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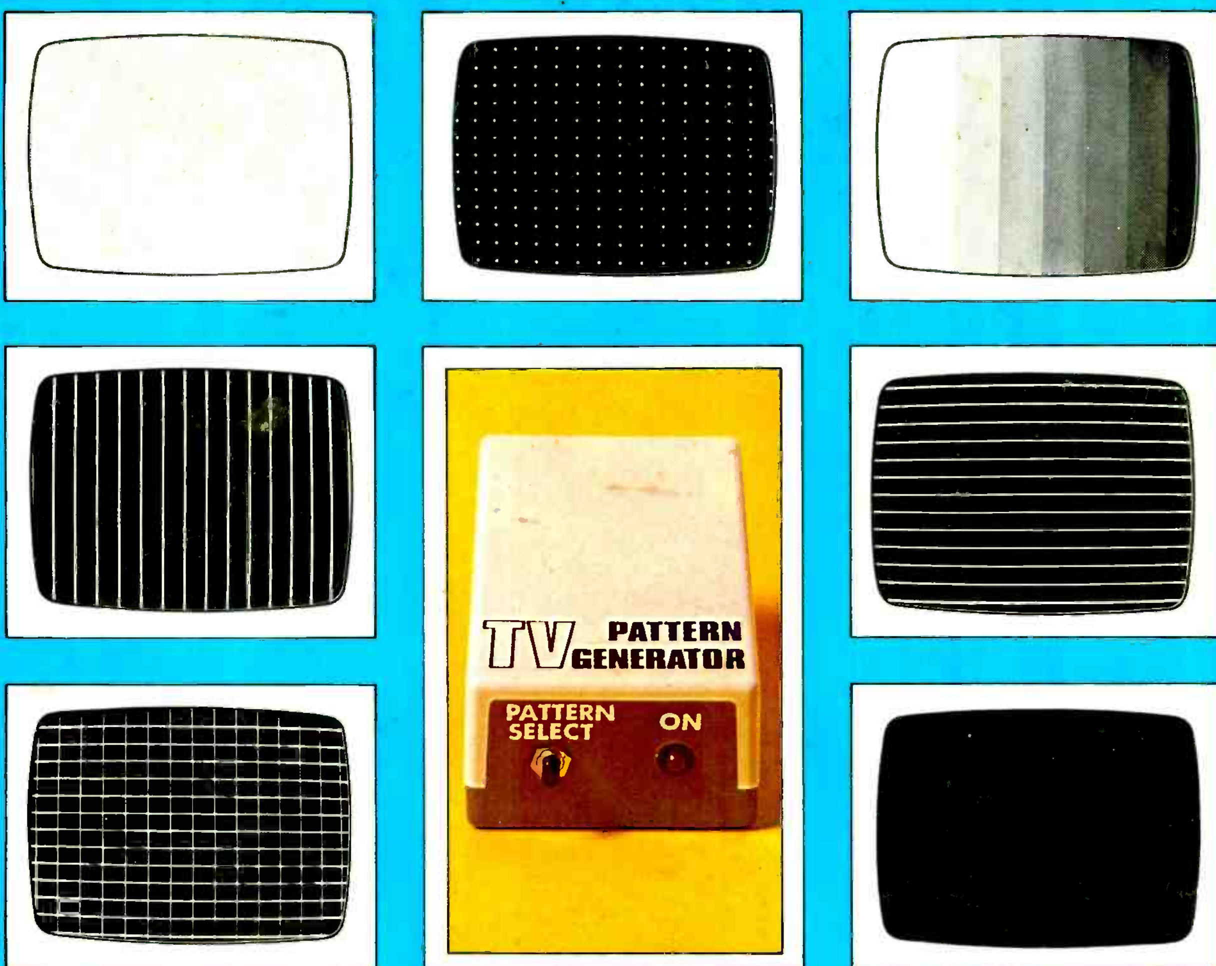
OCTOBER 1981 70p

