced 3D TV.

It's true that dual-channel TV and video is useful for bilingual information, but just whom does the industry think it's fooling when it predicts any sort of future for stereo TV? Creating a stable stereo image is difficult enough, but when there's a visual scene complementing it the task become virtually impossible.

In the case of mono sound, the visual impression dominates and the viewer has no problem in identifying the sound source with wherever the visual information dictates. No one has ever complained that the visual image and the sound source are separated. The distance involved is too small for this. Once stereo sound is introduced however it's a different matter: attention is immediately drawn to an apparently shifting sound source, and the discrepancy between it and the visual scene can only cause confusion.

Leaving aside more subtle discrepancies, take the case of an opera singer moving across the stage, the sound faithfully following him whilst his image remains dead centre as the camera pans him! Are we to assume that this is taken into account, along with a reduced stereo image requirement as the camera closes in on the scene? Furthermore, if any claim to accuracy is made, why the restriction of the sound image in one direction while the TV picture is two-dimensional? Visualise this scene: thousands of disappointed stereo TV owners witnessing the launch of some new space venture, the rocket travelling upwards through the top of the TV set while the roar of the motors stubbornly remains smack bang in the middle of the screen. And whom do Thorn think they're kidding with their stereo video demonstration tape? The deterioration of sound quality on the "old mono" part compared with the "new stereo" section is obvious even on monophonic equipment! Just what went on when this tape was recorded one can only wonder . . .

But the Gimmick of the Year award must surely go to NordMende/Saba for their introduction of "3D TV". Now obviously there's no way in which the TV set can know what is foreground information and what is background information unless this is transmitted. Practical tests bear this out, showing that the only effect of this "revelation" is to give the impression that the picture is situated in a different plane from the TV screen – and with poor colour at that. Not only is the public expected to swallow this but, through the technical information sent out, it seems that we in the retail and servicing trade are expected to swallow it as well. Well, no thank you.

Any steps taken to improve the picture and sound quality are welcome, but let's avoid these gimmicks please.

Alan Willcox,
Llanadeyrn, Cardiff.

TWELVE-HOUR CLOCK CORRECTION

I've not seen a correction yet to an error that occurred in the twelve-hour clock conversion article in the December 1982 issue. This applies to the information given for the Ferguson 3V30, where link B454 should read link B453. Lifting links B453 and B464 alters the clock as intended in the article – I believe link B454 in fact supplies the "first" week indicator.

P. Jigins,
Grays, Essex.

PORTABLE LIGHT UNIT

I'd like to make a couple of points about Victor Rizzo's portable light unit (letters, April). First the standard car reversing lamp in the UK is 21W, which would require a 2A transformer. Secondly the method of construction, with an earthed metal box, could be extremely dangerous. Suppose you used it in the corner of a customer's house – now imagine what would happen if you touched a live TV chassis and this earthed box at the same time!

P. Richards,
Criccieth, Gwynedd.

Editorial comment: Several readers have written to point out the dangers of the earthed portable light. Our thanks to one and all.

PHILIPS K30 CHASSIS

Here's an interesting problem we had recently with a remote control Dynatron set fitted with the Philips K30 chassis. The set stopped working in the show room and I was asked to look at it. On examination I found that the 285V h.t. supply was reaching the collector of the chopper transistor, but the output at its emitter was pulsating at around 8V. No fault could be found in the power supply, so attention was turned to the line output stage. The line output transistor and the various diodes in the circuit all read o.k., and after making various checks I discovered that conditions returned to normal – with e.h.t. present and the tube's heaters alight – when the scan coils were

disconnected. Further investigation revealed that the print running from the line linearity coil beneath the line output transformer to the scan correction capacitor C1560 was being shorted by the line output transformer's earthed clamping washer. The cure is to cut the print and bridge across with insulated wire. It's worth checking this point on the K30 chassis – could save callbacks.
M. S. Barakat,
Slough.

SERIES REGULATOR FAULT

The following fault recently experienced may serve as a warning to others. The set was a Bush Ranger monochrome portable, Model BM6514, the symptoms being that the set was dead – no sound or raster, and the tube's heater out. It didn't take long to see that the fusible resistor R62 (see Fig. 1) was open, thus removing the output from the series regulator – or rather preventing it from starting up. When this resistor was resoldered and the set switched on R62 began to overheat badly and the regulated supply line fell from 11V to 4V.

Quick as a flash I diagnosed an overload and began disconnecting the various sections of the receiver. Sure enough when the print to the line output stage was cut the supply returned to exactly 11V, with sound and the tube's heater alight. The line output stage was carefully checked, but no obvious culprits could be found. "Line output transformer" I muttered, and obtained a replacement which I then confidently fitted. When the set was switched on however the fault symptoms remained exactly as before!

There followed a lot more checking around the line output stage, and I finally disconnected all the leads from the output transformer. Only when the supply lead to the primary winding was disconnected did the fault disappear. So another line output transistor was tried, in vain, and a check on the line drive waveform revealed that this was correct. Dark thoughts about the new transformer began to gather in my mind, and yet another was obtained – with the same results.

Whilst wondering what to do next I tried the effect of adjusting the set volts control RV6 with the line output stage disconnected. Imagine my amazement when I saw the 11V line remain rock steady at exactly 11V when RV6 was adjusted from one end to the other!

The penny then dropped. The series regulator transistor VT10 was not conducting, so R62 was overheating, being called upon to handle all the current. By coincidence (or Sod's Law) the supply voltage became exactly 11V on light load with the line output stage disconnected. Had the supply line voltage been anything else I wouldn't have wasted so much time on the line output stage.

Having reached this stage, it didn't take long to discover that the driver transistor VT12 was open-circuit base-to-emitter, a replacement restoring normal service.
Dennis Apple,
West Bridgford, Nottingham.

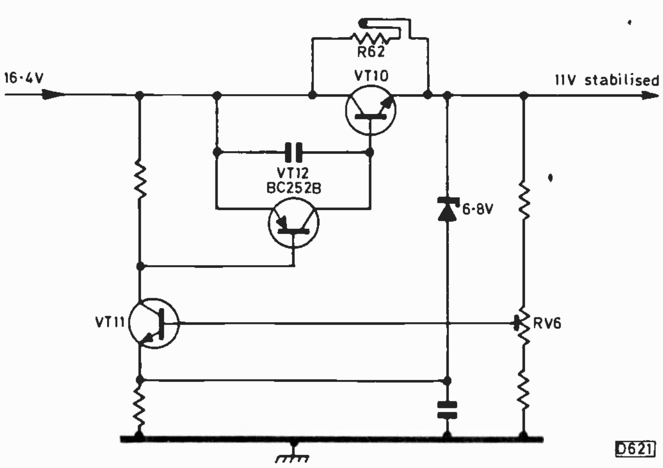

Fig. 1: Series regulator circuit used in the Bush Ranger Model BM6514. With a light load and VT10 non-conductive the output remained at 11V.

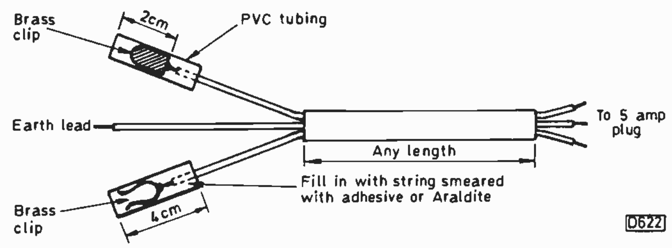

Fig. 2: DIY adaptor for converting a 13A plug for operation from a 5A socket.

5A ADAPTOR

Most homes are fitted with 13A sockets, but the service engineer still occasionally encounters 5A types. Since the soldering iron is usually fitted with a 13A plug, this means either having to improvise or waste time swapping plugs. The contraption shown in Fig. 2 solves this problem and is safe to use.

The clips in the prototype were made from the terminals of a discarded 4·5V battery – 3cm is a good length. These are bent to fit the 13A plug flat pins (live and neutral only), the clips then being tightly embedded in a length of suitable PVC tubing (about 4cm long). The outer covering of white coaxial cable will do. For safety's sake it's important that the plug pins are completely covered by the tubing. Fill the wire end of the tubing with Araldite (costly) or with a piece of string smeared with adhesive.

For the earth connection I've found that it's better to use a suitable crocodile clip – it's easy to get mixed up, notwithstanding the wire colour coding!
Victor Rizzo,
Msida, Malta.

SURGE MODIFICATION

Other readers may be interested in a modification I carried out on the Decca hybrid colour chassis (Bradford chassis) – the version with no thermistor in the heater circuit, resulting in a surge which appears almost too bright for comfort.

An 0·3A thermistor was fitted in series between the heaters of the PCL82 and PCF80 valves, with the normally-open contacts of a relay of some 500Ω coil resistance wired across the thermistor. The relay's coil, with a 60Ω resistor in series, was used to replace the PCL82's 560Ω cathode bias resistor.

This modification eliminates the switch-on surge, and gives a time delay after which the thermistor is shorted out. It's worked with no problems for over a year.
F. S. Yates,
Bedford.
Editorial comment: In many of these sets a modified audio circuit is used, the PCL82's cathode bias resistor being 390Ω.

Teletopics

EIGHT-HOUR VHS MACHINES

The VHS system is proving to be very adaptable. We've already had the compact version (VHS-C) – the latest models are described later. Now come two-speed, eight-hour machines. Models so far announced include the JVC HR7655, Ferguson 3V32, Panasonic NV788 and the Hitachi VT17. These are all top of the range models, featuring front loading, infra-red remote control, etc.

The two speeds are 2·34cm/sec and 1·17cm/sec, the later giving up to eight hours' recording time on a standard E240 cassette. Two extra heads are used, the second pair having a narrower gap width for the slower speed (the Panasonic machine has five heads in all, the fifth having a wider gap to give improved still and slow motion pictures with standard tracks). Both standard and long play recordings can be made on the same tape, the machines automatically detecting the type of recording on playback and setting up accordingly.

END OF 405

The Home Secretary announced on April 12th the government's decision to bring forward to the end of 1984 the closedown of the BBC and IBA 405-line transmitter networks. The aim is to allow the Band I/III v.h.f. allocations to be made available sooner for mobile radio. In his statement, the Home Secretary recognised that some 70,000 people in smaller communities scattered throughout the country could still be without a TV service at the end of 1986. Some of these will be catered for in a further phase of transmitter building designed to cover communities down to 200 people where this is economic.

THOMSON-JVC DEAL

Thomson-Brandt and JVC have signed an agreement on the manufacture of VHS equipment. Thomson-Brandt hopes to produce a million VCRs a year and to produce precision mechanical parts, including heads, for use in the J2T (JVC-Telefunken-Thorn) plants in Newhaven and W. Berlin. By boosting the locally made content of VHS machines, the problem of export restrictions on Japanese machines could be avoided.

The initial Thomson-Brandt plans are to set up a plant to produce mechanical parts accounting for some 40 per cent of the value of a VHS machine. This boost to VHS manufacture in Europe, plus the new eight-hour capability of the VHS system, would seem to place a further question mark over the prospects of the V2000 system. Meanwhile the W. German Federal Cartel Office has given Thomson-Brandt approval for the takeover of Telefunken and, in Japan, JVC has launched its VHD video disc system.

BOOM YEAR

1982 was certainly boom year for TV and VCR sales/rentals in the UK. Colour set deliveries totalled 2,934,000, an increase of 14 per cent on 1981 and well in excess of the famed Barber boom year of 1973 when deliveries reached 2,250,000 million. Of the 1982 total, just over two million CTV sets were of the large screen type and just over 900,000 were small-screen sets (16in. and under): 571,000 were equipped for teletext reception. Import penetration overall increased from 29 to 32 per cent. Monochrome portable deliveries reached 1,012,000.

The VCR total was 2,235,000 compared to 1,035,000 in 1981.

For the present year, sales of large-screen CTVs are expected to remain at much the same level, with an increase in small-screen CTV sales to something like 1,100,000.

The value of CTV imports in 1982 was £156,367 million. CTV exports amounting to £56,440 million were recorded.

Thorn have taken a major step to increase sales of UK made small-screen CTVs with the introduction of the new TX90 chassis – see story later.

EURO SATELLITE TV DISAGREEMENT

Despite an EBU technical committee deciding that a single European standard for satellite TV transmissions is of "paramount importance", and that the standard should be a form of the C-MAC system developed by the IBA, the European Broadcasting Union has failed to reach agreement on a common standard. France is likely to go ahead with SECAM-based transmissions, while W. Germany has declined to accept a common standard unless this is agreed by all parties. UK broadcasters and setmakers are proceeding with the development of C-MAC equipment ready for the start of the BBC's satellite service in late 1986, and since the French and W. German services are due to start in 1985 there's little time left to reach agreement on a common system.

ITT-STC

As mentioned in our leader last month, ITT expects to have TV sets using the new ITT Digivision system on sale in the UK early next year. The system was described in some detail in our November 1981 issue.

Meanwhile STC has decided not to purchase ITT Consumer Products (UK) Ltd. in view of the close integration of the ITT consumer electronics manufacturing operations at Basildon and Borkum in W. Germany. It will however be buying the ITT rental operation Telebank TV Rentals, which operates mainly in the north. ITT has decided to take shares rather than cash for the sale of its UK subsidiaries to STC, which will ensure a continuing strong link between the two companies.

STEREO SOUND TRANSMISSION

The BBC's stereo TV sound test transmissions, using the W. German two-carrier f.m. system, were mentioned in this column last December. The transmissions took place out of normal service hours and were conducted to establish whether the system was compatible with normal UK u.h.f. reception. They were observed by staff from the BBC, ITV companies and receiver manufacturers in the area served by the Crystal Palace transmitter: analysis of the 414 questionnaires returned has now been completed. The results confirm the expectation that crosstalk between the two sound signals is not a problem and that patterning due to beats between the two carriers is acceptable when the amplitude of the main carrier is reduced a little. Buzz on sound can be a problem with existing receivers however, regardless of the level of the second carrier, and this problem is increased when the amplitude of the main carrier is reduced. The buzz is to some extent receiver dependent, but the main factors affecting it were found to be multipath propagation, which can cause the received sound-to-vision ratio to vary by ± 5dB or more, and the

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spectral content of the picture.

The general conclusion reached is that a system of this type could provide a largely satisfactory service but alternative possibilities should be investigated. In particular the use of digital sound for DBS transmission makes it important to establish whether a digital package could provide a better alternative for terrestrial propagation than the use of a second f.m. carrier. Preliminary assessments indicate that the digital option would give a better compromise between compatibility and ruggedness. The BBC has started an examination of digital methods and will be carrying out over-air tests in due course.

LARGE-SCREEN MONOCHROME SET

There are not many large-screen monochrome sets on the market at present, so it's worth mentioning a new addition to the Pye range, the 20in. Model 2080, which has a recommended retail price of £110.

THORN'S TX90 CHASSIS

Thorn have developed a new chassis, the TX90, with the aim of increasing Ferguson's share of the small-screen CTV market. Since the new 14in. Model 37140 has been designed to sell at a recommended price of just £169, the firm has every reason to expect success. How has the necessary cost reduction been achieved? First there's a 25 per cent reduction in the component count in comparison to the TX9 – from 410 parts to less than 300. Secondly the chassis has been designed for 75 per cent automatic component insertion initially, rising to 90 per cent when all the robots have been installed at the Gosport plant. Thirdly there's economic arrangement of the chassis and circuitry, with a reduction in scan power of some 20 per cent. There's also a weight saving of 8lb.

The new chassis has been designed specifically to drive a narrow-neck 14in. tube. The chassis is mounted vertically at the left-hand side, and the user controls are all mounted on the main panel. The latter technique, which is also used in the 1790 monochrome portable chassis (see February 1983 *Television*), eliminates the need for a separate control panel with expensive interconnecting plugs/sockets and leads. A version with remote control (Model 37141) is expected to follow in the autumn.

Thorn are also planning to introduce a "unit video" system based on the TX9 chassis. This would consist of a stereo version of the TX9 with separate speakers, a VCR, and a remote control unit for both the TV set and the VCR. The aim is a popular, rather than semi-professional, unit system.

AERIALS LEAFLET

A leaflet giving guidance on wideband u.h.f. aerials is available from South West Aerial Systems, 10 Old Boundary Road, Shaftesbury, Dorset – send a stamped, addressed envelope with requests. The leaflet is a reprint, with minor amendments, of an article by Roger Bunney that originally appeared in our August 1982 issue.

8mm VIDEO

The March meeting in Tokyo on an 8mm video standard agreed on technical standards for the audio signal but left the video signal processing system for more detailed discussion. The meeting was attended by the five leading signatories (Hitachi, JVC, Matshushita, Philips and Sony) of the group attempting to establish a world standard for the system. The Japanese companies agreed that 8mm video equipment is unlikely to be on the market before the spring of 1984.

HIRWAUN STRIKE

Production staff at the joint GEC-Hitachi TV plant at Hirwaun, South Wales have returned to work after a five-day stoppage in protest over a pay standstill for a third consecutive year and a cut of £6-£7 a week in bonus payments. The plant has been making a loss for the past six years, and recorded its largest ever loss of £5·2 million in the year to March 31st, 1982. There were 800 redundancies last year as part of an attempt to cut costs by 25 per cent – the present workforce is 1,200.

Just four years ago Hitachi joined forces with GEC to re-equip and modernise the plant, increasing production capacity from 150,000 to 300,000 sets a year, but despite boom conditions generally the factory was operating on short-time for a period last year. One of the problems is thought to be the amount of in-house component manufacture.

Meanwhile Toshiba are planning to double CTV production at Plymouth to 160,000 sets a year. VCR production is also under consideration but has been deferred due to uncertainty over the Japanese-EEC VCR import limitation agreement. Hitachi plan to start producing VCRs at Landsberg, W. Germany, this October, at an initial rate of 60,000 units a year.

PORTABLE VIDEO EQUIPMENT

Ferguson have introduced a portable video camera/recorder combination using the VHS-C system. The Ferguson Videostar C video system, Model 3V40, consists of a compact VCR weighting only 5·3lb and a colour camera weighing just 2·75lb. The camera uses a half-inch Saticon tube which can operate at light levels down to 30 lux. The camera's power consumption is 5·5W and the electronic viewfinder acts as a monitor for instant review. A shoulder-mounting carrier is available so that the camera, recorder and power pack can be combined as a single shoulder-operated assembly. There's an extensive range of accessories designed to offer the user the opportunity to exploit to the full the various possible uses of the equipment. An all-in price of around £1,000 is suggested.

A similar portable video system has been introduced by NordMende.

The latest video camera introduced by Hitachi, Model VKC2000, is of interest in using a solid-state image sensor of the MOS type instead of a tube. This has enabled the weight, compared to previous Hitachi models, to be reduced to about 3·75lb. The use of an intricate colour filter is said to greatly improve the colour reproduction. Other performance figures are signal-to-noise ratio better than 45dB and a horizontal resolution of about 300 lines. Consumption is 5·3W on record, 0·1W on standby. An advantage with a solid-state image sensor is that there is no burn-in problem when the camera is pointed at a strong light source.

BOOK NOTICE

Bernard Babani (Publishing) Ltd. have published "An Introduction to Video" by David K. Matthewson. The 86-page book, reference number BP100, is priced at £1·95 and should be available from the larger branches of W.H. Smith and Son Ltd., component shops etc. It provides a basic guide to the whole range of video equipment, with information on the development of the various systems and some useful reference material.

Routine TV Receiver Tests: Thorn 9600 Series Chassis

S. Simon

The Thorn 9000 chassis, which we dealt with last month, was designed to drive 90° PIL tubes. It featured what Thorn call a Syclops transistor, which drives both the chopper and line output transformers. To drive 110° PIL tubes Thorn designed the 9600 chassis, which reverts to the use of separate chopper (VT512) and line output (VT801) transistors. The chopper circuit has its own driver stage, employing transistor VT511, but the line output transistor is driven by a secondary winding on the chopper transformer. The two sections of the receiver thus continue to operate in conjunction with one another, the line oscillator as before driving the chopper control circuit. Because the line oscillator's supply is obtained from the chopper transformer, a start-up oscillator is required. This is on the chopper control panel and is of the Colpitts type, using transistors VT601/2: this is synchronised by the line oscillator when the start-up sequence has been completed. Fig. 1 shows the basic arrangement of the chopper and line timebase circuits in block diagram form.

The line output stage is on the horizontal board beneath the tube, the power supply board being mounted vertically at the right-hand side. With the chassis slid out in the servicing position, the wing nut that secures the screening cover of the right side power panel can be removed and the cover swung back to reveal the printed board. This enables the mains input to be checked up to the h.t. bridge rectifier, the h.t. reservoir capacitor and the h.t. input to the chopper transistor.

It's worth going into this in a little more detail in order to avoid confusion. The mains input is taken first to a 2·5A anti-surge fuse which is located in a separate holder at the bottom left side. It then goes via a filter unit to the on/off switch and thence via a brown and blue pair of leads to a plug and socket on the left side of the main frame. After this it's taken to the right side plug and socket PL511, then passing to the mains filter capacitor C531, the degaussing components and, via the 3Ω surge limiting resistor R511, the bridge rectifier W525. Thus the a.c. part of the circuit.

Basic Faults

If you find the mains fuse shattered, check C531 and W525 which is a fairly small unit and is suspect. Of the four legs viewed from the print side, the right hand leg is the output to the reservoir capacitor C515. This should read low to the other legs only with the red probe applied to it and the black probe applied to one of the other legs. Reversing the probes should produce a much higher reading. A very low reading in either direction will usually indicate a short in the bridge itself or in the reservoir capacitor C515. We say usually because there are other items across the output of the bridge, including the 1μF capacitor C530 and the chopper transistor itself (with the primary winding of the chopper transformer and its 0·75Ω emitter resistor R522 in series). There are thus several possibilities to consider and to check individually. The chopper transistor is quoted as type T9038V but can be replaced with the usual BU126 or similar.