TELEVISION

SERVICING·VIDEO·CONSTRUCTION·DEVELOPMENTS



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OA95	0.12
OA202	0.18
BA100	0.18
BA102	0.10
BA130	0.15
BA154	0.10
BA155	0.20
BA164	0.12
BAX13	0.16
BAX16	0.08
BAY38	0.16
BY206	0.20
IN4148	0.04
BY126	0.20
BY127	0.15
BY133	0.22
BY164	0.50
SKB2/08	1.00
BY238	0.15
BYX10	0.18
IN4001	0.10
IN4002	0.10
IN4003	0.12
IN4004	0.12
IN4005	0.12
IN4006	0.14
IN4007	0.16
IN5407	0.33
BR100	0.30
BR101	0.60
BRY39	0.60
TIC1160N	1.50
BT119	2.00
BT120	2.00
BYX/71/600	0.80
2N444	1.50
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BYX88 2V7	0.10
BZY88 3VO	0.10
BZY88 3V3	0.10
BZY88 3V6	0.10
BZY88 3V9	0.10
BZY88 4V3	0.10
BZY88 4V7	0.10
BZY88 5V1	0.10
BZY88 5V6	0.10
BZY88 6V2	0.10
BZY88 6V8	0.10
BZY88 7V5	0.10
BZY88 8V2	0.10
BZY88 9V1	0.10
BZY88 10V	0.10
BZY88 11V	0.10
BZY88 12V	0.10
BZY88 13V	0.10
BZY88 15V	0.10
BZY88 18V	0.10
BZY88 20V	0.10
BZY88 22V	0.10
BZY88 27V	0.10
BZY88 33V	0.10
BZX61 7V5	0.20
BZX61 8V2	0.20
BZX61 9V1	0.20
BZX61 10V	0.20
BZX61 11V	0.20
BZX61 12V	0.20
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BZX61 18V	0.20
BZX61 20V	0.20
BZX61 22V	0.20
BZX61 24V	0.20
BZX61 27V	0.20
BZX61 30V	0.20
BZX61 33V	0.20
BZX61 36V	0.20
BZX61 39V	0.20
BZX61 47V	0.20
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AC107	0.35
AC127	0.50
AC127/01	0.60
AC128	0.60
AC128/01	0.60
AC141	0.50
AC141K	0.60
AC142	0.40
AC142K	0.60
AC176	0.60
AC176/01	0.60
AC186	0.40
AC187	0.40
AC187K	0.60
AC188	0.40
AC188K	0.60
AD140	1.50
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AU113	3.00
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BC107	0.20
BC108	0.20
BC109	0.20
BC113	0.15
BC114	0.15
BC115	0.20
BC116	0.20
BC117	0.20
BC118	0.20
BC119	0.50
BC125	0.20
BC126	0.20
BC136	0.20
BC137	0.20
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BC160	0.40
BC161	0.40
BC170	0.15
BC171	0.15
BC172	0.20
BC177	0.20
BC178	0.20
BC179	0.20
BC182L	0.15
BC183L	0.15
BC184L	0.15
BC184LC	0.15
BC186	0.30
BC187	0.30
BC203	0.15
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BC206	0.15
BC207	0.15
BC208	0.15
BC209	0.15
BC212L	0.15
BC213L	0.15
BC214L	0.15
BC225	0.40
BC237	0.15
BC238	0.15
BC251A	0.15
BC301	0.40
BC303	0.40
BC307	0.15
BC308	0.15
BC327	0.15
BC328	0.15
BC337	0.15
BC338	0.15
BC547	0.15
BC141-10	0.80
BD115	0.50
BD124	1.80
BD131	0.70
BD132	0.60
BD133	0.70
BD134	0.70
BD144	2.50
BD159	0.80
BD238	0.50
BD380	0.70
BD441	0.70
BD537	0.70
BD538	0.70
BD507	0.70
BD508	0.75
16181	1.20
16182	1.20
BD709	1.00
BD710	1.00
BD442	0.70
BD379	0.50
BF115	0.60
BF118	0.60
BF152	0.40
BF154	0.20
BF157	0.70
BF158	0.40
BF160	0.60
BF163	0.60
BF167	0.50
BF173	0.50
BF177	0.50
BF179	0.50
BF180	0.50
BF181	0.60
BF182	0.50
BF183	0.50
BF184	0.50
BF185	0.50
BF194	0.20
BF195	0.20
BF196	0.20
BF197	0.20
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BF200	0.15
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BF240	0.45
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BF258	0.50
BF271	0.60

BF273	0.20
BF274	0.25
BF336	0.50
BF337	0.50
BF338	0.50
BF355	0.80
BF458	1.00
BF459	1.00
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BFX29	0.50
BFX84	0.50
BFX88	0.50
BFX89	0.50
BFY50	0.50
BFY51	0.50
BFY52	0.50
BFY90	1.20
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TELEVISION

October 1981

Vol. 31, No. 12
Issue 372

this month

625 **Leader**

626 **Teletopics**
News, comment and developments.

628 **VCR Clinic** *by Derek Snelling*
Fault reports from the video bench.

632 **Letters**

634 **TV Pattern Generator** *by Luke Theodossiou*
A compact unit based on the Ferranti ZNA234E chip. Provides grey-scale, crosshatch, horizontal line, vertical line, dot, blank and white raster outputs via a u.h.f. modulator. A single step-through switch is used for pattern selection.

636 **Practical TV Servicing: Tackling Focus Faults** *by S. Simon*
Poor focus is a common complaint in colour sets. Whilst focus circuits are simple, there are important differences to note, while the symptoms themselves can be misleading.

638 **Satellite TV Up-date** *by Roger Bunney*
Satellite TV broadcasting will be with us within a few years' time. Details of the European satellite TV channel allocations, the assumed reception conditions, likely receiver units and some new terminology.

640 **Readers' PCB Service**

641 **Letter from America** *by Jim Edwards*
All about tuning in the 'States, ranging from simple rotary tuners to microcomputer phase-locked loop systems.

642 **Pattern Generator Follow-up** *by Malcolm Burrell*
Details of how to modify our February 1979 colour pattern generator design to obtain colour bars, a crosshatch pattern and a red raster.

644 **Long-distance Television** *by Roger Bunney*
Another remarkable month, with signals from all quarters (including the Carribean!). Plus news from abroad and a circuit for a simple band-sweeper.

647 **Ridley Relents** *by Les Lawry-Johns*
Sets that go Hrrrump bonk and others that attract lightning. Also a method of dealing with difficult screws.

648 **Station Openings**

649 **Service Briefs**
Service notes from ITT and Philips.

649 **Next Month in Television**

650 **VCR Servicing, Part 2** *by Mike Phelan*
An investigation of the drum and capstan servos – what they are called upon to do and how they do it.

653 **Vintage TV: Ferguson 842T/843T** *by Vivian Capel*
Another trip down memory lane. Amongst the features of these early Ferguson sets are a separate e.h.t. generator and an unusual full-wave h.t. rectifier circuit.

654 **Servicing Switch-mode Power Supplies** *by Derek Snelling*
An introduction for those still uncertain about switch-mode power supplies. Self-oscillating, separate oscillator and line synchronised circuits are explained and fault-finding methods outlined.

658 **Colour Portable Project, Part 6** *by Luke Theodossiou*
A DIY infra-red remote control transmitter using the SAA1250 i.c.

660 **Service Bureau**

662 **Test Case 226**

OUR NEXT ISSUE DATED NOVEMBER WILL BE PUBLISHED ON OCTOBER 21

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★ EBU colour bars, BBC colour bars, whole rasters & split bars (specially useful for VCR service), white, yellow, cyan, green, magenta, red, blue and black.
★ Chequerboard.
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★ Easy to build kit. Only 2 adjustments. No special test equipment required.
★ Mains operated with stabilised power supply.
★ All kits fully guaranteed with back-up service.

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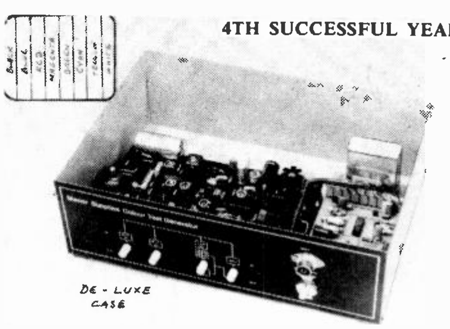
plus CROSS HATCH KIT (Mk. 4)

4TH SUCCESSFUL YEAR



★ Output at UHF, applied to receiver aerial socket.
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★ Cross-hatch, grey scale, peak white and black level.
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Further details on request	P/P £2.80.