In common with more recent chassis, most of the troubles revolve around poor connections or dry-joints. Particularly the latter, which seem to be very common under the centre line output section, especially in the area of the scan coils plug and socket (often accounting for the complaint of a white line down the centre of the screen). One or two of the diodes used in the line output stage are also suspect, chief amongst these being W810 (BY298) in the diode modulator circuit – it seems to get burnt up every now and again. The line scan coupling/correction capacitor C809 (4·7μF) is also suspect and will often be found misshapen due to the effect of internal heat.

It's essential to understand the functions of the three secondary supply fuses in the lower corner of the power supply panel, also the top empty diagnostic socket TSB. The centre fuse F511 (500mA) supplies 34V to the 24V regulator. The output from the top fuse F512 (800mA) is also at 34V: it supplies the field oscillator and output stages and, via R520, the TBA920 sync/line oscillator chip. The lower fuse F513 (500mA) supplies 31V to the audio panel. These fuses are all anti-surge types. The diagnostic socket TSB enables various points on the power supply panel to be monitored.

No Field Scan

If the sound is normal but there's no field scan, slide the chassis out to the service position, remove the wing nut and swing open the power supply panel's screening cover. Refit the earth braiding under the wing nut, then check the voltage at pin 1 of TSB. This should be 34V. If this voltage is absent it's a fair bet that F512 is open-circuit and that 34V will be read at only one side of it. If this is so, switch the set off and measure the resistance between pin 1 of TSB and chassis – black lead to pin 1, red to chassis. If the reading is less than 1kΩ, check the field output stage. The field output transistors are mounted at the front of the main timebase panel. If 34V is recorded at pin 1 of TSB we know that F512 is intact and a check should be made at F511 and at pin 10 (80V rail) of the other diagnostic socket TSA on the main, centre timebase panel. The output from the 24V regulator, which provides one of the feeds to the field timebase, can be monitored at pin 2 of TSA. If F511 is blown, measure the resistance between pin 2 of TSA and chassis – black lead to pin 2, red to chassis. The reading should be not less than 150Ω. If the reading is much lower, check the 24V regulator transistor VT812 and its driver VT813. A study of the circuit diagram will show the voltages to be expected at TSB and TSA.

Dead Set Tests

The drill in the event of a dead set is similar to that just described. The first thing to do is to check the voltage at pin 9 of diagnostic socket TSB. If the chopper is working

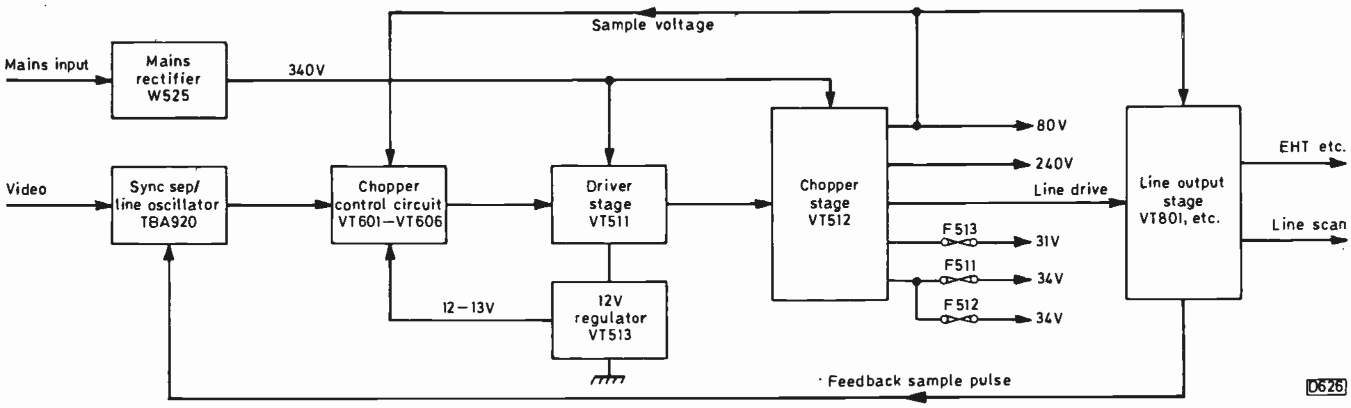

Fig. 1: Power supply/line timebase arrangement used in the Thorn 9600 chassis.

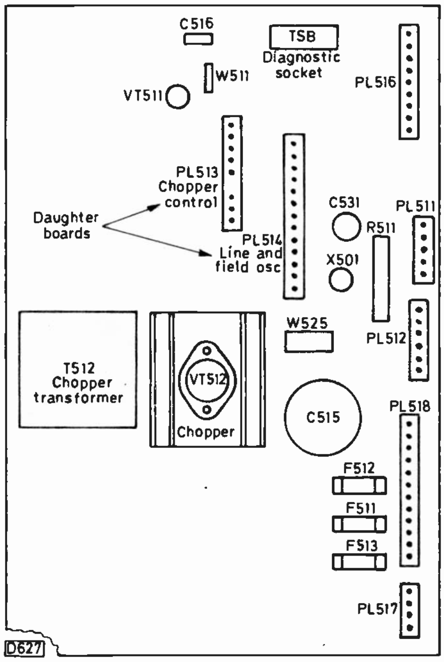

Fig. 2: Items on the right side power supply panel.

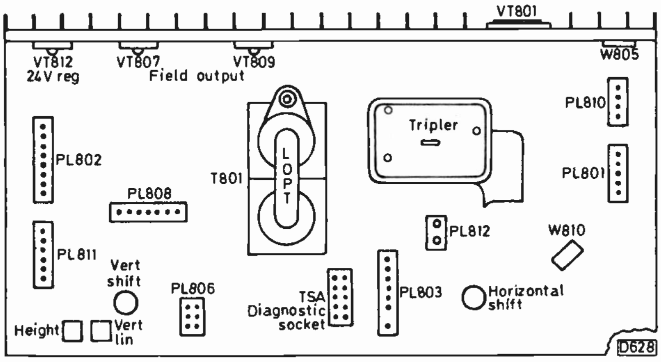

Fig. 3: Main items on the centre horizontal panel, which houses the field and line output stages.

the voltage here should be 580V. Zero voltage suggests an open-circuit between the mains fuse and the chopper circuit, so the circuit to and from the bridge rectifier should be checked. If the voltage is 340V or so the h.t. supply to the chopper circuit is present but the chopper isn't working.

If the voltage at TSB-9 is over 500V, check the 34V and 24V lines as described above.

If the voltage at TSB-9 is about 340V, check for 13V at PL513-2 – this is the supply to the chopper control circuit. If this voltage is correct, check the chopper drive (see later). If it's low at about 10V, short test point TP601 to chassis. If the voltage rises to 13V, check transistors VT601/2/3. If the voltage is less than 9V, unplug the panel to see whether it rises. If so, check the panel for shorts. If the voltage remains low, check the 12V regulator transistor VT513 and the associated 6·2V zener diodes W529 and W530.

If 340V is present at TSB-9 and 13V at PL513-2, suspect lack of chopper drive. Switch off and allow a minute or so for things to stabilise (capacitors to discharge). Switch the meter to the resistance range and apply the black lead to the collector of the chopper driver transistor VT511 and the red lead to its emitter. If the reading is less than 1kΩ, check VT511 and if necessary W511 and C516. If the reading is over 1kΩ, switch to the voltage range and measure the voltage at the collector of VT511. If, when the set is switched on, the voltage rises to a high value and then falls back to 13V, check the chopper transistor VT512 and the components in its base circuit. If the voltage rises evenly to 13V, there's a fault in the chopper control panel and this should receive close attention. The correct voltage is 82V.

In Conclusion

There are many other check procedures for the 9600 chassis, for example when the set is tripping. Details of these can be found in the field service manual – full data should be to hand if you are going to service any number of these sets.

Such tests are rarely required however, since most fault conditions are due to dry-joints under the timebase panel, a break in the mains supply circuit, or a similarly fairly obvious condition. Unhooking the tripler from the line output transformer is a "must" from time to time, as in most sets, but due to its revised position (away from the metal frame) the tripler in the 9600 does not cause the trouble it does in the 9000 series chassis.

The left side panel contains the tuner and remote control circuit and the audio subpanel. It swings up for service and for access to the signals panel, which is the same as in the 9000 – this swings out for service after the tuner panel has been swung up. As with the power supply panel, a screening plate covers the print side.

Finally, that BY298 diode (W810) in the EW diode modulator circuit. In our opinion the BY298 is not suitable for use in this position. It is our custom to replace it with a BYX71-600, fitting this under the print for convenience, having first correctly identified the cathode connection.

In-circuit Transistor Tester

Alan Willcox

In addition to transistors, the tester to be described also checks diodes and thyristors. The basic principle of the unit is that the device being tested is turned on by a bias from the tester, thereby diverting current from an LED which is thus extinguished. Fig. 1(a) shows the arrangement for checking an npn transistor while Fig. 1(b) shows the equivalent test for a pnp transistor. Reversal of the supply line and of the LED is required in order to test both types. Since it's undesirable to have to operate an npn/pnp switch on an in-circuit tester, the circuit shown in Fig. 1(c) was adopted. The supply line is reversed at about 5Hz, and two LEDs are connected back to back. As it stands, the two LEDs will blink alternately as the supply reverses.

If a good npn transistor is connected, it will conduct on the positive-going supply half cycles, diverting current from LED2 only. LED1 is left flashing. With a good pnp transistor LED1 is extinguished and LED2 continues to flash. The LEDs are thus labelled as shown, so that the LED that continues to flash indicates the type of transistor connected. Both LEDs will continue to flash if the transistor is open-circuit, and both will be off if it's short-circuit.

This basic circuit suffers from certain limitations. For example, if the transistor being tested has a base-emitter or base-collector short-circuit it will act as a diode, conducting on one half cycle and thus extinguishing one LED. This would give an erroneous indication of a good transistor. Also, if there's a low-value resistance across the transistor being tested sufficient current may pass through it to cause both LEDs to turn off, giving an incorrect short-circuit indication.

Diodes are added to the circuit to overcome these drawbacks. Fig. 1(d) shows the set up for testing an npn transistor. The voltage appearing across the collector/emitter terminals is the forward voltage drop across the LED minus that of the two diodes. This is about 0·4V, which is insufficient to cause a diode connected across the terminals to conduct. The reduced voltage available also means that the tester is less affected by in-circuit resistance – in fact it will tolerate values as low as 50Ω or so before any dimming of the LEDs occurs.

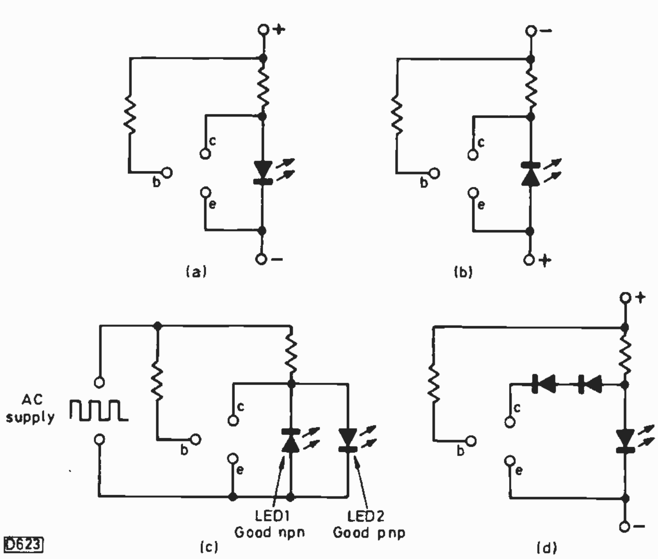

Fig. 1: Basic principles. (a) Arrangement for npn transistors. (b) Arrangement for pnp transistors. (c) Arrangement for testing both types automatically. (d) Addition of two diodes to ensure that only the low saturation voltage of a good transistor will extinguish the LED.

The original circuit before the introduction of the diodes is satisfactory for testing diodes and thyristors with their forward voltage drops of 0·5-1V or so. In the final circuit (see Fig. 2), cancellation of the voltage drops introduced by diodes D1-4 is achieved by supplying power to their junction via R5 when the transistor/diode switch SW2 is in the diode position. For example, on positive half cycles LED2 would be supplied via D3, but if a good diode was connected for test across the collecter-emitter terminals the current would be diverted from LED2 via D2: as D2 and D3 are effective in opposite directions, the effect of their voltage drops is cancelled out. If the diode under test was reversed, D4 would conduct on negative half cycles and LED1 would be extinguished.

The diodes could simply be switched out of circuit of course, but the method adopted allows a suitable resistor value (R5) to be switched in at the same time. This lower value ensures that the same tolerance to in-circuit resistance is retained, though at the cost of increased power consumption.

Thyristors can also be tested with the switch in the diode position. To allow for the fact that these are often insensitive devices, gate bias current is supplied from the positive side of the battery via R2. As the gate is not required to be negative with respect to the cathode, reversal of the supply to it is not necessary.

A 556 dual timer i.c. is used to provide supply line reversal at about 5Hz. One section of the i.c. is connected as an astable oscillator with R1 and C1 the timing components. C1 is charged and discharged from the output at pin 9 via R1. The other section of the i.c. has its trigger and threshold inputs (pins 2 and 6) connected to pin 9, with the result that its output at pin 5 follows the square wave present at pin 9 but with reversed polarity. When internal voltage drops are taken into account, the net result is a 14V peak-to-peak squarewave between pins 5 and 9. This forms the supply for the rest of the circuit.

Construction

The PCB is small enough to fit into almost any case that will accommodate the battery, but a larger case will allow for the inclusion of test sockets. The smaller prototype was built into a hand controller box which will take a PP3 battery once some internal struts have been cut away.

The probes consist of short lengths of plastic-covered curtain wire supported in a section of 5A strip connector (an idea suggested by J. Bloor in a letter in the April 1978 issue). Dart points were filed down to a push fit in the ends of the wire, the assembly being bolted to the bottom of the case through the hole in the connecting strip.

The miniature red LEDs were simply push fit and

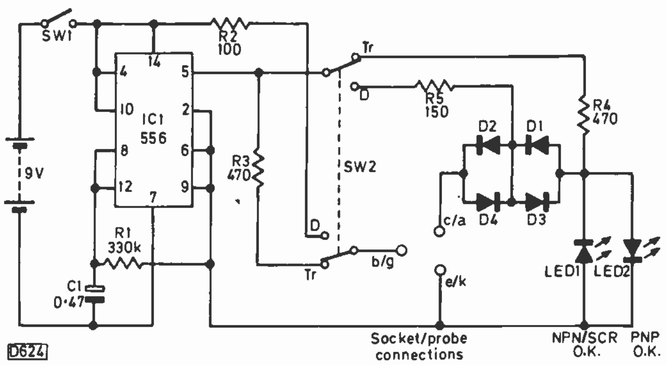

Fig. 2: Complete circuit. Diodes are tested by being connected across the collector-emitter terminals.

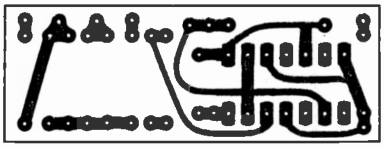

Fig. 3: Printed board layout – 1:1 scale.

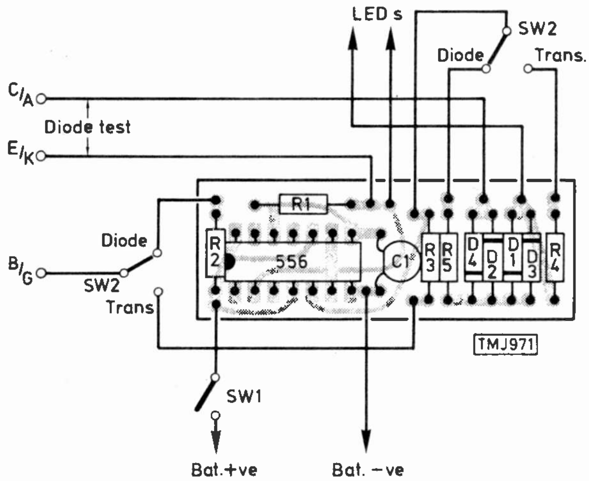

Fig. 4: Component layout.

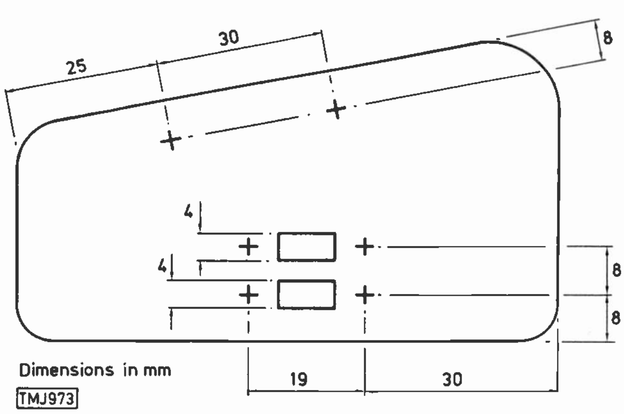

Fig. 5: Small case details.

secured with a spot of glue. The PCB itself is secured with an adhesive pad. The larger version has a red and a green 0·2in. LED, both mounted in holders. The battery is fixed to the case bottom with an adhesive pad.

Tests

Table 1 lists the main possibilities that may be encountered in operation. One LED flashing generally indicates a good device. One of the exceptions is when two diodes are

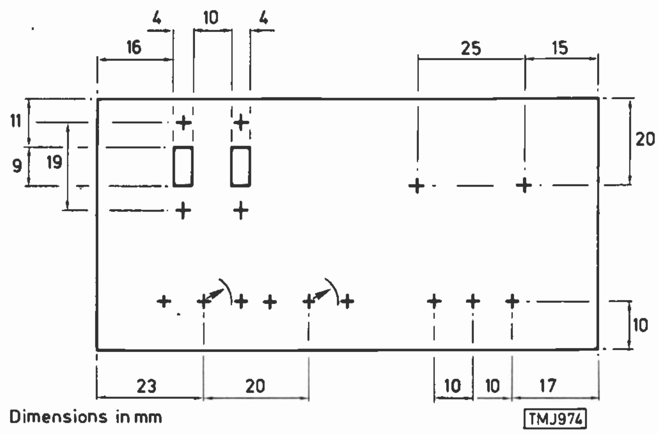

Fig. 6: Large case details.

connected back to back. In this case current flows on both half cycles, turning off both LEDs. If this action is in fact due to normal diode current, this will be confirmed by switching to the transistor test position, whereupon both LEDs will turn on again. If they stay off, at least one of the diodes is short-circuit.

Another example is when testing a thyristor which has either an integral or external diode across its anode and cathode connections. Here again current flow is in two directions, positive half cycles through the thyristor and negative half cycles through the associated diode. Now if the thyristor is good, removal of the gate (base) probe should bring on the pnp LED, the other LED staying off because of the diode across it. In this way both the thyristor and the parallel diode are checked out.

If it's found when using the tester that one LED

Table 1: Test conditions and results

DEVICE CONNECTION	SW2 at *	PNP LED†	NPN LED†	CONCLUSION
b c e	Tr	●	◑	Good npn
b c e	Tr	◑	●	Good pnp
b c e or pnp	Tr	◑	◑	Faulty: o/c or base s/c
b c e or pnp	Tr	●	●	Faulty: c–e s/c
c e	D	●	◑	Good diode‡
c e	D	◑	●	Good diode‡
c e	D Tr Tr	● ◑ ●	● ◑ ●	Switch to transistor Both diodes good One or both s/c
b c e	D	●	◑	Good thyristor‡
b c e.	D	● ◑	● ●	Now remove base/gate connection Base disconnected, thyristor and diode O.K.—see text

* Tr = transistor. D = diode/thyristor (SCR)
† ● = off ◑ = flashing
‡ S/c and o/c conditions as for transistors

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extinguishes while the other dims somewhat, this would indicate a suspect device – unless there is an unusual circuit configuration.

In Conclusion

Although the tester is basically a go/no go checker, the majority of semiconductor device faults in fact fall within this category. Its main virtues are that it is quick and simple to use, giving rapid indication of transistor types, diode polarity, etc., while possessing good immunity to in-circuit conditions. More subtle faults caused by semiconductor devices not being quite up to specification, e.g. low gain and so on, would require a different fault-finding procedure anyway.

Finally, I've a number of the smaller, hand controller boxes etched as per the prototype (see front cover) available at £1 each on a first come, first served basis from 33 Hill Rise, Llanedeyrn, Cardiff.

Components list

R1	330kΩ	SW1, SW2 Miniature double pole
R2	100Ω	Battery PP3 alkaline
R3	470Ω	
R4	470Ω	Small version:
R5	150Ω	1799 Verocase hand controller
All ¼W carbon film 5%		with RS 586-447 miniature LEDs (LED1-2)
C1 tantalum bead	0·47µF	Large version: RS509-282 Verocase (100 × 50 × 40mm.) with 0·2in.
D1-4	1N4004 or BA148	LEDs. LED1 green RS 587-838, LED2 red
IC1	556	RS 587-822

TV Rental

Tony Thompson

There's money and satisfaction to be gained from running a TV rental service. That's a fact, and if you need convincing a look at the number of national outlets, many specialising in rental only, along any high street should be proof enough. These are the big league however, with glossy showrooms, corporate image, massive advertising campaigns and high-technology products, the whole served with considerable style. You can't hope to compete with them in the new set rental market, with their capital expenditure and block discounting, but you can join in by looking for subscribers in the areas where the big guns are weakest – the so-called decontrolled set field.

Those who rent sets in this sector of the market have as their main reasons for doing so (1) the fact that the initial deposit is limited to one month in advance, i.e. no deposit rental, and (2) the fact that the rates are usually lower than with new sets. If you check, you'll find that the major companies make little distinction in their charges between new and not so new sets – the overheads remain the same whatever the set.

Legal Aspects

A number of things have to be done before embarking on a a rental scheme, however limited its scale. First, a licence from the Office of Fair Trading is required. This is in fact a licence to offer credit, since that's precisely what you'll be doing. This costs, for a sole trader part or full time, in the region of £90 – about double this amount if you are in partnership. All this for what is bound to start as a mere handful of sets! It will take a few weeks for the department to check you out (they do this before issuing a licence), and it's a waste of time phoning them in an attempt to speed things up. You'll get it when they are good and ready: estimate a couple of months . . .

Once you have the licence you can start to plan the operation. Are you going to work alone or with a partner – or at least someone who is willing and able to help out at least some of the time? Working in partnership with another engineer can be very convenient, as days off are easier to organise, similarly holidays. But there are inherent difficulties too. Financing the scheme for a start. Who pays for what and when? Who's phone number do you use for adverts? Remember that BT consider that any telephone number used in trade advertising is a business line, and is thus subject to the higher business rate. To be legal you must inform British Telecom – and if you don't, someone else probably will. Another point must be made about partnerships, though it should be obvious: halving the work also halves the individual's profit from the venture.

Your advertisements should make clear that the sets will be demonstrated in the prospective renter's home, unless you've a shop or other trade premises from which to work. This neatly sidesteps the thorny subject of trading from a private address, something that many local councils – and some neighbours – find irritating.

Insurance for the small or part-time businessman can be an expensive affair, yet the fact that you will be putting complex electronic equipment into your renters' homes must be taken into account. Your vehicle may also require modified insurance to cover its use for business purposes, though this need not necessarily involve expense. And finally, legally correct rental agreement forms are essential. Willow Vale amongst others can supply these.

Be Businesslike

It's worth being businesslike – after all, it's a business you're running! You should keep books: a simple income/expenditure type will suffice. You can obtain the Simplex books from most stationers (ask their advice), or you can use something as inelegant but practical as an exercise book.

Open out at a double page spread and on the left chart your income with dates, on the right the same with your expenditure. Use one double page spread a month initially. Keep all bills safely. If you're starting from the ground up you needn't worry about VAT, at least to begin with. Keep a weather eye on your turnover however: presently, if this exceeds £5,000 in any quarter, that quarter is liable to VAT charges. If you get caught unawares you may find yourself paying VAT twice on some goods as, not being registered, you will have paid the VAT upon purchase but you will have to pay it again upon compulsory registration! Remember that the figure quoted refers to turnover, *not* profit! It's worth a chat with a sympathetic accountant, if only to allay any doubts.

Keeping tabs on your renters can be a problem. I suggest that a simple method is to use a card index, again available from stationers, and using the day of the month as a filing system. Ensure that your renters pay on the date each month. This system works well for a small scale operation, though it's obviously capable of improvement.

Obtaining Sets

There are plenty of sets about, but beware! Many older sets, offered at apparently attractive prices, are unsuited to the purpose we have in mind. My advice is to purchase only solid-state chassis, and as modern as possible. I admit that there are some stylish and fairly reliable valved chassis about, but they are ageing and, as the cost of replacement valves continues to rise, they don't represent a good prospect for long-term rental use.

If you opt to obtain a few sets at a time you may well have to "cash and carry" them from trade sources. These may be many miles from your location, and wasted journeys (in terms of both time and money) are sometimes inevitable. Don't be tempted to buy at all costs just because you've covered a lot of ground getting there. Sigh and keep on looking. If you can find a source through recommendation you will be well advised to use it. Remember that tubes are all too easy to boost undetectably and may well fail on you in a matter of weeks, damaging your profit, reputation and faith in human nature . . . As a start, check around the advertisers in this magazine. And when buying non-workers, check each one carefully for completeness.

Which Sets to Choose?

We all have our preferences about particular chassis, and I'll try not to influence you on this score. By and large however, sets with varicap tuners are preferable to those with the more clumsy mechanical types. But don't go in for touch tune types, especially not the GEC ones, unless you're prepared to fit replacement light-action types. And don't buy ultrasonic remote control sets.

Chassis using the later generation of high-voltage line output transistors (BU208 etc.) are preferable to earlier solid-state chassis. This does, I'm afraid, rule out the ubiquitous Thorn 3000/3500 series – good as they were in their day, they are now getting long in the tooth and good examples with a worthwhile span of trouble-free life still to be expected are becoming rare.

Another thing to consider when purchasing stock is the availability of stands. Most renters will require one. Your best bet is to purchase a batch of adjustable trolley types. These can be attached to most cabinets, though you will probably have to take the feet off first – assuming the feet are still attached! Plastic cabinets pose a problem. With some, the only way to attach a stand is by means of the correct short metal screws. The accent here is on "short" – metal trolleys are conductive.

It's worth remembering that certain parts of sets take a lot of hammer over the years, even in normal use, and it's these parts that you may have to find replacements for – the kind of things I have in mind are the tuner control panel, on/off switches, slider potentiometers, the aerial socket, and of course the knobs themselves.

Whatever you buy, the aim is to get at least two or three years' relatively trouble free service. For this reason, the cheapest initially may not turn out to be so in the end.

Whichever sets you opt for, it's wise to limit your selection to say one or two chassis. This makes servicing much easier, especially if you choose the types (mainly British) with easily replaceable panels. You can then minimise the time spent in the subscriber's home by carrying a set of serviceable panels that can be maintained during slack periods.

Obtaining Customers

If you've no shop and are working part time, in the evenings, your advertising should stress "NO DEPOSIT COLOUR TV, ONLY £XX·XX MONTHLY. For prompt installation or free home demonstration THIS EVENING, phone . . ." I don't advise offering a free trial as this will mean leaving the set, perhaps for several days. They'll know if they want it once you've demonstrated it – if they don't they won't after a week either.

You can advertise in a local paper, but display advertisements are expensive and frankly unlikely to yield a quick return. A card in the window of a local shop can be just as effective, or more so, at a fraction of the cost. Another good method is to put leaflets through letterboxes. This is particularly effective if you're pushing other lines, such as repairs and sales or aerial work. Such leaflets, often regarded as the poor man's method, can pay long term dividends. Folk often stick them behind the clock on the mantel shelf and fish them out a year or so later.

Some Pitfalls

The bad payer is always with us, and unfortunately you're bound to attract some of these. They'll already have done the rounds of the major firms, who will have repossessed their sets due to the accumulated debts: now it's your turn. How to spot them? Intuition helps, but if you are weak on this sort of thing, as most of us are, it helps to have built-in safeguards.

One technique is to insist on payment by standing order, which is common enough these days. Fill out the form at the time of installation, and post it to the bank yourself. To be certain that the bank will carry out this type of instruction, the renter must have a current account. The form itself can be a simple affair, duplicated from your typed original by photocopying. The wording should be along the lines: "To ..... Bank, ...(address). Please make monthly payments FROM the account of ....., account number ....., the amount of £XX·XX, TO the account of ..... Rentals, ... Bank, ... (address). First payment to be on ..." Leave a space for their signature – both signatures will be needed if the account is a joint one. If the prospective renter has an account but is unwilling to sign such a perfectly acceptable document, you can draw your own conclusions.

Another problem arises when people some distance away rent your sets. My area for example consists of a small market town with numerous villages and hamlets ten or more miles out, plus lots of remote farmsteads. The reliability of your sets is crucial if you are to be cost effective on long-range installations. A breakdown every month or so can be crippling financially, especially at the beginning when every penny counts.

It's been my experience that the older folk are the most reliable payers. It's to these if to anyone that you can issue a small payment card, being reasonably sure that they'll come along regularly. You need patience with this type of customer however. The older folk are often lonely, and tend to keep you trapped whilst the kettle boils, unmindful of your crowded schedule. They can natter, too. At the other extreme it's been my sad experience that some young married couples and single men make doubtful propositions. Some simply forget to pay, others have no intention of doing so. Stick to standing orders where you can, and bear in mind that the above comments are only generalisations, which are always dangerous.

Servicing Aspects

You'll need manuals or at least circuit diagrams for each type of set you have out on rental. A fair selection of spares should also be carried, including the major valves if you have hybrid chassis, at least a couple of e.h.t. trays (the universal ones if your sets suit), tuner units, aerial sockets, on/off switches, one or more line output transformers, fuses, crystals and the usual assortment of droppers, resistors, small electrolytics and semiconductor devices. Electrolytics present a problem: they do age when simply left, and are rather expensive. It's best to replace them when doing your initial service, prior to installation.

This initial service must be thorough if you are to minimise the failure rate and customer dissatisfaction. I start by cleaning out all debris and dust, with paintbrush and vacuum, then carry out a careful inspection. Cabinets can be tidied up at this point (see my article on Cabinet Renovation in the January 1983 issue). Clean and lubricate all variable resistors and user adjustable presets with Servisol or similar switch cleaner, but don't use this on the mains switch. If this item is rough or uncertain in operation, replace it. Make sure that the mains filter capacitor is in place: if missing, fit one rated at 1kV at least.

Check all presets on the timebase panels, especially the height and linearity potentiometers, using a spot of switch cleaner or replacing the component as necessary. Check for dry-joints, first visually on the power and timebase panels then, whilst observing the picture, by gentle tapping on the video, chroma, i.f. and tuner panels. Clean dust away from the c.r.t. base panel, checking the spark gaps especially.

You may well find that certain potentiometers on the convergence panel are in an advanced state of decay. These tend to work hard, and replacements should of course be heavy-duty wirewound types.

The main thing is to be thorough and give each set a soak test. When carrying out the installation it's useful to have with you some mains plugs, including the older 5A round pin type, and a few coaxial plugs.

In Conclusion

Running an efficient rental organisation is no picnic. It demands skill and knowledge and, at least to start with, quite a lot of groundwork. There's also the initial outlay, both in terms of time and money, little of which is likely to return quickly – it must be looked upon as a medium-term investment. It's not an easy way to riches, but can make a worthwhile supplement to your earnings, giving an extra string to your bow and a satisfying outlet for your skill.

Finally, rental forms (see earlier) can be obtained from Willow Vale Electronics Ltd, Old Hall Works, Shinfield, Reading, Berks. Literature explaining licence requirements is available from the Office of Fair Trading, Consumer Credit Branch, Bromyard Avenue, London W3.

B & O Tripler Conversion

Keith Cummins

DISASTER struck one evening. The Beovision 2600 had no picture and smoke was emerging from the back. A quick check showed that the e.h.t. transformer's overwinding was overheating – the result of shorted turns. For those not familiar with this particular chassis (90° hybrid) I should perhaps mention that there are separate, linked line output and e.h.t. generator stages, each with its own output transformer. This means that a superbly regulated e.h.t. is provided.

The e.h.t. transformer has always been an expensive item, and now appears to be obsolete. Being reluctant to write off what has always been a very good receiver, I decided to investigate the possibility of using an e.h.t. tripler.

Modification Details

The e.h.t. transformer was removed and the overwinding clamped in a vice. Then, using a hacksaw, I cut down through the overwinding until the saw was just nibbling the ferrite core. Twisting a screwdriver in the slot thus produced cracked the overwinding into two parts. The leads were unsoldered and the whole overwinding was opened out and withdrawn from the core. The third harmonic tuning coil and an 0·01μF capacitor were also removed, so that the transformer was left with just the windings on the opposite leg of the core.

Having done this I replaced the transformer and reconnected those parts remaining. Upon switching the set on, the expected healthy sparks could be drawn from the top caps of the PL509 and PY500A valves, using an insulated screwdriver, thus indicating that the primary winding was operating normally.

There's a pulse of some 8kV at the top cap of the PL509, and the use of a tripler would increase this to 24kV for the c.r.t. The GY501 e.h.t. rectifier and its base were removed, and an ITT replacement tripler, type TS30-11THV, was fitted to the inside of the e.h.t. enclosure just above where the GY501 had been situated.

Fig. 1 shows the connections. The tripler's grey input lead is driven from the anode of the PL509 while the black lead is taken to pin 3 of the transformer – this is the boost voltage point and has the grey leads from the receiver attached to it. Since the focus voltage in this chassis is produced by a separate rectifier driven by the line output stage, the tripler's white focus lead was cut short and sleeved. The red e.h.t. lead was cut and joined to the original lead to the c.r.t., then heavily insulated – this maintains the capacitive feedback used to improve the regulation in these sets. The mauve lead which emerges from the receiver's cableform and goes to the earthy end of the overwinding was cut back to the loom and sleeved, being no longer required.

Both the e.h.t. max and min potentiometers should be rotated fully clockwise (minimum position when observed from the component side of the board). The e.h.t. max potentiometer should be left in this position and not touched again.

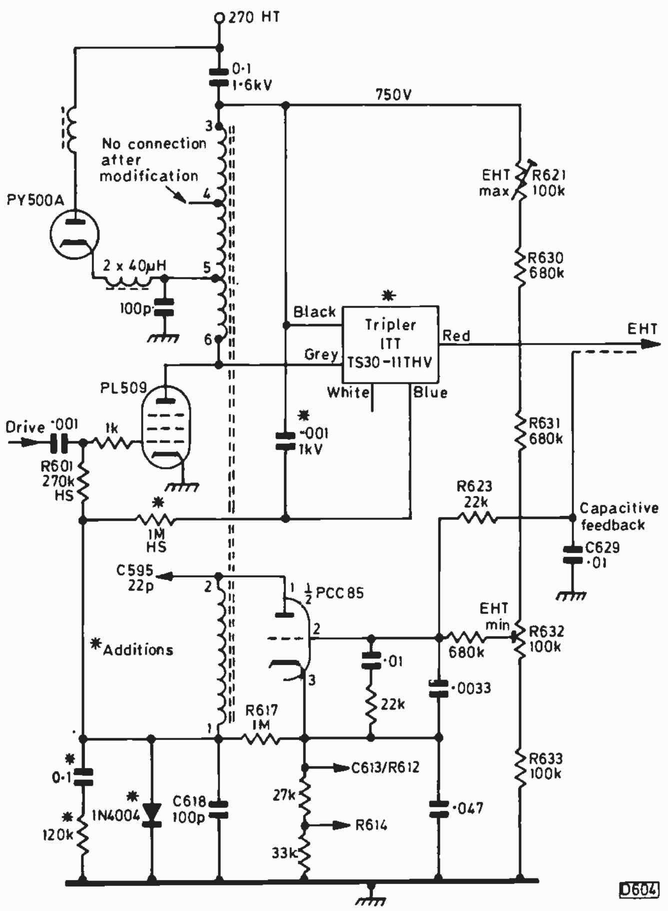


Fig. 1: Circuit details.

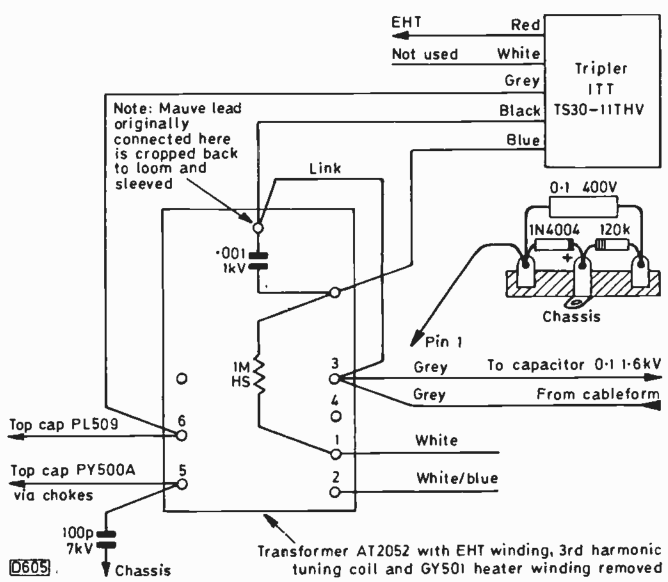


Fig. 2: Mechanical details.

Whilst testing the circuit I discovered that the regulation could be improved to almost the original Bang and Olufsen standard by employing feedback from the tripler's blue clipper diode output lead to the PL509's control grid circuit. An $0{\cdot}001\mu$F, 1kV capacitor is used as a reservoir and the feedback is taken via a 1MΩ H.S. resistor (and, physically, pin 1 on the transformer). The feedback voltage becomes less negative as the circuit is loaded. Also added, from pin 1 of the transformer to chassis, are a 1N4004 clamp diode and an anti-hunt network consisting of an $0{\cdot}1\mu$F capacitor and 120kΩ resistor in series – these components are mounted on a tagstrip held by one of the screws that originally secured the GY501's socket. The anti-hunt network ensures rapid warm-up stabilisation, while the clamp diode prevents the control line going positive even under fault conditions.

Fig. 2 shows the physical connections.

Setting Up

The system should be set up as follows. Turn the two potentiometers to the minimum position as previously mentioned then, with the brightness turned down, adjust the e.h.t. min potentiometer for 24kV at the c.r.t.'s final anode. Turn the brightness up, and if necessary set up the contrast, focus, scan amplitudes etc., preferably on a test card.

Circuit Operation

Some of you may be interested in a little more detail on the working of the circuit. Pin 3 of the e.h.t. transformer sits at a nominal boost voltage of 750V, to which the "earthy" end of the tripler is connected. As a result, the e.h.t. voltage generated sits on this 750V pedestal. The clipper diode output also sits on this voltage, and under no-load conditions reaches an amplitude of approximately −950V. Thus the voltage at the junction of the $0{\cdot}001\mu$F reservoir capacitor and the 1MΩ feedback resistor relative to earth is 750 − 950V = −200V. Loading affects this voltage, but the 750V offset makes the change proportionately larger with respect to earth. If for example the loading reduces the negative voltage from 950V to 850V, the resultant potential becomes 750 − 850 = −100V. It will be seen then that a small percentage change in the loading can produce a large proportional change in the voltage when the 750V offset has been built in.

The feedback obtained in this way is in phase with the action of the PCC85 stabiliser triode, which sets the bias applied to the PL509 from pin 1 of the transformer. We have thus enhanced the regulation, offsetting the relatively "soft" (fairly high impedance) drive from the PL509's anode circuit. The amount of feedback is determined by the value of the feedback resistor – 1MΩ was found to be the optimum.

Another point worth mentioning is that removal of the GY501 rectifier results in a quicker warm-up time. About twenty seconds is saved. The convolutions of the circuits as they settle down (rolling or jittery defocused picture for example) will be displayed before the proper picture appears.

In Conclusion

This has proved to be a simple and cheap answer to the transformer problem and works well. Under normal viewing conditions it's hard to notice any difference from the set's original performance.

Finally I must emphasize the need to set the two e.h.t. adjustment potentiometers to their minimum position initially, as described above, before the modified set is switched on. Failure to do this can result in excessive voltages which could damage the tripler or even the tube. Remember also that this receiver does not discharge the e.h.t. energy stored in the tube's capacitance. Be careful to discharge this energy (it can remain stored for days) before commencing the job – otherwise you might receive a nasty jolt.

VCR Clinic

Derek Snelling, Peter H. Dolman, Leslie Harris, Mike Sarre, M.S. Barakat and Richard Roscoe

Fidelity VCR

A couple of months ago I mentioned the Fidelity VCR, saying that it uses the mechanics from the Hitachi VT8000 series. I've subsequently found that it suffers from the same problem, that of looping the tape at the end of rewind, and consequently requires the same modification, i.e. filing the brake arm (see page 15, November 1982 *Television*). As the electronics differ from the Hitachi machines the electrical modification is not possible. **D.S.**

Hitachi VT8000

The symptom with an Hitachi VT8000 was that the clock worked but the operate light would not come on and none of the functions worked. A quick check showed that the 15V and 9V rails were not being switched on, though the 18V rail was present. A check at pin 2 (power control) of the microcomputer on the system control panel showed that this device was providing the correct output to switch the power supply on, but a meter check at the collector of the following transistor Q051 produced a reading of zero instead of 16·5V. Checks in the collector circuit of this transistor then revealed that R054 and R055 were open-circuit whilst the 16V zener diode ZD051 was short-circuit. It's amazing how many faults in these machines are due to zener diodes. **D.S.**

Sanyo VTC9300P

An interesting point arose with a Sanyo VTC9300P I repaired. The original fault was that the machine stopped a few seconds after the play key was pressed though the other functions worked perfectly. A quick inspection showed that the tape was not moving in the play mode because the pinch wheel was not being pulled in by the solenoid. This is operated by a high current via Q810 and is then held in by a small holding current via Q816. If the centre was pushed into the solenoid by hand it held there, showing that the fault was in the pull-in rather than the hold-in part of the circuit – in fact Q810 was open-circuit. I thought that this was the end of the matter – a quick test then back to the customer.

Next day he phoned to say that the machine was dead except for the clock. Just my luck I thought: the 12V regulator transistor would pick this moment to fail. When I got there however I found that although the power light did not come on neither did the wait light when switched to timer, though it will when the regulator transistor fails.

I decided to check the fuses on the power supply panel and found that the first one, F701, was faulty, though you needed good eyesight to spot the break. In with a replacement and the machine was once more o.k. As this fuse is one of the two in the 17V supply, which feeds Q810, I thought that it had been strained by the failure of that transistor and had just waited for an hour or so to fail. Next day however the customer reported that the machine had worked for just forty minutes and then stopped.

Back at the house I decided to check the fuses again. The one I'd fitted the previous day had been of the mica filled variety, which means you have to check it with a meter, so being idle I decided to check the other one (F702) in the 17V supply first. Sure enough there was a small break in the wire, a replacement restoring normal operation. I came to the conclusion that they'd both been strained and that I should have replaced the two of them at the same time.

Next day the same thing happened again of course, so I lent him a machine and took the 9300 back to the workshop. There I had the brainwave I should have had at the house. Check *both* fuses: both faulty. It turns out that in this machine if either F701 or F702 (they each feed one of the two diodes in a full-wave rectifier circuit) goes open-circuit the machine will continue to work normally but the current flowing through the remaining fuse will be so close to its failure current that it will fail after 30-40 minutes. I've since taken one of these fuses out of a working machine whilst it was playing and was unable to see any noticeable effect despite the 17V supply coming from a half-wave instead of a full-wave rectifier. So be warned! **D.S.**

Ferguson 3V29

A Ferguson 3V29 replayed prerecorded tapes normally. In the E-to-E mode however the sound was accompanied by a continuous harsh buzz which, unlike the early u.h.f. TV receiver intercarrier buzz problem, was relatively unaffected by the picture content or fine adjustment of the VCR tuning presets. For this reason vision i.f. response problems were not suspected and attention was directed to the sound i.f. section.