TELEVISION PROJECTS & SERVICE SPARES

"TELEVISION" NEW COLOUR PORTABLE PROJECT (Parts available) **SWITCH MODE POWER SUPPLY KIT £26.00** p.p. £1.60. **SIG BOARD KIT** (Incl. ALT. SAW IF) **£70.00** p.p. £1.60. Also time base & CRT base. (PHONE, CALL, SEND FOR LIST). FULL TECHNICAL ADVICE & PANEL TEST SERVICE FOR OUR CUSTOMERS, BACKED BY YEARS OF EXPERIENCE ON PREVIOUS MAGAZINE TV PROJECTS.
"TELEVISION" MONITOR PARTS AVAILABLE.
"TELEVISION" MONO PORTABLE RECEIVER PARTS AVAILABLE. WORKING MODEL & PANEL TEST SERVICE.
"TELEVISION" COLOUR RECEIVER (LARGE SCREEN) PROJECT ALL PARTS AVAILABLE. SEND OR PHONE FOR LIST. WORKING MODEL ON SHOW WITH TELETEXT. (PANEL TEST SERVICE)
NEW SAW FILTER IF AMPLIFIER PLUS TUNER COMPLETE AND TESTED FOR T.V. SOUND & VISION **£32.80** p.p. £1.20 (SUITABLE FOR USE WITH TELEVISION SIGNAL BOARDS).
SPECIAL OFFER TEXAS XMII TELETEXT MODULE NEW & TESTED, LIMITED QUANTITY AT HALF PRICE **£69.00** p.p. £1.60.
TELETEXT 23 BUTTON DE-LUXE HANDSET WITH 5 YDS. CABLE **£7.80** p.p. £1.20. XMII INTERFACE PANEL (THORN) **£2.10** p.p. 75p.
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UHF SIGNAL STRENGTH METER KIT £20.00 (VHF VERSION **£21.60).** ALUM CASE **£2.00** DE LUXE CASE **£5.95** p.p. £1.80.
CRT TESTER & REACTIVATOR PROJECT KIT FOR COLOUR & MONO **£28.00** p.p. £2.00.
BUSH Z718 BC6100 SERIES IF PANEL **£5.75** p.p. 90p.
BUSH A816 IF PANEL (SURPLUS) **£1.90** p.p. 90p.
BUSH 161 TIMEBASE PANEL A634 **£3.25** p.p. £1.40.
DECCA "Bradford" IF T.B. POWER ex rental **£5.75 each** p.p. £1.40.
DECCA 80, 100 SERIES, IF FRAME TB **£7.90 each** p.p. £1.40.
GEC SERIES I MONO PANELS **£2.10** p.p. £1.30.
GEC 2110 Decoder, RGB panels (ex rental) **£5.75 each** p.p. £1.00.
GEC 2010 SERIES TIMEBASE PANEL **£1.15** p.p. £1.00.
GEC 2040 (TYPE) CDA PANEL **£2.88** p.p. £1.25.
PYE 713/715 Convergence **£5.75 each** p.p. £1.40.
PYE 697 Frame T.B. ex Rental **£2.88** p.p. 90p.
PYE 697 Line T.B. P.C.B. type salvaged **£4.80** p.p. £1.50.
THORN 3000 LINE TB PCB **£5.75 each** p.p. 85p.
THORN 3000 VID, IF, DEC, Ex Rental **£5.75 each** p.p. £1.30.
THORN 8500 SERIES CHANNEL SELECTOR & FRONT CONTROL UNIT **£4.37** p.p. £1.80
THORN 8000/8500 IF/DECODER PANELS salvaged **£5.52** p.p. £1.60.
THORN 8000/8500 FRAME T.B. PANELS salvaged **£5.52** p.p. £1.40.
THORN 8000/8500 POWER/SALV. SPARES **£2.88** p.p. 60p.
THORN 9000 LINE T.B. (incl. Lopt etc.), Salv., spares **£8.62** p.p. £1.60.
THORN 9000 SERIES TOUCH TUNE REMOTE CONTROL UNIT PLUS ULTRASONIC TRANSMITTER HANDSET **£19.32** p.p. £1.84.
THORN 9000 IF/DECODER PANELS Salvaged **£8.90** p.p. £1.60.
PHILIPS 210, 300 Series Frame T.B. Panels **£1.15** p.p. 80p.
PHILIPS G8/G9 IF/DECODER Panels for small spares **£4.80** p.p. £1.30.
G8 IF Panels for small spares **£1.75** p.p. 95p.
G8 Decoder panels salvaged **£4.25.** Decoder panels for spares **£2.00** p.p. £1.35.
VARICAP, U321, U322, ELC 1043/06 **£7.82,** ELC 1043/05 **£6.35** p.p. 60p; G.I. type (equiv. 1043/05) **£4.00** p.p. 60p. Control units, 3PSN **£1.40,** 4PSN **£1.75,** 5PSN **£2.00,** 6PSN **£2.88** p.p. 60p.
BUSH "Touch Tune" and Varicap Control Unit **£4.40** p.p. 95p.
VARICAP UHF-VHF ELC 2000S **£9.80.** BUSH TYPE **£8.60** p.p. 85p.
VARICAP VHF MULLARD ELC 1042 **£7.95** p.p. 60p.
UHF/625 Tuners, many different types in stock. **UHF** tuners transisted. incl. s/m drive, **£3.28.** Mullard 4 position push button **£4.80** p.p. £1.30.
TRANSISTORISED 625 IF for T.V., sound, tested. **£7.82** p.p. 95p.
MULLARD EP9000 Audio Unit incl. LP1162 Module **£4.38** p.p. 85p.
LINE OUTPUT TRANSFORMERS. New guar. p.p. £1.25.