Amplification/limiting/detection is carried out by IC2. The 6MHz input enters at pin 8 and the audio output appears at pin 4. The input level appeared to be correct, but in addition to the audio output a combination of line and field rate pulses was present at pin 4. This led us to investigate the muting circuit (see Fig. 1), which operates during channel change or signal loss.

The composite video signal from the i.f. strip is fed to the base of Q10, the positive-going tips of the sync pulses triggering Q10. As a result, a line frequency sinewave is produced at its collector. This is coupled to the base of Q11 by C46, with d.c. restoration by D11, and as a result Q11 is saturated during viewable display conditions, the voltage across C47 falling to only 0·1V. Should the r.f. input signal be lost or an untuned channel selector button be depressed, there's no input to Q10 and Q11 and the

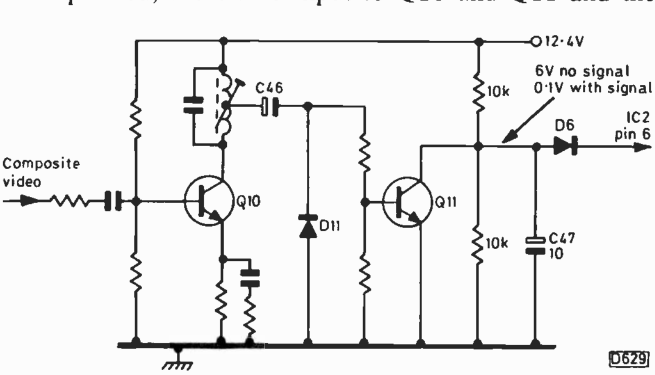


Fig. 1: Sound muting circuit, Ferguson 3V29.

voltage across C47 rises to 6V. This is applied to pin 6 of IC2 to mute the sound. The problem was that C47 was open-circuit, as a result of which the audio signal was being subjected to a sync-rate disturbance. **P.H.D.**

Toshiba V8600

The problem we had with a Toshiba V8600 was tuning drift, and on checking the voltage at the 32V regulator zener diode D004 we found that this was low at only 30V. This voltage comes from a voltage doubler via the stabiliser transistor Q811 on the line filter board. There should be 56V at the collector of this transistor, 48V at its base and 47·4V at its emitter, the base bias being set by two zener diodes (D814/5) and a further diode D816. One of the zener diodes (D815) proved to be leaky. **L.H.**

ITT TR3913A

The ITT TR3913A is very similar to the Ferguson 3V29. The trouble we had on one of these machines was that whilst the picture was o.k. in the E-to-E mode on playback (test tape) the frequency gratings were tearing very badly. The playback f.m. waveform was found to be very "spiky", and whilst making voltage checks around the HA11724 preamplifier etc. i.c. we found that pin 13, which is fed from the E-to-E 9V rail, was at 0·65V instead of zero volts as it should be on playback. We suspected the mode control transistor Q102 since this controls the E-to-E 9V rail, but the 0·65V was present even with Q102 removed from the board. The fault was eventually traced to D407 in the colour circuit being leaky! **L.H.**

Sony C7

The fault we had with a Sony C7 was that the test signal was showing in the play mode. When the test signal switch is operated, the voltage at pin 8 of connector CN1008 on the video panel should be 12V. At other times the voltage here should be 0V. In fact the voltage on the "test 12V" line was 12V during play as well, due to D41 being leaky (disconnecting D41 restored a normal playback signal). Replacing D41 cured the trouble. **M.S.**

Sony C6

The trouble with a Sony C6 was that it would unthread but wouldn't always eject. After making myself dizzy watching the machine thread and unthread I eventually got it to stay in the fault condition. Shorting out the cassette off switch ejected the tape, and on examining the switch I found that the spring had weakened. As a result it sometimes didn't switch over. Replacing the switch and setting up cured the fault. **M.S.**

Mitsubishi HS300B

A Mitsubishi HS300B – an oldie but a goodie – caused us premature greyness recently. The complaint was that very occasionally the machine would refuse to respond to the front panel controls when a tape was loaded. Over a period of about a week we gradually pieced together the following story. First we discovered that the fault occurred only when the tape was at the beginning. This suggested that we should take a look at the start sensor and its associated circuitry, see Fig. 2. Sure enough we found that the fault disappeared when the start sensor phototransistor

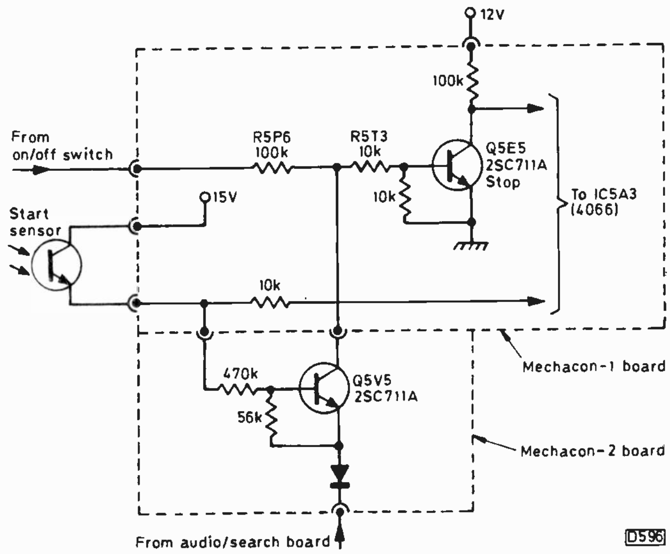


Fig. 2: Start sensor circuit, Mitsubishi HS300B.

was blanked off. The transistor itself seemed to be working correctly, so we went on to check the gate circuit it controls. This is part of a 4066 chip (IC5A3) on the mechacon-1 board. We've had trouble with this type of chip before, but in this case the action was correct. Whilst checking this chip however we discovered that another gate control signal, from the collector of transistor Q5E5, was high when it should have been low. Q5E5 is turned on by a voltage from the front panel on/off switch, via resistors R5P6 and R5T3. The switch-on voltage was being lost at the junction of these two resistors, a point which is also connected to transistor Q5V5 on the machacon-2 board.

The machacon-2 board is unfortunately buried under the capstan motor and a large bundle of cable. It's almost impossible to get at (0 out of 10 for Mitsubishi design here), and is secured to the chassis by the motor drive transistor's heatsink. When we burrowed under all this we discovered that the cable run had pushed Q5V5 over, with the result that its emitter was just touching the heatsink. This was the final link in the chain. Q5V5 is turned on and off by the start sensor transistor. Under normal stop conditions it's base is at a positive voltage but its emitter is floating. Under certain conditions its emitter is pulled down by circuitry on the audio/search board, but with the emitter touching the earthed heatsink this point was at zero voltage even under normal stop conditions.

This possibility is now on our checklist for these machines, and in one or two instances the effort has clearly been just in time. **R.R.**

Sony C6

Here are a couple of faults we've had with the Sony C6UB. First the 3·15A fuse F001 blowing instantly. This was due to a short-circuit in the r.f. converter – an r.f. trimmer capacitor leaf had dropped off, shorting the l.t. supply. The offending trimmer is in a subassembly in the converter. It can be repaired or, more expensively, the complete unit can be replaced.

The second fault we had was no fast forward or forward search, though all the other operations were o.k. The trouble was that the fast forward solenoid drive start transistor Q025 was leaky. It's a special Sony Darlington, type 2SD1164. **M.S.B.**

Long-Distance Television

Roger Bunney

March produced another excellent tropospheric opening, from the 7th through to the 9th, with another minor event on the 12th. With the approach of the Sporadic E season (usually around the second week of May), there's been an increasing incidence of short-lived Band I signals – stronger than the usual MS (meteor scatter) pings and of longer duration, at times up to half a minute. SpE signals should be with us again by the time these words are read, though some of the familiar Band I signals will be absent – as previously reported, DFF (E. Germany) ch. E3, YLE (Finland) ch. E2 and SR-1 (Sweden) ch. E4 (Finnveden) have now closed.

The event on the 12th was an aurora from 1530-2100, producing Band I activity. Slight auroral activity was also noted on the 25th and 28th, but in the far north only.

Here at Romsey, Hants, tropospheric conditions began to build up on the 7th, with Band III being particularly active – signals were received during the evening from the low countries and W. Germany. I found the morning of the 8th perhaps best, with many W. German Band III/u.h.f. signals, DFF chs. E6 and E34 and, for my location, an excellent long-haul signal from ORF-2 (Austria) on ch. E24. The latter consisted of the PM5544 pattern, which was unfortunately obliterated at 1000 when the local BBC-2 transmitter came on air. Many enthusiasts reported good reception from RTL (Luxembourg) ch. E7 – the new standard B transmitter. Conditions improved again during the evening, giving mainly W. German signals.

During the evening of the 9th there was a more concentrated offering of Band III and u.h.f. signals from Germany, including DFF chs. E5 and 6. The opening came to an end on the 10th – with rain!

A short-lived tropospheric duct occurred on the 12th, giving excellent reception of Swiss Band III and u.h.f. signals in Holland. The signals lasted for some five hours before fading into the noise.

On both the 6th and the 8th I logged ATV signals from G6CPE, G8FAB/A and G6GXG. It later transpired that the signals came from a common transmitter belonging to the Southampton Amateur Radio Club. At a distance of one mile this hardly represents DX reception, but the signals were noise free and confirm that at least one ET021 tuner can cover the 435MHz amateur band (my other two didn't).

My thanks to Cyril Willis (Cambridge), Hugh Cocks (Robertsbridge), Ian Menzies (Aberdeen), Garry Smith (Derby) and Ryn Muntjewerff (Holland) for sending details of their reception.

News Items

Pirate TV: There's been considerable publicity in the press about a pirate TV station operating in the Birmingham area – it calls itself Second City Vision and uses ch. E40 when the local BBC-2 transmitter goes off-air on Friday/Saturday nights. So far there seem to have been only low-power test transmissions, but some sort of programming is expected. The service area will undoubtedly be small, and could be around Edgbaston.

Seychelles: The Radio-Television Seychelles (RTS) TV service started on December 31st, with PAL colour and some nine hours of programmes at the weekends (Friday-Sunday). Channel information is not known at present.

Turkey: Colour transmissions (PAL) are to start in July.

Band I Allocation Chart

Letters arrive from time to time asking for explanations of ch. E2, R1 etc. In a monthly summary of DX reception it's obviously impossible to give full frequency details of the various channels. In view of recent changes however Table 1 provides an updated Band I/II channel allocation listing – note particularly the French channels.

New readers may not be familiar with SpE, so for these a brief recap. The phenomenon occurs mainly during the summer months, starting in May and continuing through to late August/early September. SpE openings cannot be predicted, but there are various signs when conditions are about to open up. The openings last anything from five minutes to fifteen hours, producing high-level signals from Band I up to some 100MHz (intense openings can produce signals in Band III).

SpE signal propagation is caused by localised or widespread intense ionisation in the E layer, some 70 miles above the Earth's surface. The ionisation causes reflection of v.h.f. signals that would otherwise pass through to

Table 1: Band I/II Channel Allocations

Channel	*Vision carrier MHz*	*Sound carrier MHz*	*System*
B1	45	41·5	A
B2	51·75	48·25	A
B3	56·75	53·25	A
B4	61·75	58·25	A
B5	66·75	63·25	A
E2	48·25	53·75	B
E2A	49·75	55·25	B
E3	55·25	60·75	B
E4	62·25	67·75	B
IA*	53·75	59·25	B
IB*	62·25	67·75	B
IC*	82·25	87·75	B
R1	49·75	56·25	D
R2	59·25	65·75	D
R3	77·25	83·75	D
R4	85·25	91·75	D
R5	93·25	99·75	D
F2†	52·4	41·25	E
F3†	65·55	54·4	E
A‡	47·75	41·25	L
B‡	55·75	49·25	L
C‡	64·75	58·25	L
C'‡	63·75	57·25	L
A	45·75	51·75	I
B	53·75	59·75	I
C	61·75	67·75	I
A2	55·25	59·75	M
A3	61·25	65·75	M

* Italian channels.
† Old French channels.
‡ New French channels.
F.M. radio allocations: 66-73MHz E. Europe, 87·5-108MHz W. Europe.

space. Signal reflection occurs over distances of between 450-1,500 miles, but with multiple reflection (if you're lucky!) the distance is extended. The reflected signals can be of sufficient strength for reception with relatively simple equipment – even an indoor dipole can produce excellent results. An upconverter can be used to receive Band I signals with a u.h.f. receiver – simply add a wideband dipole and you're in business.

Space permitting, a Band III update will be included in next month's column.

Commercial News

The newly published BATC booklet "TV for Amateurs" was mentioned in Teletopics last month. I'd just like to add my own recommendation! With some 52 pages it's excellent value at £1·50 plus 25p post and packing.

If you're contemplating the construction of a 5·5MHz system B/G i.f. strip it's worth knowing that 5·5MHz ceramic filters are available from Marco Trading, The Maltings, High Street, Wem, Salop SY4 5EN at 50p each, or three for £1, plus 35p postage and then VAT.

A free leaflet on wideband u.h.f. aerials is available from South West Aerial Systems. It's a reprint, with minor corrections, of an article of mine that appeared in the August 1982 issue. Include a stamped SAE.

The Future of Band I

For many years Band I has been used exclusively for TV. Things are about to change however. The BBC/IBA 405-line services are to close at the end of next year, and various interests are looking at the bandwidths thus to be made available. UK radio amateurs had an allocation at 50MHz from December 1947 to March 1949, so it's hardly surprising that the RSGB is lobbying for the restoration of this. In fact some 40 licenced amateurs throughout the UK have already received permission for test transmissions in the 50-52MHz band outside TV hours, and a beacon at 50·02MHz (GB3SIX, Anglesey) is now in operation.

It looks as if the 50-52MHz spectrum will be given to amateur radio by early 1985. Being h.f. of ch. R1 vision, the band can be filtered out, though the presence of an amateur operating at high power nearby could prove troublesome, calling for good filtering and equipment with good dynamic signal handling performance.

What is becoming an increasing problem is the cordless phone. Approval has been given for operation at 47MHz, but the UK is being swamped by 49MHz types sold as "approved" for UK use. Most have limited coverage, but the Supaphone CT505 is claimed to have a range of 1km. I've personally been dialled from one and have dialled back to a remote unit via its base at some five miles from base, the base using half-wave dipoles cut to 49/71MHz. I've heard that seven miles can be achieved in East Anglia. So this is the equipment that will cause problems – the various channels used for the 49MHz base transmitter cluster around the 49·6-49·9MHz region, right on top of ch. R1. What can one do?

Garry Smith (Derby), writing in Cyril Willis's *DXTV Newsletter*, reports considerable trouble from this source in his area. He's tracked down owners of the illegal equipment by recording the dialling blip clusters on a tape recorder at 7·5 in/sec, then replaying them at a slower speed, counting the blips in each group to find whom the operator is contacting. To locate the operator himself it's usually necessary to monitor the channel in use when a call is incoming (the dialling tone indicates this). The answer will often reveal either a name or number etc. You can then contact them, report that their total calls are being monitored, and suggest that they obtain an approved 47MHz type from the supplier, using the Sale of Goods act as a lever. Persist if necessary but remain annonymous.

Garry suggests that the normal TV set won't resolve the audio and recommends using a scanner, e.g. an SX200 or the popular Tandy Patrolman 50 (this has been discontinued, though some Tandy shops may still have them in stock). It seems that Radio Services will not be over anxious to take action unless the unit concerned is upsetting a 405-line viewer.

The new Telecommunications Bill, when it's passed and comes into operation, could be the answer. It will amend the 1949/1967 Wireless Telegraphy Acts, increasing the enforcement available. It would seem that any 49MHz apparatus used for transmission will be illegal to operate, own, sell or manufacture, with the police empowered to arrest and search people and property. Those found guilty of such offences would forfeit the illegal equipment.

Such offences were previously known as Summary Offences, but under the new act they'd be tried on indictment at a Crown Court for example, with more severe penalties – maximum fines would rise to £1,000, and those found guilty would carry a criminal record. The Bill should be passed this summer, and will enable you to take action by advising the police.

From our Correspondents . . .

Gosta van der Linden (Holland/BDXC) has sent interesting details of the Moroccan TV service. A system B ch. 34 outlet at Laayoune operates at 180kW e.r.p. and has been well received in the UK via SpE. The PM5544 pattern is transmitted between 1800-1830 GMT, with the identification "RTM" at the bottom and Arabic script at the top. A portrait of King Hussan II appears at 1830, with a reading from the Koran at 1833. There's a news programme in French at 1915! Arabic programmes last from 1930 until close down at approximately 2330-0015 GMT, preceded with another reading from the Koran.

Bud Lloyd Bennett, who was previously in Saudi Arabia, is now in Northern Nigeria. He reports that with his three-element wideband Band I array and JVC portable he can regularly receive RTM (Morocco) ch. E4 and RTVE (Canary Islands) ch. E3 via night time TE from around 1930 local time onwards. Other stations he receives at times include RTVE Madrid ch. E2 and the Sicilian ch. IA RAI transmitters. Full sound and colour vision is received, though the vision is usually very smeary and with the characteristic multiple images. Local stations are Minna ch. E10, Abuja ch. E5 (170km), and Bida ch. E12 (90km). Kaduna ch. E34 (300km) is received at times. Very weak signals of unknown origin are received on ch. E29. As an interesting aside, 27MHz CB operation is extensively used, due to the remoteness of the site, and it's been possible to work back to the UK on our 40 channels!

Another letter from Gosta van der Linden reports that all NOS (Dutch) TV transmitters are to be equipped with stereo sound facilities, starting with Smilde (ch. E47) and Wieringen (chs. E39/45) this year. The actual transmissions are expected to start in 1985/6. Finnveden SR-1 (Sweden) has now moved to ch. E41 at 1,000kW e.r.p.

Graeme Wilson (Middlesborough) mentions that some cheap and cheerful radios with MW, CB1 (a.m.) and CB2 (f.m.) coverage have come on to the UK market. Graeme's sample, called the Academy AA31, comes from the far east. He says that the 27MHz f.m. section can be realigned to cover 29-32MHz so that the set can be used as an i.f. receiver, with the input from the main tuner taken via an f.e.t. buffer stage. Graeme comments that this arrangement is "very sensitive" – remove the telescopic whip aerial and use the wired connection for the i.f. input.

TV Fault Report

Decca 110 Chassis

The customer's complaint with a Decca Model CV1110 (110 chassis) was that the brightness level had been varying for a while and flyback lines would now appear as the set got warm. We took the set back to the workshop for a soak test, and after being on for a few minutes very small changes in brightness level were visible. The fluctuations were too small to measure however, so we left the set on for a while longer. After a further ten minutes flyback lines began to appear and we were able to measure an increase in the first anode voltage at each of the three guns. The voltages at the "high" side of the first anode presets were nearly 1kV, and there was very little voltage drop across the controls. A check on R913 (22kΩ) at the earthy end of the control network revealed that it was virtually open-circuit, a replacement curing the problem. **M.D.**

Panasonic U1 Chassis

The problem with a National Panasonic Model TC2203 was normal sound but no raster. When the set was switched on there was a healthy e.h.t. crackle, and on checking the tube base voltages we found that the first anode voltages were present and normal. The cathode voltages were high however.

We operated the service switch and obtained a line across the screen. In the normal mode however the base voltages of the three RGB output transistors were low at 6·2V instead of about 7·8V. The base drives are d.c. coupled from the TDA2530 matrixing/preamplifier i.c. (IC301), and when we checked this i.c.'s supply voltage (pin 9) we found that it was high at 15·4V instead of 11·4V. The supply is taken from the stabilised 12V rail, and on checking at the series regulator transistor Q818 all three legs were at 15V. Two zener diodes (Q818/9) set this transistor's base bias, and D818 turned out to be open-circuit. Replacing this 6·3V zener diode gave correct voltages and restored the picture. **M.D.**

Thorn TX9 Chassis

The fault with a Thorn set fitted with the TX9 chassis was unstable field scanning with black lines on the picture. The field timebase controls all worked correctly, and we suspected internal breakdown in the TDA1170S field timebase i.c. Replacing this made no difference however, so we had to resort to component substitution. The problem was cured when C212 (0·1μF) was replaced – a check on the original revealed that it was open-circuit. It's in the impedance matching network across the output from the i.c. **M.D.**

Grundig 5010 Series

Intermittent field bounce and occasional field collapse was the problem with a Grundig Model 5012. We found that the fault was heat sensitive and was on the field timebase module. After careful use of freezer and a hairdryer L447 was found to be the culprit – it would alter its resistance with heat, and occasionally go open-circuit. It's in series with the unijunction field oscillator transistor, on the chassis side. **M.D.**

VCR Tuning Problem

We supplied a second-hand Bush colour set fitted with the Z718 chassis, with touch tuning and simple remote control, to a customer who already owned a Ferguson 3V22 VCR. The set was demonstrated in the shop, and we explained how to tune in the VCR. The customer took the set away but phoned a little while later to say that he couldn't get the VCR to work. When we called we found that all four channels being transmitted from Sutton Coldfield could be tuned in correctly, but it was impossible to tune in the output from the VCR (on a lower channel). The problem was eventually traced to the ETT6016 touch tune i.c., replacing this providing a cure. **M.D.**

Philips G8 Chassis

We've had three G8s recently with interesting faults. The problem with the first was flyback lines visible over the top third of the screen when the set was cold, the lines disappearing one by one as the set warmed up. This was eventually traced to C216 (1μF) on the combined signals panel. This electrolytic capacitor couples the flyback blanking pulses to pin 8 of the TBA560C i.c. and turned out to be slightly leaky when cold.

The problem with the second set was intermittent power supply flutter. The usual causes were tried – the thyristor, diac and zener diodes, but the fault was eventually traced to breakdown of R1386 (27kΩ) in the trigger pulse charging circuit.

Very intermittent loss of line sync was the problem with the third set – it would run for several days at a time without the fault appearing. Our first suspect was the TBA550Q video/a.g.c./sync i.c., but the fault remained after this had been replaced. It also persisted after fitting exchange i.f. and timebase panels. We eventually found that when the fault was present the feedback pulse to the i.f. panel (flywheel sync circuit) was missing, due to pin 3 on the line output transformer going open-circuit. A new transformer had to be fitted. **M.D.**

Telefunken 712 Chassis

The complaint with a Telefunken set fitted with the 712 chassis was no results. The 4A mains fuse Fu421 had blown and a quick check revealed that the BU208 line output transistor was short-circuit. We replaced these two items and disconnected the tripler in case it was faulty, but nothing happened at switch on. H.T. was present, but it was very high. It seemed that the regulator circuit wasn't working. We decided to start by disconnecting the line timebase and getting the h.t. right. On checking through the regulator circuit we eventually found that the set h.t. control R429 (500Ω) was open-circuit at one end of its track. Replacing this enabled us to get the correct 163V h.t. reading.

The line timebase was still inoperative however – h.t. was present at the collector of the BU208, but a high voltage was also present at its emitter, due to R566 (3·9Ω) having gone open-circuit (it returns the BU208's emitter circuit to chassis). Replacing this restored normal operation. When we returned the set to the customer he commented that for some while the picture had been jittering, presumably due to h.t. variations.

Another of these sets suffered from intermittent field collapse. This was traced to dry-joints around the scan coupling capacitor C836 (1500μF) on the scan correction panel (the PIL tube version of the chassis). **M.D.**

Decca 30 Series Chassis

A Decca hybrid colour set fitted with the 30 series chassis was brought into the workshop with the complaint that the picture was too dark and the colour wrong. We switched on and found that the picture was indeed very dark while the colour was mis-idented at the left-hand side of the screen. It seemed likely that the fault was due to lack of the line-frequency pulses that provide clamping etc. in the decoder, and we suspected the area around the MC1327 demodulator/PAL switch/matrixing i.c. The voltages here were all correct, so we moved on to the pulse shaper transistor TR203. With the use of a scope we found that R218 (150kΩ) had gone open-circuit, removing the pulse feed to the base of this transistor. A replacement resistor produced a reasonable picture. **M.D.**

Thorn 1500 Chassis

The traditional method of dealing with a set that suffers from hum is to check the smoothing capacitors by bridging a known good capacitor across each one in turn. The Marconiphone set (Thorn 1500 chassis) we were confronted with had bad hum problems indeed – the picture was very unstable, with a pronounced hum bar, and the line and field hold were both affected. So out with our jumper leads and test electrolytic. No matter where we prodded however the hum remained as bad as ever. For want of anything better to do we replaced the main smoothing block. The hum was still bad, but seemed just a little better. What next?

To cut a long story short, we had to replace all the following before the set was free of hum: the main smoothing block; the l.t. supply smoothers C56, C58 and C12; the video output stage h.t. supply smoothing electrolytic C38; and C32 which smooths the bias applied to the base of the video driver transistor.

You don't expect to find such a mass capacitor failure, and we couldn't understand what had gone wrong. It later turned out that they hadn't all failed at once. We were again witness to the remarkable ability of some people to watch anything that moves, even when it shouldn't. The owner had watched the ailing set for months until eventually the hum had got so bad that it started to affect the sync. Next time you have a bad hum fault, remember to ask how long it's been going on! **R.R.**

Contributions from Mick Dutton and Richard Roscoe

VCR Servicing

Part 18

Mike Phelan

This month we'll start looking at the 3V23's servo system, starting with the drum (head) servo.

To recap momentarily, we saw in a previous instalment that the 3V00 used a straightforward phase-locked loop for each servo, plus compensation for varying loads. This system was carried forward to the 3V16. Ajustment is critical, since maximum gain without the loop going into oscillation is necessary.

This type of servo is always a compromise. If we have a steep trapezoid slope, a small change in phase will produce a great variation in the control voltage, but a large phase change takes the sample pulse off the slope altogether, the system taking a long time to lock up again. Making the slope more gradual alleviates the latter problem, but the locking is not so "solid" since a small phase change will produce only a small change in the control voltage.

Most machines now have dual servo systems. What this means is that each servo (drum and capstan) has two phase-locked loops. One is a speed control fed from a "frequency gear" (FG) on the rotating element. This controls the speed of rotation. There is then the normal phase control loop to lock the system when the speed is right. The 3V23's servos are both of this type.

As with most machines the drum servo (see Fig. 80) is locked to the field sync divided by two on record, and to a crystal oscillator on playback (this machine is capstan controlled, i.e. on playback the off-tape control pulses are applied to the capstan servo). In addition to this, in both modes a 1·5kHz FG on the drum motor feeds a frequency-to-voltage converter which also affects the motor speed – this is the speed control loop.

The 3V23 has a fast search facility of ten times normal speed, forward or reverse. As we saw with the 3V16 in the still, slow or double-speed modes, this alters the relative writing speed and thus the number of lines per field, but the error in these modes is not very great and the TV set's line timebase compensates. At ten times normal speed however the error is about five per cent, and if nothing was done the set would display line slip or, at best, displaced colour. The only way in which this can be corrected is to vary the drum's speed of rotation so that the relative head-to-tape speed is the same as in playback. The reproduced line frequency will then be 15·625kHz. The field frequency will be incorrect of course, but the error is proportionately small and the set doesn't mind this.

The drum speed is varied by disconnecting the motor control preamplifier from the servo and connecting it instead to one of two voltages tapped from the l.t. rail to make the drum rotate more slowly in reverse search and faster in forward search. Both speeds are adjustable – they are set for minimum chroma displacement. As this is a capstan controlled machine, there is no phase reference for the head on playback – indeed on normal speed playback the phase control loop is really a speed control one since the reference is the free-running crystal oscillator.

We will mention here that the drum motor is a direct drive type, but more on this later.

Now for a closer look at the drum servo system, see Fig. 81. First the speed control loop. The printed FG coil has 60 poles and thus produces a 1·5kHz signal when the rotational speed is correct. The circuit between pins 14 and 8 of IC3 converts the squarewave at the collector of X34 to a voltage which rises if the frequency increases. We won't bother with a timing chart for this process: basically it relies upon the constant width pulses from the monostable multivibrator (MMV) being added to the output, which varies with speed, from the flip-flop (FF), the result being a series of pulses whose width varies with speed. These are integrated, the length of the ramp thus obtained altering with the speed since the slope is constant. A pulse from the MMV samples this ramp, the result being that the output voltage occurs at a position on the ramp depending on the speed of the drum. R39, R38 and C22 form the MMV time-constant, C21 and R37 provide the integration, while C20 acts as the storage capacitor for the sample-and-hold circuit.

Turning next to the phase control loop, sample pulses from the drum pickup head are passed through two back-to-back diodes which remove stray hum and noise pick up, are amplified by transistor X2, and then processed in IC3 in a similar manner to the machines we've discussed previously. There are the same three adjustments for the

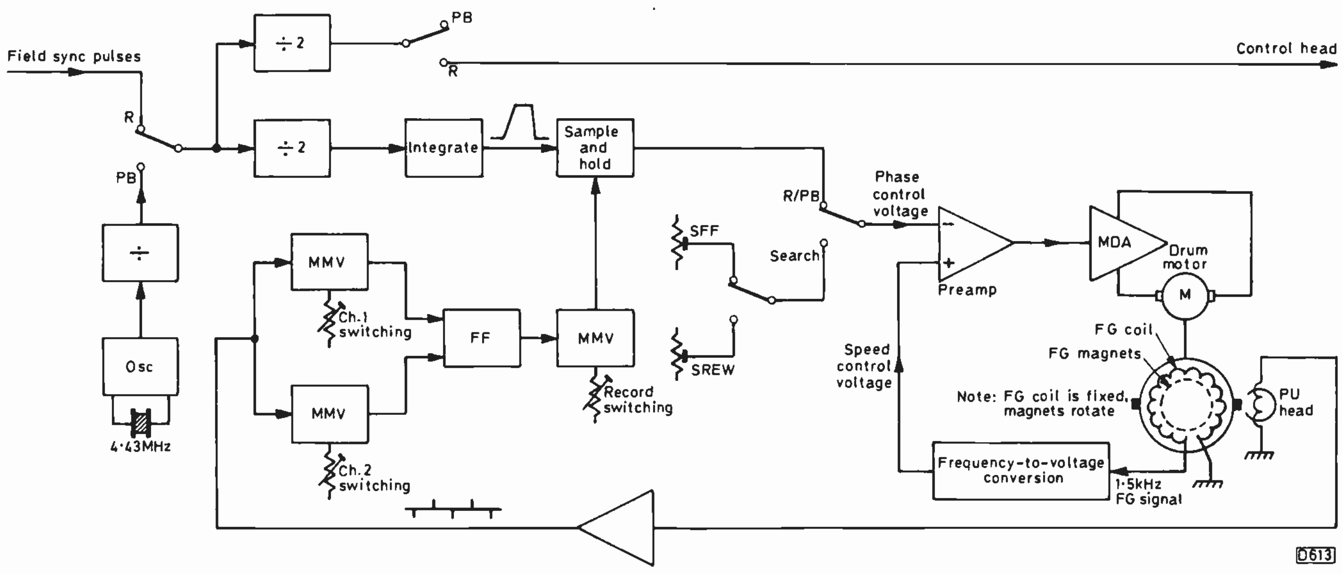


Fig. 80: The drum motor control system used in the 3V23.

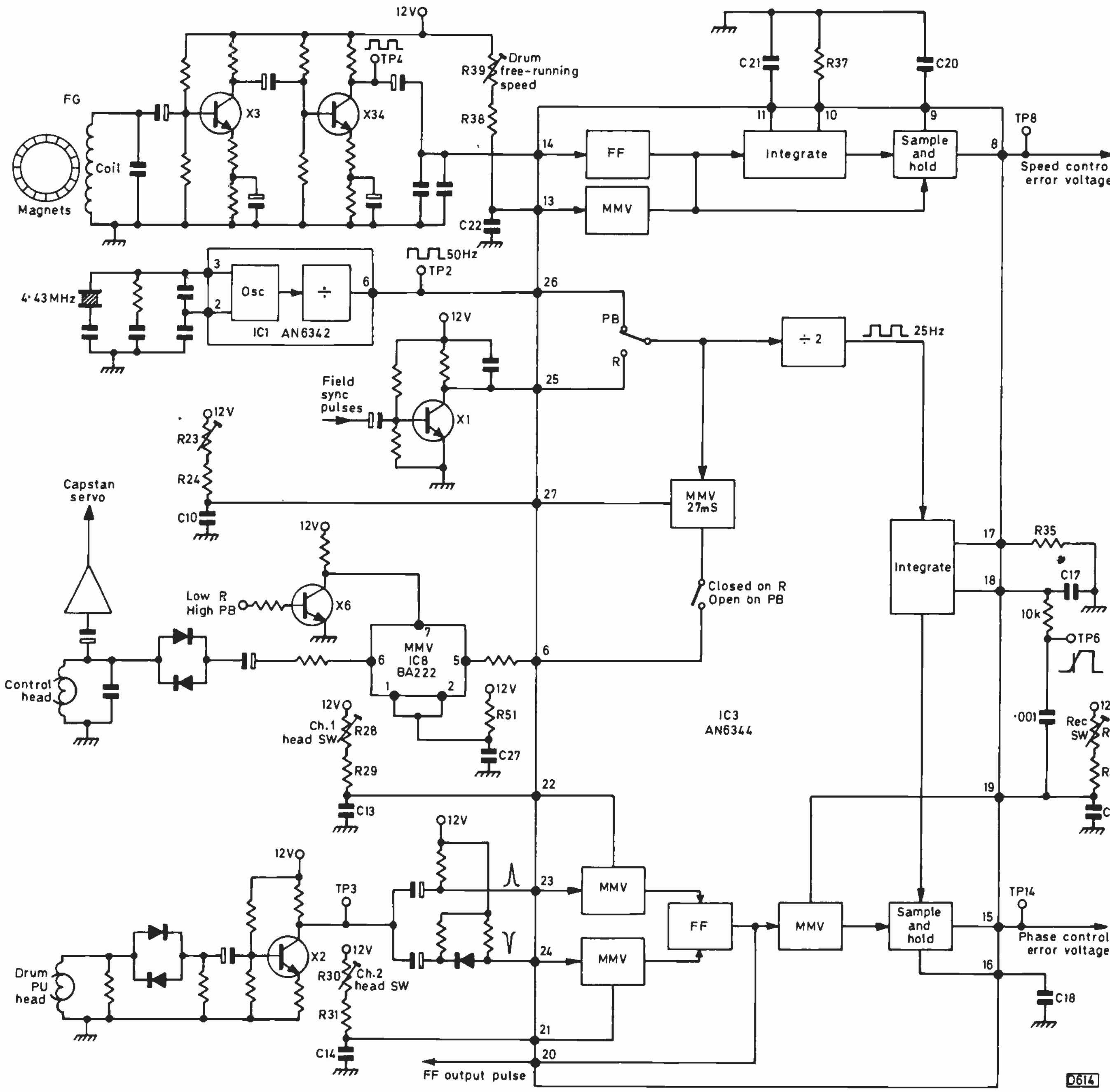


Fig. 81: The servo systems that provide drum speed and phase control.

head switching point.

On record, the reference signal is obtained from the field sync pulses which are amplified by X1 and then fed to pin 25 of IC3 for division by two. The divider is actually a flip-flop. The 1:1 squarewave from the divider is integrated by R35 and C17 to give a trapezoid for the sample-and-hold circuit. Note that this is the reverse arrangement to the 3V00, where the drum FF pulse is converted to a trapezoid and the sync pulse is used to sample this. The *RC* network connected between pins 18 and 19 has no circuit function: it adds the pulse and the trapezoid to provide a convenient test point (TP6) where both can be viewed simultaneously for the purpose of adjusting R39 in the speed control circuit. Though R39 varies the free-running speed, it can be adjusted so as to place the pulse at the centre of the ramp – you can say that if the free-running speed is incorrect then it tries to oppose the phase control, leaving the pulse in the wrong place even if the servo succeeds in locking.

Back to IC3. The field sync pulses from X1 are also fed to a 27msec MMV which effectively provides division by two – the first pulse triggers the MMV whose output stays high until after the second pulse. The resultant 25Hz output passes through an electronic switch which is closed on record only, and emerges from IC3 to the be delayed by IC8 (BA222), another monostable. IC8 provides a 28msec wide output pulse which is fed via noise removal diodes to the control head for recording on the tape. X6 is turned on during playback to remove the supply to pin 7 of IC8, thus disabling this monostable and ensuring that pin 6 goes open-circuit and doesn't load the control head – on playback the low-amplitude signal from the head is required for the capstan servo.

On playback it's not necessary to phase control the drum but a 50Hz reference signal must be supplied to IC3 in place of the field sync otherwise the output voltage from the sample-and-hold circuit (at TP14) would be incorrect. IC1 (AN6342) contains a crystal oscillator that operates in

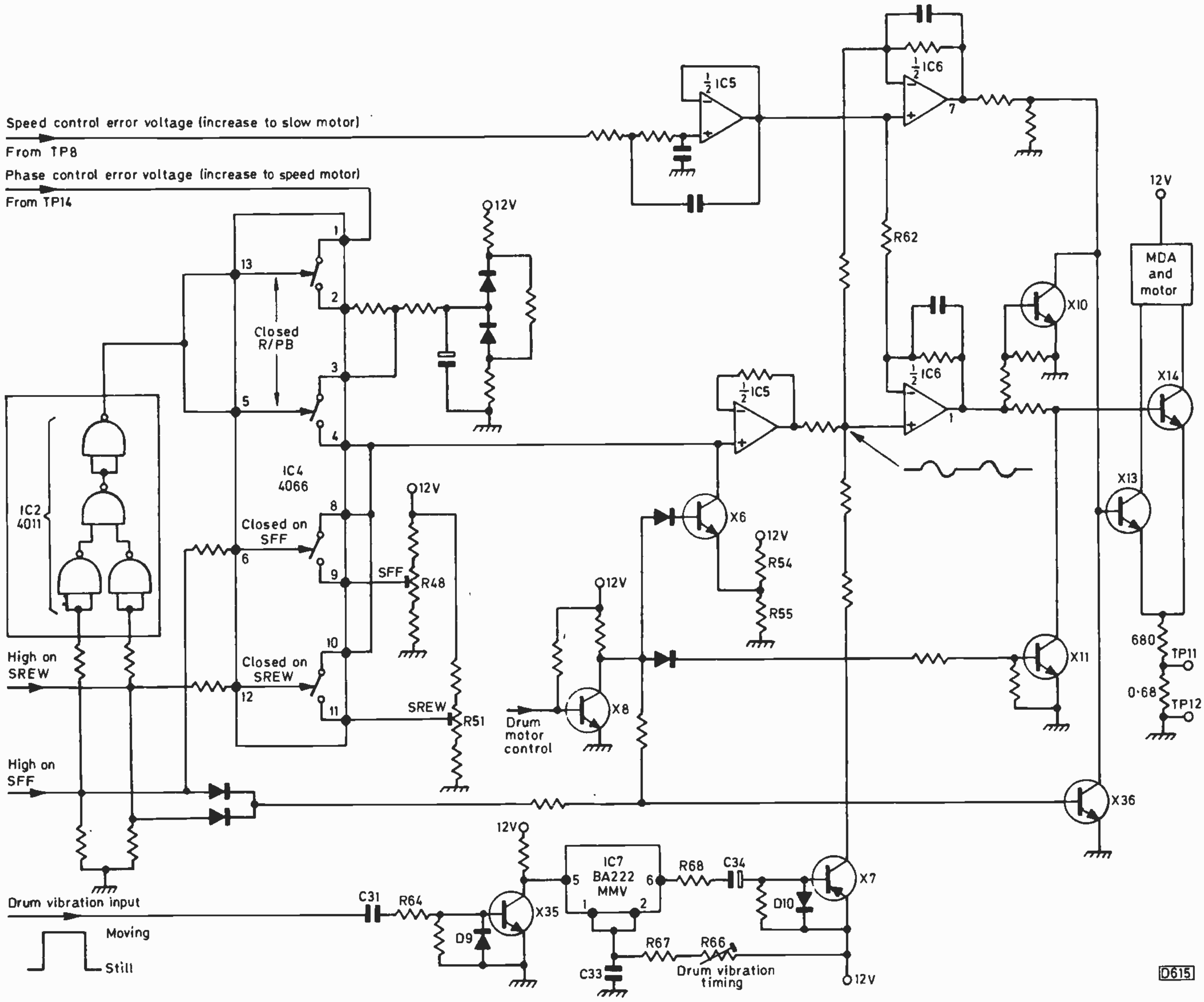


Fig. 82: Drum motor control arrangements.

conjunction with a standard 4·43MHz crystal. This is followed by divide by eight, four and 2,771 stages to get a 50Hz output.

Motor Control

So much for the dual servo loops, which have produced speed and phase control outputs. These have next to be amplified and used to control the motor. Fig. 82 shows the circuitry fed by the outputs at TP8 and TP14. Note that the two output voltages are in opposite sense – the speed error voltage at TP8 will increase with speed, to slow the motor down, while the phase control voltage does the converse.

As Fig. 82 shows, the control voltages are applied to the motor via amplifiers. The final motor drive amplifier (MDA) stages are not shown – we'll discuss them later.

Taking the speed control system first, the error voltage drives the operational amplifier voltage-follower (half of IC5) then, via R62, half of IC6. The upper half of this i.c. supplies the base of X13 and is not used in most modes – more about this later. The non-inverting (+) input to the lower half of IC6 is obtained from the other half if IC5 (also a voltage-follower) which is under the control of the phase error voltage. This latter voltage is routed through two switches in IC4. The first two of these complete the path through the filter and limiter network between pins 2 and 3 of IC4 and are closed in the absence of either the SFF (search fast forward) or SREW (search rewind) inputs to the gates in IC2. When SFF or SREW is selected, these switches open and one of the other switches closes so that the control voltage is obtained from either R48 or R51.

X8 provides on/off control for the drum motor. When X8 is turned off it's collector voltage goes high, turning on X11 which shorts out the base bias for X14. Since X14 amplifies the output from IC6, this action stops the motor. At the same time X6 is turned on, putting a voltage determined by the values of R54 and R55 on the phase control line. The values of R54 and R55 are chosen so that this voltage is the same as that present during normal running, the idea being to eliminate hunting when the motor is restarted.

X14 drives the motor drive amplifier – the motor speed increases with collector current increase. The motor current can be measured at TP11, with TP12 as earth. X13 also drives the drum motor, but does so in the opposite direction. We don't want to do this of course, X13 being used to brake the drum when we go from SFF to playback. At all other times X13 is off.

Due to the construction of the MDA, if X14 and X13 were turned on at the same time the l.t. rail would be

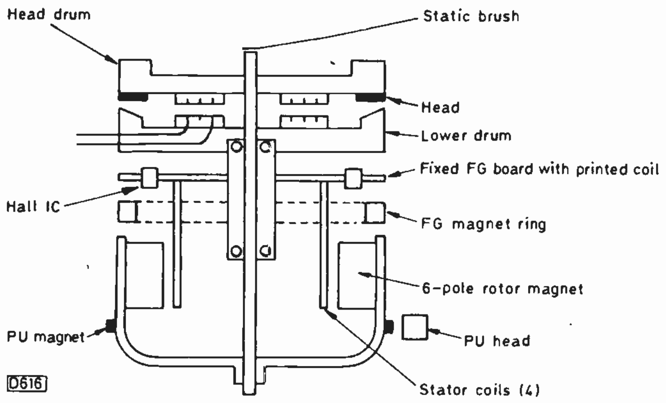


Fig. 83: The head drum/motor assembly.

the differentiating circuit C31/R64, with D9 to remove the negative-going excursion at the output. The positive pulse switches X35 on to produce a negative pulse at its collector coincident with the start of tape movement. This pulse triggers the monostable IC7, whose time-constant consists of C33, R67 and R66 – the latter is adjusted for minimum picture disturbance on "slow". The monostable's output is a replica of the slow drive pulse but with the width variable. R68 and C34 provide differentiation of the output, with D10 clipping the positive-going excursion. The negative-going pulse is amplified and inverted by X7 and is then added to the output from IC5. The time-constants are such that X7 conducts slightly when the tape stops.

shorted out. X10 prevents this from happening by removing X13's base bias. In the SFF mode X14 is on and X13 is off, due to X10 conducting. When the machine returns to play as the SFF button is released, the speed control registers excessive drum speed. So X14 and X10 turn off, since pin 1 of IC6 goes low. Pin 7 of IC6 is high, so X13 turns on to brake the motor. As it slows, pin 7 goes lower and pin 1 higher, turning X14 and X10 on and X13 off. During both search modes X36 conducts, providing a safeguard to ensure that X13 cannot turn on. X36 is also driven on when the machine goes to stop, since X8 switches off.