BUSH 145 to 186SS series	**£8.80**
BUSH, MURPHY A816 series	**£9.80**
DECCA 20/24, 1700, 2000, 2401	**£8.80**
FERG., HMV, MARCONI, ULTRA 850 to 1580	**£6.80**
THORN 1690, 1691	**£10.15**
GEC 2000, 2047 series, etc	**£8.80**
INDESIT 20/24EGB	**£8.80**
ITT/KB VC1 200, 300	**£8.80**
MURPHY 1910 to 2417 series	**£8.80**
PHILIPS 19TG 170, 210, 300	**£8.80**
PYE, INVICTA, EKCO, FERR. 368, 169, 569, 769 series	**£8.80**

SPECIAL OFFER

GEC 2114J/FINELINE	**£5.50**
PYE 40, 67	**£5.50**
THORN 1590/1591	**£5.50**
KB VC ELEVEN (003)	**£3.25**

COLOUR LOPTS p.p. £1.30
(BOBBINS **80p**)

R.B.M. A823	**£5.60**
R.B.M. Z179	**£6.70**
R.B.M. 2718	**£14.38**
R.B.M. T20, T22 Bobbin	**£6.44**
DECCA Bradford (state Model No.)	**£10.15**
DECCA 80, 100	**£9.50**
GEC 2028	**£7.82**
GEC 2040	**£11.30**
GEC 2110 Series	**£12.20**
ITT CVC 5 to 9	**£10.15**
ITT CVC 30 Series	**£10.15**
PYE 691-697 (BOBBINS)	**£7.60**
PYE 713-715	**£7.85**
PYE 731 to 741	**£7.85**
PHILIPS G8, G9	**£10.15**
PHILIPS 570	**£7.85**
THORN 3000/3500 SCAN, EHT	**£7.85**
THORN 8000/8500	**£14.80**
THORN 9000	**£10.15**

OTHERS AVAILABLE, PRICES ON REQUEST. ALSO F.OPTS.
TRANSDUCTORS Suitable for G8, A823, Bradford etc. **£1.72** p.p. 60p.
THORN 950 3 Stick Tray **£1.15** p.p. 55p. Most others available.
THORN 3000/3500, 8000, 8500, MAINS TRANSF. **£10.15** p.p. £1.80
6·3V CRT Boost Transformers **£5.00,** Auto Type **£3.20,** p.p. £1.20.