Finally the drum vibration circuit X35, IC7, X7. In the slow motion mode the tape moves for a fixed period and is then stationary for a variable period depending on the setting of the controls. Every time the tape moves the writing speed alters, the result being a horizontal "twitch" of the picture with each tape movement. To avoid this we need to speed up the drum momentarily when the tape moves, then slow it down when the tape stops – the latter is necessary due to the system's mechanical inertia (the drum would take a second or so to slow down of its own accord).

To this end a pulse from the slow drive circuit is fed to

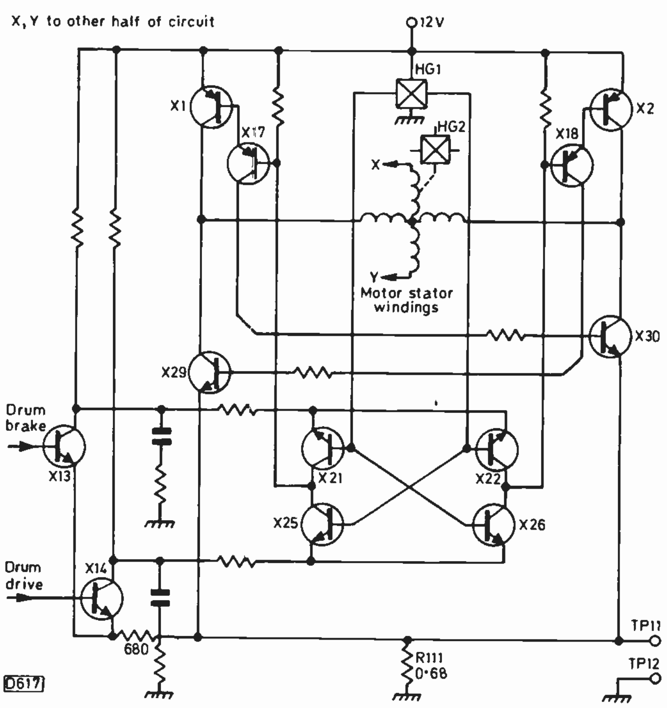


Fig. 84: Motor drive amplifier circuit.

Motor Drive

The only thing remaining is the drum motor itself. With this machine we come to the concept of a direct drive motor. Previously, most machines used normal d.c. permanent magnet motors, with a wound armature and brushes and a commutator to switch the windings on when they are in the correct juxtaposition to the stationary magnet poles. It would be nice to drive the drum directly without the intervention of a belt and pulleys, but permanent magnet motors don't run evenly at low speeds, due to lack of inertia and the sudden pole switching. If we made the latter electronic, with more gradual switching, it would overcome that problem, but we would still have to get the current to the coils. The answer with direct drive motors is to make the coils stationary with the magnets rotating outside them (see Fig. 83), thus also adding to the inertia. The motor and head drum thus become one compact assembly.

The pole switching is done by two Hall effect i.c.s – remember how one was used in the 3V00 series to sense take-up spool rotation. In this case two are used, 90° apart. The signals induced in them by the six pole motor magnets are amplified to drive the two pairs of coils which are also spaced at 90°. As we've seen, X13 and X14 control the direction of this current. Fig. 84 shows half the circuit – the other half is the same, and all the components are on the servo-2 board, with the drum servo.

X13 or X14, depending on which is conducting, provides an emitter return for two of the transistors X21/22/25/26. When the Hall effect device HG1 is enabled by the rotor magnet, it turns on one of the two transistors selected. Say we are in playback with the motor running. X14 will be partially turned on, providing a ground path for the emitters of X25 and X26 whose bases are alternately forward biased as the magnet poles pass HG1. As each transistor passes current, two of the four transistors X1, X2, X29 and X30 conduct. For example when X26 conducts, X18, X2 and X29 conduct while X17, X1 and X30 are all off. As a result current flows through the winding from the collector of X29 to the collector of X2.

We can now see why it's necessary to have X10 to ensure that X13 and X14 could not both turn on hard – this would turn on all the MDA transistors, stalling the motor and connecting the coils and R111 across the 12V rail, much to their disadvantage.

The other half of the circuit, with HG2, the remaining two coils and associated transistors, is identical – X13 and X14 don't need to be duplicated of course.

Next month we'll deal with the servo-1 board (capstan servo), including the still, slow, double speed, frame advance and assembly edit facilities.

Servicing the Toshiba C800B

John Coombes

The Toshiba C800B is a table model fitted with an 18in. in-line gun tube. It features touch tuning and conventional circuitry, though there are one or two things that can cause confusion. The main power supply arrangements are as follows (see Fig. 1).

The mains autotransformer T802 on the left-hand side of the chassis (viewed from the rear) feeds a bridge rectifier (D801-4) which produces 130V across its reservoir capacitor C810. A secondary winding on the mains transformer supplies the tube's heaters, via a fuse which is part of the transformer. The output from the bridge rectifier is fed via the two h.t. fuses F803 and F804 to a series regulator circuit which produces a stabilised 107V h.t. rail. This supplies the line oscillator and driver stages, also the audio output stage, the tuning voltage circuit and the field flyback switch. D407 in the line output stage produces a boosted 130V supply which is used by the line output transistor and the RGB output stages.

In addition to D407 and the e.h.t. rectifier, the line output transformer feeds four other rectifiers, D403, D405, D409 and DB01. Two of these, D403 and D405, are on the line drive board. D403 produces the supply for the c.r.t.'s first anodes whilst D405, which is separately fused, produces a 15V supply for the low-voltage stages in the receiver. The third rectifier D409, on the mother board, produces a 55V supply for the field driver and class B field output stages. A switching circuit increases the supply to the field output stage to 100V for the field flyback. The fourth rectifier DB01 is on the channel selector board. It produces 19V which is fed to a series regulator that provides a stabilised 15V output.

Before mentioning particular components to check for various faults, it should be pointed out that in practice most faults are caused by dry-joints, due mainly to the metal lugs between the print on each side of the boards. This problem occurs mostly on the daughter boards, though it can also occur on the mother board.

Dry-joints on the vision i.f. panel can be responsible for a blank raster with low sound, intermittent buzz on sound, intermittent sound, intermittent picture, and intermittent low gain.

Dry-joints on the a.f.c. panel can cause loss of sound with a snowy picture.

Dry-joints on the chroma panel can give intermittent colour or intermittent loss of red or green.

In the event of loss of red/green/blue or loss of picture, check the RGB output panel for dry-joints and check the connections between this and the mother board.

For field collapse, lack of height, intermittent lack of height, bottom cramping or the scan reduced to half an inch, check for dry-joints on the field output transistors Q306 (2SC1448) and Q307 (2SA740) or on the mother board in the vicinity of these transistors.

Fault Summary

Other than dry-joints, our fault experiences with this set have been as follows.

No results: Check the mains fuses F801/2. If blown, check the mains filter capacitors C811/2, the bridge rectifier diodes D801-4 (type 1S1887) and the h.t. reservoir capacitor C810 for shorts.

If the mains fuses are o.k., the tube's heaters should be alight. The next thing to check is the h.t. fuse F803. If this has blown D808 will be reverse biased and the regulator will not start up. Check C807 and D812 (1S1555 – in the error amplifier circuit) for being short-circuit, and Q801 and Q803 (2SC735 – error amplifier transistor) for being open-circuit. Next check the line output transistor Q405 and the line driver transistor Q404 (2SC1447). If these are o.k., suspect the line output transformer T402.

If any of these three fuses has blown and no short-circuit can be found, a replacement fuse restoring normal operation temporarily, replace the mains transformer T802.

No sound or raster can be caused by C408 (0·0043μF) in the line oscillator circuit – check by replacement. With this

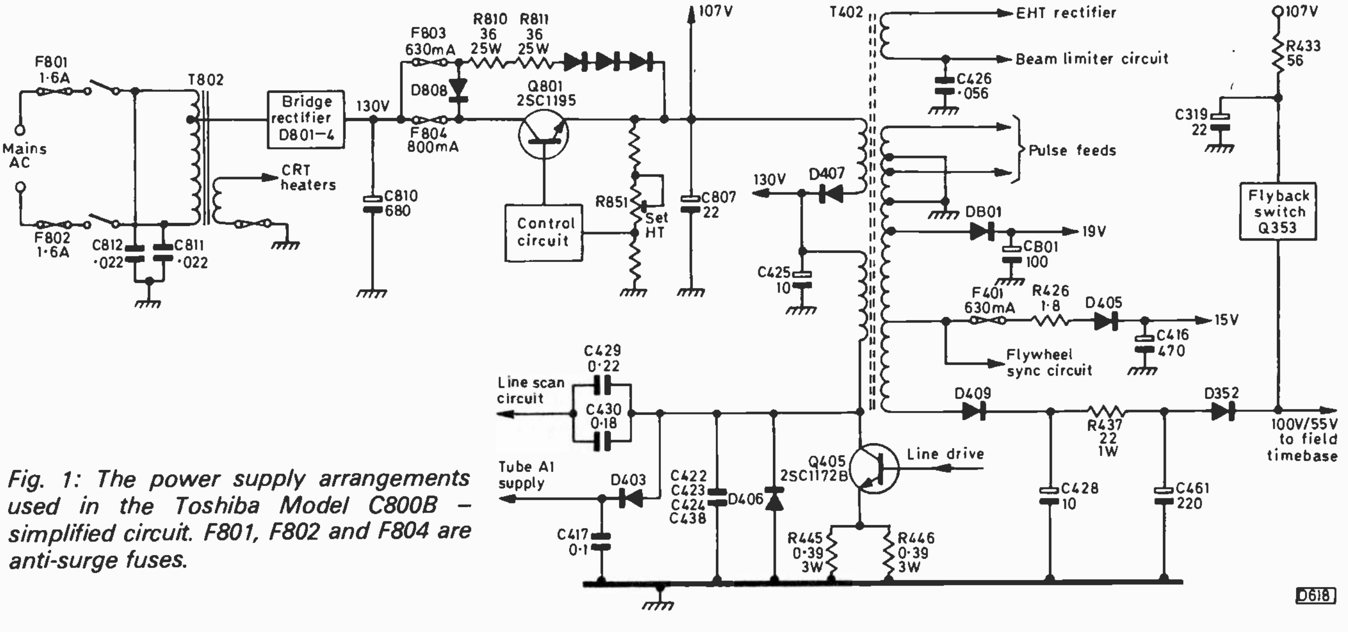


Fig. 1: The power supply arrangements used in the Toshiba Model C800B – simplified circuit. F801, F802 and F804 are anti-surge fuses.

fault the touch sensor neons will flash.

No raster: In the event of no e.h.t., check whether the e.h.t. rectifier D408 (ESPA04-40) is open-circuit. If the diode is all right, check whether C426 at the earthy end of the overwinding is short-circuit.

Focus troubles: The usual cause is the focus unit R452 (22MΩ). This forms part of a potential divider chain across the e.h.t. supply. The other two resistors in the chain, R462 (22MΩ) and R461 (135MΩ), are in the e.h.t. rectifier unit and can also become faulty. It may be necessary to check the decoupler C909 (330pF) and the spark gap Z909 for being short-circuit. If all these items are in order, check the tube base connection (pin 9) and finally suspect the tube.

Striations down one side of the picture: Check the line linearity coil damping resistor R436 (1kΩ).

Sync problems: No sync or intermittent loss of sync is not common but can be caused by the sync separator transistor Q301 (2SA495Y) which should be checked by replacement.

In the event of poor line sync check the flywheel sync discriminator diodes D401/2 (1S1555) which tend to go open-circuit. If necessary check the filter capacitor C406 (3·3μF) by replacement.

In the event of poor field sync, check the gating diode D302 (1S1555), the integrating capacitor C305 (0·01μF), and if necessary the field oscillator/amplifier chip IC351 (TA7132P) by replacement.

Field jitter: Check the field hold control R351 (150kΩ) then if necessary replace IC351 (TA7132P).

Sound, no picture: The video amplifier transistors can be responsible for this – usually the second one Q202 or the fourth one Q204 (both type 2SC372). Check for an open-circuit or dry-joint on the panel, and if necessary check the luminance delay line W201 which can go open-circuit.

No red/green/blue: The RGB output transistors are Q505 (red), Q507 (green) and Q509 (blue), all type 2SC1447. Check as necessary, also for poor joints on the RGB output board or on the base of the mother board. Also check the connections to the leads between the RGB output board and the c.r.t. base panel.

Excessive R/G/B: Check the spark gaps at the tube's cathodes – Z901 in the event of excessive red, Z902 for excessive green and Z903 for excessive blue.

Intermittent bistable operation: Check D501 (1S1555).

No sound: Check the audio output transistor Q603 (2SC1447) by replacement – if the trouble is intermittent, check for dry-joints at its base and emitter. If this transistor is without collector voltage, check the feed resistor R688 (390Ω). Check the continuity of the output transformer's primary winding (T661). If necessary check the sound module (U601) for dry-joints and replace the i.c. on this panel – IC601, type TA7146P. On rare occasions the loudspeaker goes open-circuit.

Touch sensors: In the event of channel jumping or sticking in one position, try cleaning the touch sensor pads. The problem can be made worse by the use of spray furniture polish. The remedy is to spray on switch cleaner and then wipe off.

Sticking in one position can also be caused by the neons (GA01/2/3/4) and their driver transistors (QA09/10/11/12). The neons are type NE2D, the driver transistors type 2SC734FA-2.

Associated models: The 20in. Model C2000B uses similar circuitry to the C800B. Differences include the use of i.c.s in the channel selector circuit and a TA7152P in the IC351 position (field oscillator/amplifier).

Frequency Counter-Timer

Part 3

Tony Jenkins, G8TBF (WKF Electronics)

This month we'll deal with completion of the construction of the basic unit. Prescaler 2 will be the subject of an article to follow later.

The component layout for the preamplifiers is shown in Fig. 12. When connecting these up the input and output cable screens are connected at the preamplifier PCB only.

Fig. 10 shows the prescaler 1 component layout. The input is fed from the 200MHz input socket via a short length of 50Ω coaxial cable. The screen of the output lead is connected at the prescaler board only.

The final task is to interconnect the whole unit. Fig. 11 shows the interwiring and connection details for the complete assembly, with the exception of prescaler 2 which has to be mounted inside a diecast box. Both preamplifiers and prescaler 1 are mounted by soldering the ground planes to the row of earth pins along the side of the main board. The input and offset grounds are connected to the front pin. Check all wiring carefully before applying power.

Setting up

VR1 on main board: This is the l.c.d. drive control. Adjust for a well contrasted display without the unwanted segments being visible.

TC1 on main board: This sets the counter chip's clock frequency and has to be accurately adjusted with a known frequency source since it determines the accuracy of the unit. The best source available to service engineers is a CTV's reference oscillator when this is locked to an off-air signal. This is specified by the broadcasting authorities as 4·43361875MHz ± 1Hz, which is pretty accurate! Adjust the trimmer to give the correct display.

VR1 on the preamplifier boards: This compensates for spreads in the MOSFET's pinch-off voltage (Tr1). Adjust for 2·5V at the collector of Tr2 with the input socket shorted to chassis.

VR1 on the prescaler 1 board: This sets the transistor's operating point. With the 200MHz input shorted to chassis, adjust for 2·5V at the collector of Tr1.

The instrument is now ready for use.

A separate article on prescaler 2 is in preparation. This extends the instrument's capability to around 2GHz. We plan to publish the article in the near future.

WKF Electronics inform us that they are able to supply a complete kit of parts for the project (excluding prescaler 2) for £170·49. Alternatively the instrument can be

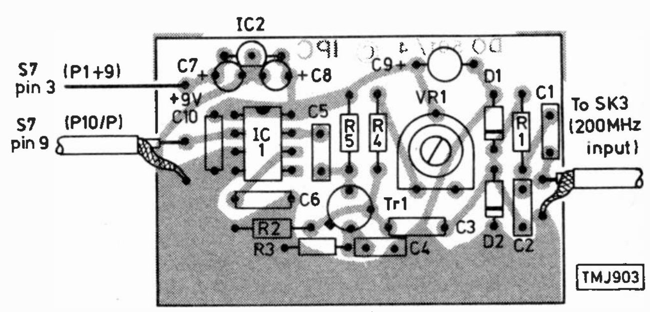


Fig. 10: Prescaler 1 component layout.

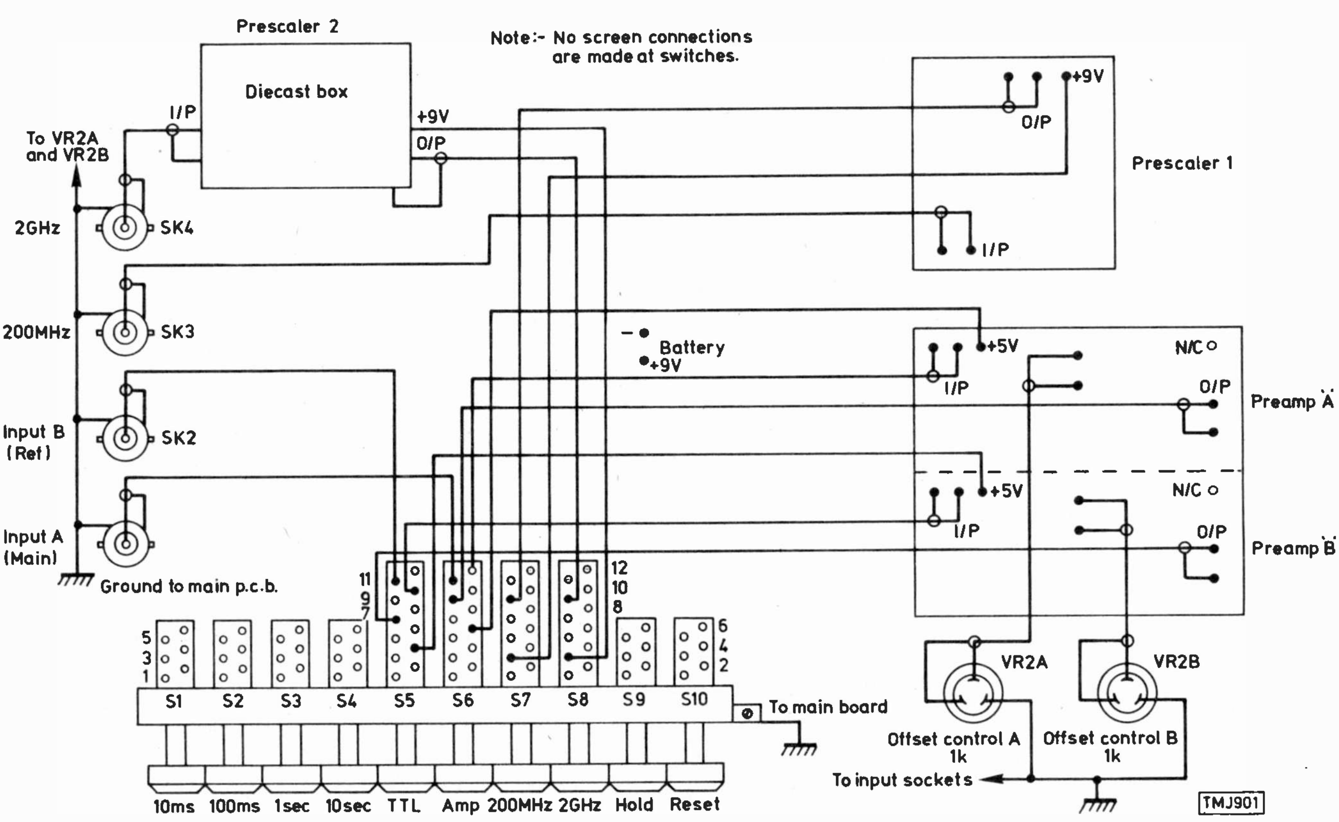
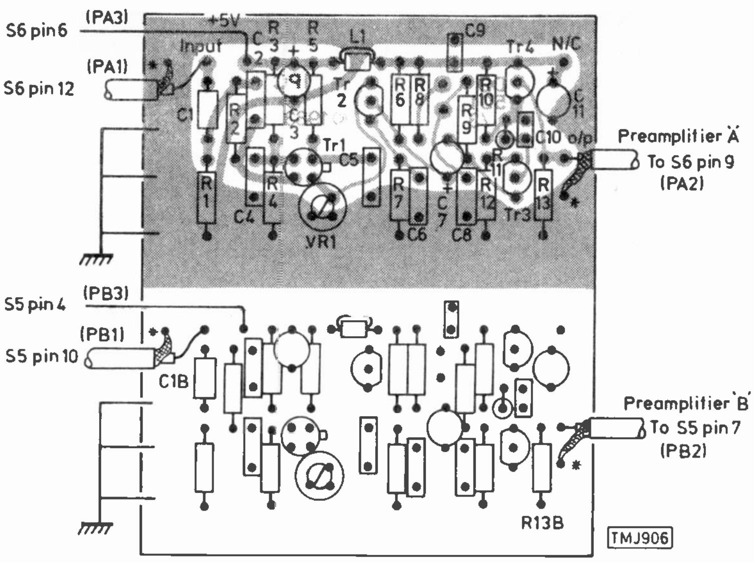


Fig. 11: Interwiring for the complete assembly.



Ref's for this section as above but with a suffix 'B'.
= Ground connection established via mounting pins.
N/C = No connection.
* = Screen connections at p.c.b. end only.
L1 = 1 turn 22swg en. copper wire on a ferrite bead.

Fig. 12: Preamplifier component layout.

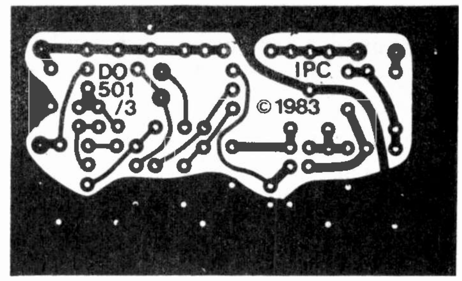


Fig. 13: Preamplifier board pattern.

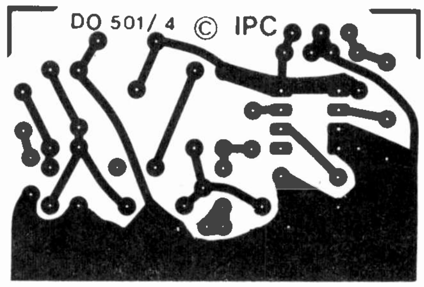


Fig. 14: Prescaler 1 board pattern.

bought fully built and tested for £190·49. Both prices are inclusive of postage, packing and VAT. The main board DO501/1 is available from Readers' PCB Service at £15 while the other boards are available at £1 each. In both cases the address is Fleet House, Welbeck Street, Whitwell, Worksop, Notts.

Lords of the Morning Air

Les Lawry-Johns

MANY years ago, more than I care to admit, I was an avid reader of science fiction magazines. My favourite, if I remember correctly, was *Astounding Stories.* There were some good yarns in it, and the title of one sticks in my mind – it was Lords of the Morning Air and was about some superior beings that came to visit earth. They looked like us but were far superior of course, with long fair hair and blue and gold robes to prove the point. Kind they were too, not like us louts.

Anyway it was a bright and sunny morning, and as I took Ben for his stroll we first waved at the drivers of the cars – the ones that came up the road and honked at us – and then went round the back of the flats (two large blocks opposite the shop), continuing to wave at all the occupants who waved at us. One old boy opened his window and bawled out that he'd "let us look at his TV set later". "Thank you, thank you very much" I bawled back, without much conviction in my voice. What he really meant was that I was to be allowed to cart a load of equipment over to the flats, lugging it through the corridors, then performing a miracle on his old set before carting the lot back again. Anyway, we dismissed this diversion from our minds and continued our walk in the morning air, still waving to all and sundry and wishing we didn't have too because our arms were aching. Now we know how royalty feels. Royalty, that's what we were, Lords of the Morning . . . until we got back to the shop, when we became surfs once more.

Who should be waiting for us but Mr. Piddlewell – he who'd threatened to cut off our milk supply last time. He didn't even give me time to get the lead off my neck.

"We were watching that science fiction film last night when the picture went off and someone started talking in a foreign language – lots of other voices chattered away too."

"What do you expect if you put the volume full up?" I snarled.

"Well it shouldn't chatter away in a foreign language, should it?"

"It might if it doesn't feel well. It was probably delirious" I replied, looking on the shelf for an MC1330 chip.

"What's that?" demanded Mr. Piddlewell. "It doesn't look much."

"That there does a very difficult job" I explained. "When it stops doing it the set jabbers away in lots of foreign languages and you don't get a picture either."

"Oh" said Mr. P. "How do you know it's that?"

"Because I can feel it in my water" I explained, not wishing to go into detail about previous tests with prods at the input and prods at the output.

So we opened the signals panel of Mr. P's Thorn 8000 chassis, took out the MC1330 from the left-hand side, and fitted the new one. Just for fun I applied the meter's test prod to the chip's output pin and switched the set on. There was an air-splitting garble of voices from the speaker, and Mr. P's eyes widened.

"It's still doing it" he bawled.

"No it ain't" I said, removing the test prod and plugging an aerial in. Soft music accompanied the BBC-2 test pattern.

"You're having a go at me. I know you are."

"Not at all, Mr. P. I was just demonstrating that when the chip goes open-circuit it acts like an aerial for the reception of 6MHz signals and the harmonics thereof" I said, laying it on a bit thick.

"Oh, very genital" said Mr. P, reverting to his coarse upbringing.

"Well pay up, look big and sod off" I advised him, reverting likewise.

Another Lord

Stripe me pink if Mr. Lord didn't walk in carrying a large Philips radio cassette. It was Mr. Lord my accountant.

"What do you want? you robber" I greeted him warmly.

He looked pained. "We don't rob you Les. It's not our fault if you don't charge enough for your services. At least we're realistic."

"I'll start charging realistic fees right now Mr. Lord" I said.

"Don't be impetuous. Rome wasn't built in a day."

"It would never have been built at all if the contractors had charged your fees" I replied, warming to my task.

Mr. Lord crossed his fingers and said "Faye Knights". That put an end to it of course.

"Sorry Mr. Lord. Well now, perhaps I can help you in some way?"

"It's just the cassette section of this thing Les. The pinch wheel is flopping about."

So he left it for me to fiddle with whilst he returned to his office to do his fiddling. I hope he had better luck than I did.

Due to my lack of observation I mucked about with it for ages. Having stripped it down and removed the cassette section I couldn't find any sign of the pinch wheel spring. So I thought I'd try to make one, which I did, having to remove the wheel to fit it. When I refitted the wheel and anchored the free end of the spring the wheel did what it was supposed to do and fitted tightly against the capstan. A little too tightly I thought, but blundered on.

To test the machine the panels had to be reassembled, so I thought I might just as well put the whole thing together anyway, just leaving the rear cover off. I switched on and pressed play. The capstan rotated nicely but the spool carrier didn't move. I tried again but it stayed still and refused to rotate. So I took the panels out again and got the screws thoroughly mixed up whereas I'd previously had them organised for proper replacement.

I stared at the cassette section and pushed down the play button. The plastic carrier went down but when I rotated the flywheel the take-up spool carrier didn't rotate. It would spin freely, but didn't engage with the sprocket which should have driven it. The sprocket is pushed into position by the plastic carrier which didn't seem to be travelling far enough. Perhaps it was because I'd anchored the spring to the carrier? So I took the pinch wheel off and tried again. The sprocket engaged, and the take-up spool carrier rotated with the flywheel.

At this point the cat walked across the bench and sat looking at the rear cover. Something was attracting her attention. It also attracted mine because it was a nice bronze spring caught up in the leads which connect the rear cover to the main unit. "Thank you Spock" I said gratefully as I shoved her off the bench.

So I put the right spring on and checked it carefully. The pinch wheel fitted tightly against the capstan and the take-up carrier didn't rotate. I felt peeved about this, and once again removed the pinch wheel. The carrier then rotated. I stared at the assembly and then saw what I should have seen earlier. There's a plastic obtrusion just above the pinch wheel assembly, and I'd put the assembly back to ride below it, which was why it fitted too tightly against the capstan. Assembled so that it rode above the obtrusion, the plastic carrier could ride fully down and the sprocket would engage.

What would have taken any sensible person a few minutes had taken me over an hour, and I was not pleased with myself. No wonder I can't pluck up enough courage to tackle these videos. Just imagine what a mess I'd make. Mind you, some of these audio stack systems seem to be just as inaccessible, with the whole works up front and acres of nothing in the rest of the cabinet. Come back music centres, all is forgiven.

It wasn't my fault that my accountants had advised me to increase my service charges. Sorry Mr. Lord.

More Royalty

What a funny thing. If you get one type of set in you can bet that a whole row of them will follow. In this case it was names however. Next along comes Mr. Knight who wanted his G8 repaired. He also announced that he intended to buy a new set for the lounge, keeping the G8 for the bedroom.

I didn't go along with this idea, and suggested that it would be more convenient to leave the G8 where it was and invest in a 14in. colour portable for the bedroom, with remote control so that if anyone was confined to bed they could change channels, control the volume and switch the set off with the small handset. In addition there would be a considerable saving because a portable was a lot cheaper than a 22in. set. As his wife was with him I added that a portable could easily be moved to the kitchen for the reception of breakfast TV, the set having its own aerial.

Mrs. Knight was immediately convinced and informed her husband that he'd be a fool to buy another large set.

So I showed them a Fidelity CTV14S, and they were most impressed with my demonstration of mirror reflected channel changing, though I couldn't quite see the value of this if you're watching the set anyway and holding the remote unit.

Mr. Knight announced his decision. If I could repair the G8, he'd take the portable. So we checked the G8 and found that there was lack of red. The red BF337 output transistor was o.k., but there was precious little turn on bias at its base. The driver load resistor R7326 (39kΩ) was accused of being high and proved to be so. I looked in vain for a 39kΩ resistor but the nearest I could find was 47kΩ, 2W. Fitting this restored normal operation without any need for adjustment, so we wrapped up the G8 and piled it and the Fidelity portable into the Knight's car, while Mr. Knight wrote out the cheque which was for a lot less than he'd expected when he first arrived.

What an honest chap I am. We haven't been able to get any 22in. remotes for some time . . .

Note on the G11

Finally a note on the h.t. reservoir capacitor (C4029) in the Philips G11 chassis – it came up in the letters column recently. Green ones are just as bad as the red ones – blue or black are o.k.

Service Bureau

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BUSH BC6004

The original fault was a dead set. Quite a lot of items had to be replaced: the BU208 line output/chopper transistor, the associated diodes D687/688/725, the mains bridge rectifier D856, the surge limiter resistor R854 and the TDA2560 i.c. in the decoder. No one around here seemed to have replacements for D687/725 so I used BY223s as in the D688 position. The h.t. was correctly set for 122V and everything works, but the BU208 and its heatsink get very hot indeed.

The overheating could be due to the use of incorrect diode types in the D687/725 positions. The specified types (SKE series) should be available from Mastercare or the electrical wholesalers SEME. The BU208 is protected by the snubber network C841 (0·001μF) and R841 (560Ω, 17W) and it would be worth checking these components.

ITT CVC9/1 CHASSIS

There's distortion on the right-hand side of the screen – the upper part bends downwards and the lower part upwards, with a gap at the bottom. A new field timebase valve has made no improvement. The distortion is not constant, the raster being normal at switch on, then distorting, then returning to normal etc.

The pincushion correction is working with a phase error. Adjustment of the NS phase coil L125h might clear the problem, but first check carefully for dry-joints around the pincushion correction transductor and the associated components. This should include C255h and C254h, both 0·033μF, which are suspect if correct raster shape cannot be achieved.

THORN TX9 CHASSIS

This set has developed faulty line sync — particularly noticeable on test pattern ETP1 where the verticals exhibit a zigzag effect. The fault also seems to be dependent on the setting of the contrast control. Would you suspect the TDA9503 line processor i.c. IC54 or its associated components?

First check the 12V regulator IC56 by confirming the correct 12V at pin 4 of IC54. If this is right, check the sync separator coupling/bias components C156/R203 (0·33μF/1MΩ) and the voltages around the sync inverter transistor VT50 before condemning IC54.

TOSHIBA C81B

The problem was fuse blowing, the cause being a short-circuit line output transistor (2SC1172). Replacing this with a BDX32 stopped the fuse blowing but failed to restore normal operation. I've now fitted a 2SC1172Y, but in doing so it was necessary to shorten the emitter coil slightly due to a fracture. Is this in order and is there anything else to check?

Slight shortening of the emitter coil should not matter, at least in the short term. It's just possible that the transistor may overrun slightly during prolonged use, though this is unlikely. Other items worth checking are the e.h.t. regulator transistor Q405 (2SC792) and its emitter resistor R438 (5·6Ω, 1W), also R435 (6·8Ω, 5W) which is in series with the h.t. feed to the line output stage.

RANK A823 CHASSIS

As the set warms up, the sound starts to buzz and crackle. This can be tuned out with the fine tuner, but then either the picture goes or it has to be watched in monochrome. The crackle is present on all stations.

This is the early version of the chassis fitted with the A809 i.f. panel. It uses a slope detector for sound demodulation, a system that was not very successful. Try adjusting the sound i.f. coils 2L26/7/8 to eliminate the crackle. A very small (less than one turn) adjustment of 2L1 in the i.f. input filter unit may also help. A conversion kit (type 154m) was at one time available from Rank to improve the sound reception. Alternatively the later Z182 panel can be used – it works better.

FERGUSON 3787

The original fault was a burnt out tripler and focus unit. These items were replaced and a new line output transformer was fitted, and after adjusting RZ13 for the correct supply rails the set ran all right for a couple of days. It then went dead. At first there was an intermittent ticking sound but this has now disappeared. All fuses are intact, and the pulse feed resistors (RU15 and RU16) to the electronic trip thyristor DU04 are intact.

If there's no "burst" of energy at switch on to indicate operation of the trip we would suspect that the flyback thyristor DA12 is faulty, though it would be useful to check for drive via CA13 with an oscilloscope. If there is a burst of energy, check the regulator thyristor DU11 and make sure that its gate trigger pulse circuit is intact. It's essential to use the correct thyristor types.

NATIONAL PANASONIC TC85GA

The problem with this set is a dark band on the left-hand side of the screen, extending from the edge for about four inches towards the centre – it looks rather like a shadow. The rest of the picture is all right.

The fault is not uncommon on these sets and is usually due to C514 (4·7μF, 350V) drying up – it's the reservoir capacitor for the video output transistors' 220V h.t.

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TELEVISION JUNE 1983

supply, which is derived from the line driver transformer. Other things to check if necessary are the first anode supply reservoir capacitor C518 (0·068μF, 1·5kV) and the 24V line reservoir/smoothing capacitors C523/4 (both 330μF, 35V). These two supplies are derived from the line output transformer.

THORN 1690 CHASSIS

This set works normally when switched on, but after some five minutes the screen blacks out (no raster), the tube's heater becomes dull and after a further ten minutes the sound also gradually disappears. Sound and normal tube heater brightness are restored when the e.h.t. connector is removed.

The e.h.t. rectifier stick, which is encapsulated in the line output transformer, is breaking down. As a result a.c. is fed to the c.r.t. anode connector and is shorted via the tube's capacitance, loading down the line ouput stage. It would be best to fit a new line output transformer assembly, though a stick as used in the 8000 chassis could be wired in series.

TEST CASE

246

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

THE number of service calls to a particular item of domestic entertainment electronics seems to depend largely on whether it's rented (lots of calls at no charge to the customer) or purchased (very few calls after the guarantee has expired!). The care lavished on rented TVs and VCRs also seems to be much less than when the user owns the gear. At the termination of the rental contract the equipment comes into our workshop for checking and refurbishing, and a great deal of time often has to be spent on repolishing, cleaning and replacement of cosmetic items in order to bring the performance and appearance up to scratch.

This month's tale of intrigue concerns an ex-rental Ferguson VCR, Model 3V20. The job ticket conveyed the depressing message that the subscriber had defaulted on his rental payments and that the machine was not working. Plainly the customer's problems were not confined to finance, for a cracked side and deep dents in the bottom cover around the feet betrayed the fact that the VCR had been dropped. When we tested the machine we found that it would lace up and then unlace after a few seconds, reverting to stop. A careful examination of the relevant printed panels and the top of the tape deck was made for signs of cracking or damage, but none were found.

The system control circuitry on this model is quite straightforward, consisting of a single MSM5830 chip on the mechacon panel and a handful of transistors in the interfacing circuitry. The fact that the machine would lace up initially suggested that most of the mechacon system was in order, and we could see that the cassette lamp was working and the head drum was rotating. During the five second period of operation the machine provided, all seemed to be normal. So our first investigation was centred on the spool rotation detector – if this fails to produce an output, a counter within the mechacon chip shuts the machine down after five seconds.

The spool rotation detector consists of a Hall effect i.c. and a rotating magnet driven from the counter belt – all were present and correct, and there was adequate a.c. input to the mechacon chip. The AL (after load) switch was also found to be working correctly, putting a logic high on pin 13 of the chip at the completion of lacing. There seemed to be no point in checking the memory (counter) and tape end sensor inputs to the chip as these, if giving false signals, would not permit the five seconds' operation available. So we pressed on.

There's one other input to the mechacon system required for normal operation, and here lay the trouble. The oscilloscope led us to another panel, then away again to .... where? If you haven't already got there, suffice it to say that the machine stopped working from the time it hit the floor – yet nothing internal was broken, and there were no discontinuities in the panels, leads or connections. Time now to enter stop . . . full replay in the next issue!

ANSWER TO TEST CASE 245
— page 377 last month —

Last month we described one of those obscure, minor faults that sometimes afflict TV sets. The set concerned was fitted with the Decca 100 chassis, and the trouble was a slight vision instability effect, showing plainly on only certain types of picture, the standard test card being the favourite. The instability took the form of faint, distorted multiple images to the right of the correct one, as a result of which the picture was somewhat blurred.

After various initial checks we'd fitted a substitute i.f. panel. This had made no difference, so the trouble wasn't there. Another tuner had subsequently been tried, and the fact that the appearance of the symptom was then slightly different encouraged us to concentrate on the area of the tuner.

Bridging the tuning line decoupler C3 with a similar component did nothing, but the same capacitor when placed across C1 completely cleared the trouble! This 0·1μF capacitor decouples the tuner's a.g.c. line, and is on the tuner panel. It's a polyester type with a much higher voltage rating than one normally finds used in this position, and was the last thing we'd expected to fail!

Published on approximately the 22nd of each month by IPC Magazines Limited, King's Reach Tower, Stamford Street, London SE1 9LS. Filmsetting by Trutape Setting Systems, 220-228 Northdown Road, Margate, Kent. Printed in England by The Riverside Press Ltd., Thanet Way, Whitstable, Kent. Distributed by IPC Magazines Ltd., Lavington House, 25 Lavington Street, London SE1 0PF. Sole Agents for Australia and New Zealand – Gordon and Gotch (A/sia) Ltd.; South Africa – Central News Agency Ltd. Subscriptions: Inland £11, overseas (surface mail) £12 per annum, payable to IPC Services, Oakfield House, Perrymount Road, Haywards Heath, Sussex. "Television" is sold subject to the following conditions, namely that it shall not, without the written consent of the Publishers first having been given, be lent, resold, hired out or otherwise disposed by way of Trade at more than the recommended selling price shown on the cover, excluding Eire where the selling price is subject to currency exchange fluctuations and VAT, and that it shall not be lent, resold, hired out or otherwise disposed of in a mutilated condition or in any unauthorised cover by way of Trade or affixed to or as part of any publication or advertising, literary or pictorial matter whatsoever.

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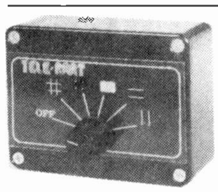

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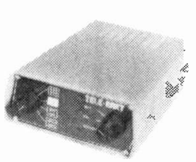

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BC307	10p	BU326A	1.30	T9016V	1.20
BC308	8p	C1172B	9p	T9017V	1.20
BC347	8p	C1129	9p	T9050V	1.50
BC394	8p	ME0404	8p	T9051V	1.00
BC454	8p	ME0412	8p	T9052V	1.30
BC455	8p	ME6002	8p	T9053V	1.30
BC460-6	40p	MJE340	50p	S2800E	90p
BC549	8p	MJE520	65p	S2800C	1.00
BC556	8p	NKT241	8p	S2800D	1.25
BC559	8p	NKT276	20p	S2800E	1.40
BC595	8p	NKT453	1.65	S2800M	2.00

ZENER DIODES

TOSHIBA 200MV 10p each
6.2v, 12v.

BZY88 10p each
3.9v, 5.6v, 12v, 16v, 20v, 30v, 33v.

TOSHIBA 500MV 10p each
5.6v, 6.8v, 7.5v, 8.2v, 11v, 15v.

BZX61 16p each
9.5v, 10v, 11v, 15v, 27v, 72v.