CALLERS WELCOME AT SHOP PREMISES Telephone 01-794 8751/7346
THOUSANDS OF ADDITIONAL ITEMS AVAILABLE, ENQUIRIES INVITED
LARGE SELECTION TESTED COLOUR PANELS POPULAR MODELS

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172 WEST END LANE, LONDON, N.W.6.

NEAR: W. Hampstead Tube Stn. (Jubilee) Buses 28, 159, C11 pass door
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	IN 10's	In 20's	GOOD WORKING in 10's
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GEC 2040	£25.00 each	£20.00	£48.00
BUSH 184	£30.00 each	£25.00	£50.00
THORN 3000 19"	£35.00 each	£30.00	£50.00
THORN 3000 25"	£28.00 each	£25.00	£50.00
THORN 3500 26"	£35.00 each	£30.00	£50.00
DECCA BFD - 30's	£35.00 each	£30.00	£50.00
KORTING	£35.00 each	£30.00	£50.00
TELPRO	£30.00 each	£27.00	£45.00

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@ £40.00 each

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@ £50.00 each.

OPENING TIMES MON-FRI 9.00-12.00/1.00-5.45 (CLOSE 4.30 SAT)

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BRIARWOOD

QUALITY SELECTED EX EQUIPMENT SPARES

MISC S/Output Trans. £1 + VAT + P&P
F/Output Trans. £1.25 + BAT + £1 P&P
Scancoils £1.50 + VAT + £1 PIP. Other spares available, please write or phone for details.

MONO TUNERS

6 button integrated all at **£4.00**
U.H.F. P/Button D/S **£3.50**. U.H.F. P/Button S/S **£4.00**. Rotary **£3.00** + £1 P&P

MONO TUBES

(tested)

19" Rimguard	£3.00
23" Rimguard	£4.00
20" Rimguard	£5.00
24" Rimguard	£6.00

+ £5.00 P & P

MONO LOPTS

All D/Standard Lopts at **£4.00** + £1 P&P.
All S/Standard at **£4.00** + £1 P&P.

MONO PANELS

i.e. Philips, Bush, etc. **£3.50** + £1 P&P.
Quotations for complete S/hand chassis if required. (Diff. prices)

PLEASE ADD 15% V.A.T. TO ALL ITEMS AND OVERSEAS AT COST. CASH WITH ALL ORDERS.

VALVES (MONO & COLOUR)

PCL82	0.10	30C1	0.10	PCC189	0.10	EF183	0.10	PL504	0.25	ECL80	0.10
PCL83	0.25	30C17	0.10	30C15	0.10	EF184	0.10	6/30L2	0.10	PL509	1.00
PCL84	0.10	PCF802	0.10	30C18	0.25	6BW7	0.10	30PL1	0.25	PY500	1.00
PCL85	0.10	PCF805	0.25	PC97	0.20	EH90	0.10	30PL13/4	0.10	GY501	1.00
PCL86	0.10	PCF806	0.10	PC900	0.10	DY802	0.10	30FL1/2	0.25	PL508	0.50
PFL200	0.10	PCF808	0.25	EF80	0.10	PY800/1	0.10	ECC82	0.10	PCF200	0.50
PCF801	0.10	PCF80	0.10	EF85	0.10	PL36	0.25	ECC81	0.10	EY51	0.15

Please note there is 50p Postage and Packing per order.

WE DO NOT SELL RUBBISH AT BRIARWOOD TV

BRIARWOOD TV LTD (Export Division)

TEL: 0274-306018 FOR PRICES & FREIGHT DETAILS

COLOUR & MONO TV'S ALWAYS AVAILABLE FOR WORLDWIDE USE

Briarwood T.V. Ltd., have international experience in quality used T.V. supply. Fully tested & converted where necessary – by our experienced Export Division.