THORN TX9 main panel complete (no tuner) Ex-factory. **£11.00**

Thorn 10Ω 20W (3500) R751 Safety Resistor	75p
Pye 713 Speaker 5" × 3" 70Ω	1.00
Pye 713 Complete Tube Base Panel with Focus Slider & Leads	2.75
Pye 713 Control Knobs	4 for 50p
Tube Base Socket ITT CVC32	45p
Tube Base Socket Thorn 3000/8000 etc	50p
IC Inserter 16 Pin	50p
Large IC Extractor	50p
Crystal 4.43MHz	65p
EHT Lead & Cap for Split Diode Lopt	90p
Anode Capacitor	47p
Sanyo Anode Cap Assy + Lead. 12TCD-CT-1G	65p
Degause Thermistors. PT37P. ITT/GEC	35p
Degause VDR E299D/HP230 3000/8000	25p
Casters Set of 4	1.90
Double Fuse Holder on Small Pax Board 20mm type	10p
Single Fuse Holder on Small Pax Board 20mm type	5p
Direct Panel Mounting 20mm Fuse Clips (pair)	15p
Single Fuse Holder on Small Pax Board. As per early 3000 mains input	6p
EHT Cable Metre 25p	13A Plugs 12 for 4.80

THICK FILM RESISTOR UNITS

3500 Thorn (5 Pin Connection) video	1.70
4000 Thorn (4 Pin Connection)	1.90

TANTALUM CAPACITORS

0.1MFD to 470MF 6.3v/10v/16v/35v
£6 per 100

MINIATURE CERAMIC DISC

1PF to 10NF 50v/250v/500v
£2 per 100 or £15 per 1000

HIGH VOLTAGE DISC

Most Values Available 2KV to 12KV
£5 per 100 or from £40 per 1000

With these items No Mixed Values in Lots of 100

SERVICE AIDS

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

MIXED PACKS

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

AERIAL SOCKETS

AE. Socket & Lead. Pye, ITT, Thorn	25p
AE. Socket & Lead. GEC	25p
AE. Socket & Lead. (long) GEC	25p
AE. Socket & Lead. Pye 691/693	25p
AE. Socket & Lead. Philips KT3	25p
AE. Socket & Lead. Thorn col. portable	25p
AE. Socket & Lead. (long) Pye 725/731	25p
AE. Socket & Lead. ITT CVC32, etc	25p
UHF TV Aerial for portable	50p
Indoor Aerial Parabolic Type Reflector to Help Combat Ghosting Problems	2.50
Line Connectors	38p
Coax Plugs	10 for 1.65
Band Change Switch Assy, Pye 725	40p
Flush Mounting TV/FM Diplexer	1.00
Switched Flush Fitting Aerial Outlet	1.00

Thorn Mains TX 3000/3500	10.00
Thorn Mains TX 8000/8500	10.00
Thorn S.O.P.T 8000/8500	3.50
Thorn Scan TX 3000/3500	6.00
Thorn EHT TX 3000/3500	6.00
Thorn LOPT 9600	12.00
ITT LOPT CVC1-9	9.60
Pye LOPT 713	10.00
Pye LOPT 725	9.85
Pye LOPT 169	9.70
GEC LOPT 3133	7.40
Diode Split LOPT AT2076/35	14.75
Sanyo LOPT AM-WM-21	6.75
Sanyo LOPT AM-WM-4	7.30
Thorn LOPT 1615	7.25
Thorn LOPT 1590/91	7.25
Thorn LOPT TX9	9.85
Thorn LOPT 9800	17.00

CAN TYPES

0.2MF 250V	50p	1250MF 40V	50p
2MF 250V	50p	1250MF 50V	50p
22MF 275V	50p	1500MF 70V Thorn 3K	1.00
50MF 275V	50p		
100MF 150V	65p	1500MF 100V	1.05
100MF 250V	70p	2000MF 30V	50p
100MF 450V	75p	2200MF 40V Thorn 4K	95p
220MF 400V Thorn 9K	1.30	2500MF 35V	65p
220MF 450V Thorn 4K	1.30	2500MF 40V	65p
		3000MF 30V	65p
220MF 450V Thorn 8K	1.00	3300MF 16V	50p
		3300MF 25V	60p
800MF 250V Print type	80p	4700MF 16V	72p
800MF 250V	70p	4700MF 40V	75p

MULTISECTION CAPACITORS

100+150+150	350V	50p	16+16	450V	45p
220+47	350V	65p	200+100+100+50	350V	60p
200+150+50	350V	60p	200+200+100	350V	55p
200+200+100	325V	54p	200+200+75+25	350V	60p
32+32+16	275V	52p	16+16	500V	45p
200+200+100+32	350V	70p	50+50+8	300V	55p
100+50+150	350V	58p	100+50+100	350V	55p
400+400	200V	72p	16+16	350V	45p
32+32+16	350V	52p	100+150+50	350V	55p
200+32+300+100	350V	70p	2500+2500 (Thorn 8K)	63V	1.20
225+25	350V	50p	150+150+100	300V	1.80
200+200+100	350V	70p	200+47	250V	65p
200+100	325V	65p			

CAPACITORS

3.3PF	350V	3000PF	2KV
6.8PF	63V	3300PF	250V
8.2PF	350V	4700PF	400V
10PF	350V	.0047MF	500V
12PF	1000V	.0075MF	2KV
22PF	63V	.01MF	250V
30PF	63V	.01MF	600V
47PF	350V	.015MF	400V
182PF	63V	.02MF	200V
250PF	2000V	.02MF	250V
330PF	63V	.022MF	250V
330PF	160V	.047MF	400V
330PF	8KV	.1MF	250V
470PF	250V	.1MF	600V
560PF	63V	.1MF	2KV
1000PF	250V	.22MF	400V
1500PF	250V	.33MF	250V
1800PF	160V	.39MF	250V
2700PF	63V	.47MF	250V

Any 10 @ £1.00

ELECTROLYTICS

1MF 63V	20/£1	100MF 25V	10/£1
1.5MF 63V	20/£1	100MF 160V	10/£1
2MF 350V	10/£1	150MF 25V	20/£1
2.2MF 25V	20/£1	160MF 25V	20/£1
4MF 64V	20/£1	160MF 40V	10/£1
4MF 350V	10/£1	250MF 16V	10/£1
6.8MF 40V	20/£1	250MF 25V	10/£1
10MF 40V	20/£1	330MF 10V	20/£1
10MF 160V	10/£1	330MF 35V	10/£1
15MF 16V	20/£1	330MF 63V	10/£1
15MF 63V	20/£1	470MF 6.3V	20/£1
22MF 10V	20/£1	470MF 10V	10/£1
22MF 63V	20/£1	470MF 25V	10/£1
22MF 160V	10/£1	470MF 40V	10/£1
32MF 275V	10/£1	680MF 40V	10/£1
33MF 40V	20/£1	1000MF 10V	10/£1
33MF 50V	20/£1	1000MF 18V	10/£1
33MF 250V	10/£1	1500MF 16V	10/£1
33MF 350V	10/£1	1500MF 35V	10/£1
47MF 350V	10/£1	2200MF 25V	6/£1
50MF 25V	20/£1	2200MF 40V	6/£1
100MF 18V	10/£1		

WIRE WOUNDS

2R 5W Thorn 3K	30p	36R 17W	23p	330R 7W	16p	4K7 7W Fus.	25p
2.2R 4W	16p	235R 9W Fus.	25p	370R 17W	23p	5K1 7W	16p
3.3R 9W	30p	220Ω 7W Fus. (Korting)	30p	1K2 10W Fus.	25p	8K2 7W	15p
10R 9W	18p	270R 5W	15p	2K2 5W Fus.	25p	8K2 9W 8K Thorn	20p
15R 17W	23p	270R 7W	16p	2K2 7W Fus.	25p	10K 7W	15p
22R 9W Fus.	25p	280R 17W	23p	2K7 9W Fus.	25p	10K 9W	16p
27R 7W Fus.	25p	330R 5W	15p	3K9 4.5W Fus.	25p	39K 4W	15p

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INTEGRATED CIRCUITS

BRC/M/200	1.00	TBA120CQ	70p
BRC/M/300	1.00	TBA395	1.00
ML237B	2.00	TBA480Q	1.40
MC1358P	1.30	TBA540	1.10
MC78M24	25p	TBA1440C	1.00
SL432A	1.80	TCA270S	1.05
SAS590	2.60	TDA1035T	3.50
SN15846N	60p	TDA2540	3.50
SN74123N	65p	TDA2680	2.80
SN74154N	1.40	TDA2690A	1.50
SN76013ND/HS	1.80	TDA3560	6.00
SN76023N	1.80	MC14426P	4.80
SN76033N	2.00	MC14429P	4.50
SN76115	2.00	MC14514	5.00
SN76660N	80p	SAA5010	6.00
SN76544N	1.20	TDA1170S	1.50

DIODES

AA112	8p	IN4007	6p
AA119	8p	IN4742A	8p
AA143	8p	IN5254B	8p
BA115	8p	IN5349	14p
BA154	8p	IS025	8p
BB103	8p	IS131	8p
BR303	46p	IS1658	8p
BT106	1.50	MR854	35p
BY127	12p	SKE1/02	20p
BY204	26p	MCR406	35p
BY298	22p	TIC106C	40p
BYX22/400	30p	2N4444	1.50
IN60	8p	Y827	80p
IN2070	8p	ZX150	12p
IN4001	4p	OA91	5p
IN4002	4p	MCR106/7	1.00
IN4003	4p	MCR106/8	1.50
IN4004	5p	TD3F800H	2.80
IN4005	5p	TD3F800R	3.00
IN4006	5p	BY255	30p
IN4007	6p		

MAINS DROPPERS

Pye 78+161	50p
Pye 147+260	50p
Thorn 56+1K+47+12	1.00
Thorn 50+40+1K5	60p
RBM 250+14+58 (TV161)	63p
Pye 3R5+15+45 (713)	90p

THERMAL CUT OUT

Thorn 3000 Metal	1.45
Thorn 8/8500 Plastic	1.45

EHT TRAYS

Thorn 3000	5.50
Thorn 8000	3.50
Thorn 8500	5.00
Thorn 9000	5.00
Thorn 900/950	3.00
Thorn 1500 3 stick	3.40
GEC 2100	5.39
Pye 713 4 lead	5.83
Pye 713 5 lead	5.97
Pye 725	6.35

FUSES

20mm		1¼"	
50MA	10 for 70p	250MA	10 for 65p
315MA A/S	10 for 50p	750MA	10 for 65p
500MA	10 for 50p	7A	10 for 50p
1A	10 for 50p	10A	10 for 50p
2.5A	10 for 1.00	20A	10 for 50p
3.15A	10 for 1.00	50A	10 for 50p

AM-LS-200 Sanyo Scan Coil (mono portables)	2.50
M-LS 145	2.50
4-2761-44570	2.50
Thorn 4000 Coil L401	40p
Thorn 4000 Coil L701/2/3	12p
Pye 713 Coil L831/832	65p
Philips G8 Coil L482 Late Type	65p
Philips G9 Luma Delay Line	90p
Pye 713 Luma Delay Line	90p
Convergence Yoke Assy AT1023/05	5.90

SWITCHES ETC

Rank A823 4 P/B Assy	5.80
Telpro 4 P/B Assy	5.80
Thorn 3500 6 P/B Assy + Leads	1.75
ITT CVC9 On/Off Switch + Relay	90p
Philips G8 On/Off Switch	65p
Thorn 3/3500 A1 Switch	50p
Thorn 4000 A1 Switch	50p
Korting Shift Pot 50Ω	65p
Thorn 4000 Focus Pot	4.75

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LC7120	4.30	TBA480Q	1.40	TDA2591	2.50
LC7130	4.50	TBA510	2.30	TDA2593	2.30
MC1327A	1.00	TBA520Q	1.00	TDA2600	4.30
MC1358P	1.60	TBA530Q	1.00	TDA2611A	1.50
MC1330P	.90	TBA540Q	1.20	TDA2640	1.80
ML231B	1.95	TBA550Q	1.40	TDA3560	5.10
ML232B	1.70	TBA560Q	1.45	UPC1156H	2.95
MR475	2.00	TBA750Q	2.30		
SAS560S	1.65	TBA800	.80		
SAS570S	1.75	TBA810AS	1.15		
SAS580	2.40	TBA820	1.40		
SAS590	2.40	TBA890	2.95		
SL901B	4.80	TBA920Q	1.50		
SL917B	6.40	TBA950/2X	2.15		
SL1327Q	1.30	TBA990	1.55		
SN76003N	1.80	TCA270SQ	1.30		
SN76013N	1.80	TCA800	1.95		
SN76023N	1.80	TCA940	1.55		
SN76110N	.90	TDA1002A	1.50		
SN76226DN	1.45	TDA1003A	2.80		
SN76227N	1.00	TDA1004A	2.70		
SN76660N	.65	TDA1035	3.20		
SN76666N	.65	TDA1044	3.10		
TN7120P	2.05	TDA1170	1.80		
TA7130P	2.00	TDA1412	.90		
TA7193P	4.20	TDA2190	3.20		
TA7205AP	2.80	TDA2020	2.95		
TAA550	.28	TDA2522	1.80		
TBA120A	.62	TDA2523	2.25		
TBA120AS	.70	TDA2530	2.10		
TBA120B	.90	TDA2532	2.20		
TBA120SB	.90	TDA2540	1.95		
TBA120U	1.00	TDA2560	1.80		
TBA395	1.25	TDA2581	1.70		
TBA396	.85	TDA2590	2.20		

DIODES

BA102	.15
BA115	.14
BA154	.07
BB105B	.25
BB105G	.25
BY127	.10
BY133	.15
BY164	.40
BY179	.60
BY210/800	.30
BY223	.82
BY227M	.23
BYX10	.20
BYX55/600	.26
BYX71/600	.78
OA90	.07
1N4001-7	.07
1N5401-8	.12
Y969	.85
BZX61-range	.18
BZY88-range	.11

TRANSISTORS

TYPE	PRICE	TYPE	PRICE	TYPE	PRICE	TYPE	PRICE
AC127	.22	BC184L	.11	BF115	.30	BU205	1.30
AC128	.22	BC208	.12	BF167	.26	BU206	1.35
AC128K	.30	BC212L	.10	BF184	.28	BU208A	1.40
AC141K	.30	BC213L	.10	BF185	.29	BU208/02	1.70
AC142K	.30	BC214L	.10	BF194/394	.12	BU326A	1.30
AC176	.28	BC237B	.11	BF195	.13	BU407	1.12
AC176K	.30	BC300	.25	BF196	.11	BU500	1.80
AC187K	.30	BC303	.26	BF197	.11	BU526	2.00
AC188K	.33	BC337	.11	BF198	.14	BUW81A	2.80
AD149	.70	BC338	.10	BF241	.15	MJE340	.40
AD161	.42	BC547	.10	BF256LC	.25	MJE3000	1.50
AD162	.42	BC548	.10	BF258	.25	R2008B	1.40
AF126	.38	BC557	.10	BF259	.26	R2010B	1.40
AF127	.36	BC558	.10	BF337	.28	R2540	2.35
AU110	2.10	BD124P	.55	BF338	.30	TIP29C	.45
AU113	1.85	BD131	.33	BF355	.32	TIP30C	.45
BC107B	.14	BD132	.33	BF362	.38	TIP31C	.46
BC108B	.14	BD201	.70	BF458	.30	TIP32C	.47
BC109B	.14	BD202	.70	BF459	.36	TIP33B	.80
BC139	.24	BD203	.70	BFR90	1.50	TIP41C	.46
BC140	.26	BD204	.75	BFT42	.30	TIP42C	.46
BC141	.26	BD222	.50	BFT43	.30	TIP2955	.70
BC142	.23	BD232	.50	BFX85	.30	TIP3055	.55
BC143	.25	BD233	.37	BFY51	.22	TV106/02	1.60
BC147	.09	BD234	.40	BR100	.18	2N3054	.55
BC148	.09	BD235	.32	BR101	.32	2N3055	.50
BC157	.10	BD236	.43	BR103	.55	2N3703	.12
BC158	.11	BD237	.40	BT106	1.15	2N5496	.50
BC159	.11	BD238	.34	BT116	1.15	2SC1172Y	1.85
BC160	.22	BD410	.50	BT106/2	1.58		
BC172	.10	BD434	.50	BT119	2.30	2SC2029	2.00
BC177	.22	BD437	.70	BT120	2.30	2SC2078	2.00
BC182	.10	BD438	.78	BU105/02	1.44	2SC2091	1.10
BC182LB	.11	BD707	1.05	BU126	1.25		
BC183LB	.11	BDX32	1.36	BU204	1.30		

LINE O/P TR.

RBM T20/22A	11.85
RBM Z718 18/20/22	22.95
PHILIPS G8	7.90
PHILIPS G9	8.75
PHILIPS G11	13.50
THORN 1590/1	8.68
THORN 1690/1	9.68
THORN 1615	9.75
THORN TX10	12.50
PYE 731/713(110)	10.20
PYE 725(90)	10.20
ITT CVC 1-9	9.60
DECCA 2230	8.30
DECCA 80	8.58
DECCA 100	8.58
GEC 2110	9.45
ITT CVC 20	7.75
ITT CVC 25/30/32	8.00

E.H.T. TRAYS

RBM T20/22A	6.80
RBM A823	7.20
PHILIPS G8-550	6.25
PHILIPS G9	6.45
THORN 950 MK2	4.35
THORN1500-3S	4.25
THORN1500-5S	4.55
THORN3000/3500	7.40
THORN8000	4.00
THORN8500/8800	5.90
THORN9000	7.95
PYE 731	6.55
DECCA 2230	6.30
DECCA 80	6.30
DECCA 100	6.20
GEC 2001H	6.95
ITT CVC 20/30	6.30
Universal	5.60

NEW VALVES

DY802	.72
PCF802	.86
PCL82	.78
PCL84	.81
PCL805	.90
PCL86	.81
PFL200	1.35
PL504	1.50
PL508	2.90
PL509/519	5.65
PY88	.69
PY500A	1.90
PY81/800	.69

ANTI-SURGE FUSES

A/S20MM 80MA	2.75
100, 160, 200MA	1.70
315, 400, 500, 630, 800MA, 1A, 1.25, 1.6, 2A	1.20
2, 3.15, 4, 5A	1.35

A/S 1.25"

250, 500, 630, 750, 1A, 1.25, 1.5, 2A	1.55
2.5, 3, 5A	2.40

SUNDRIES

PYE IF GAIN MOD	7.85
E/W COIL G11	1.65
VA1104	.70
G8 TRANSDUCTOR	2.25
G8 ON/OFF SW.	1.40
B/L COAX PL.	.16
LINE CONNZ.	.14

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DECCA 30(400/400)350V	2.55
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PHILIPS G8(600)300V	2.00
PHILIPS G9(2200)63V	1.15
PHILIPS G11(470)250V	2.20
PYE 691/7(200-300)350V	2.10
RBMA823(2500/2500)30V	1.10
THORN1400(150/100/100/100/150)320V	2.40
THORN3500(175/100/100/400)350V	2.25
THORN3500(1000)70V	.85
THORN9000(400)400V	2.75

PUSH BUTTONS/TUNERS

DECCA/ITT 4W	6.45
DECCA/ITT 6W	7.40
PYE201 6W	15.80
PHILIPS G8S/L	13.50
PHILIPS G8S/Q	12.00
HITACHI 4W	8.50
ITT CVC5 7W	9.40
ITT CVC8/9	12.80
PHILIPS G11 (TIP SW.)	23.80
1043/05TFK	7.95
U321 TFK	7.75
U322 TFK	7.40

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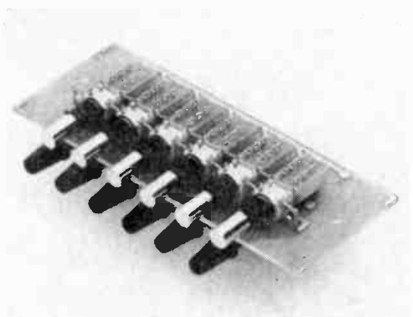

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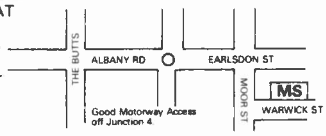

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BT120	£1.00
BRC4443	75p
G11 Thyristor	60p
Decca 80-100	60p
G11 Teletext Decoder Panel Philips	£30.00

Crystal T/V

T/V 4.433-619KHz	50p
6 MHX Crystal	50p
8.8867-238KHz Min	50p
Miniature ITT 6meg	75p

Filters

5-5MHz	15p
6MHz	35p
BFU455K	5p

Thermistors

VA1104	35p
ITTP7266312	15p
PTH451 AOR	15p
PT37P Fits Pye & Bush	25p
PT34	20p
Degausing Thermistor (fits most sets)	20p
3 Pin Blue Thermistor (fits most sets)	20p
GEC Double Thermistor	75p
BLY49	50p
I.C. Heat Sink	10p
20×TO5 Heat Sink	£1.00
T4040 Clock Display	£1.00

BFT43	10p
BFT84	8p
BFW11	20p
BFX29	30p
BFX84	25p
BFY50	15p
BFY90	25p
BRX43	15p
BSY95a	10p
BTY80	20p
BSX19	17p
BSX20	17p
2N930	5p
2N2221	8p
2N2222	8p
2N3055	40p
2N3703	10p
2N3711	10p
2N3583	50p
2N3904	15p
2N3906	15p
2N4355	10p
2N4442	£1.00
2N4444	£1.00
2N5296	40p
2N5983	30p

2N6099	40p
2N6109	40p
2N6133	20p
2N6348	20p
2SB407 Sanyo TO3	10p
2SB474	30p
2SB566	10p
2SC733	10p
2SC1030	£1.00
2SC1173	£1.00
2SC1617	£1.00
2SC2073	8p
2SC2122A	£1.00
2SC2229	15p
2SD180 TO3 80v/ 6A	15p
2SD200	£2.00
2SK30A	10p
2SN30A	8p
FT3055	30p
BC107	10p
BC108	10p
BC109/2N930	5p
BC113	10p
BC114	10p

BC115	10p
BC116	10p
BC125	10p
BC139	10p
BC141	25p
BC142	25p
BC143	25p
BC147	10p
BC148	10p
BC149	10p
BC153	10p
BC154	10p
BC157a	10p
BC158	10p
BC159	10p
BC160	25p
BC171	10p
BC172	10p
BC173	10p
BC174	10p
BC182L	10p
BC183	10p
BC184	10p
BC187	10p
BC204	10p
BC207	10p

BC212	10p
BC213	10p
BC214	10p
BC237	10p
BC238	8p
BC239	10p
BC250	8p
BC251	10p
BC252	10p
BC262	10p
BC298	10p
BC300	30p
BC301	30p
BC303	30p
BC307	7p
BC308	7p
BC309	10p
BC327	10p
BC328	10p
BC337	10p
BC338	10p
BC347	10p
BC349b	10p
BC350	20p
BC365	10p
BC384	10p

BC394	10p
BC413	10p
BC414	10p
BC416	10p
BC440	30p
BC447	10p
BC454	10p
BC455	10p
BC456	10p
BC460	25p
BC462	10p
BC463	10p
BC478	10p
BC527	10p
BC532	10p
BC546	10p
BC547	10p
BC548	10p
BC556	10p
BC557	10p
BC558	10p
BC559	10p
BC635	10p
BD116	25p
BD124	50p

BD124 (metal)	£1.20
BD130Y	25p
BD131	30p
BD132	30p
BD135	30p
BD136	30p
BD140	30p
BD176	25p
BD202	60p
BD204	60p
BD207	30p
BD221	20p
BD222	30p
BD226	20p
BD233	30p
BD235	30p
BD238	30p
BD239	15p
BD243a	30p
BD250a	30p
BD252	20p
BD253B	50p
BD331	20p
BD332	20p
BD416	25p
BD433	25p
BD437	25p