S/STANDARD COLOUR SPARE PANELS

	IF	LUM	CHROMA	VIDEO	CON	POWER	L/TB	F/TB
Bush 184	9.50	—	12.00	—	6.00	6.00	12.00	—
GEC Hybrid	6.00	6.50	9.00	—	5.00	—	—	12.00
Philips G6 S/S	9.50	—	10.00	—	5.00	—	—	6.00
Thorn 3000	6.00	6.00	6.00		5.00	15.00	15.00	6.00
Pye 691/693	6.00	6.00	8.00	—	5.00	—	15.00	5.00
Thorn 3500	6.00	6.00	6.00	6.50	12.00	15.00	15.00	6.00

Korting and other foreign panels available on request.

Postage & Packing £1.25

COLOUR TUBES

17"	£15.00
18"	£15.00
19"	£15.00
19" A49/192	£18.00
20"	£18.00
22"	£20.00
25"	£15.00
26"	£22.00

Plus P&P £6.00
New rebuilt tubes available on request.

COLOUR TUNERS

Bush	£5.00
GEC	£5.00
Philips G6 S/S	£5.00
Pye 691	£5.00
Thorn 3000	£5.00

Some new tuners in stock, can supply on request. Many Foreign Tuners also available on request. Plus P&P £1.

COLOUR LOPTS

Most Lopts available from £5.00. Both British & Foreign makers. Please ring or write.
P&P per Lopt £1.00

MISC.

S/Output transformer from £1.50.
F/Output from £1.25.
Scancoils from £5.00.
P&P £1.00
Other spares available on request.

THORN 1500 TUNERS

NEW SPECIAL OFFER AT £8.00

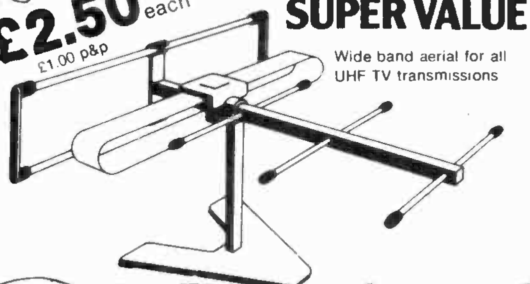
Postage & Packing £1.00

NEW PRODUCTS!

SUPER VALUE - SUPER QUALITY

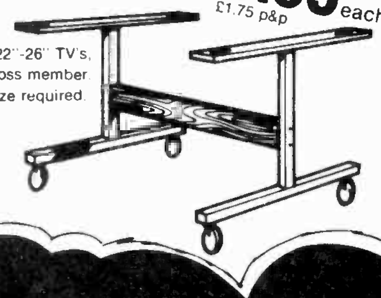
£2.50 each
£1.00 p&p

Wide band aerial for all UHF TV transmissions



£5.95 each
£1.75 p&p

Fits 22"-26" TV's, wood finished cross member. State size required.



P. V. TUBES

Telephone: Accrington (0254) 36521

REPLACEMENT ELECTROLYTICS

DECCA 30 (400/400/350V)	2.82
DECCA 80 (400/350V)	3.00
DECCA 100 (800/250V)	3.00
DECCA 1700 (200/200/400/350V)	4.60
PHILIPS G8 (600/300V)	2.11
PHILIPS G9 (600/300V)	2.11
PHILIPS G11 (470/250V)	2.58
PYE 691/7 (200/300/350V)	2.28
PYE 731 (60/300V)	2.20
RBM A823 (2500/2500/30V)	1.20
(2500/2500/25V)	1.10
RBM A823 (600/300V)	2.10
RBM Z146 (300/300/350V)	3.00
ITT CVC5/9 (200/200/75/25)	2.35
ITT CVC 20 (220/400V)	1.92
GEC 2110 (600/250V)	1.85
GEC 2040 (1000/2000/35V)	1.14
GEC 2040 (300/300/150/100/50)	3.90
THORN 3500 (400/40V)	26
THORN 950 (100/300/100/16/275V)	1.75
THORN 1400 (150/100/100/100/150/320V)	2.60
THORN 1500 (150/150/100/300V)	1.92
THORN 1500 (12/300V)	30
THORN 3500 (175/100/100/400/350V)	2.34
THORN 3500 (1000/63V)	62
THORN 3500 (1000/70V)	80
THORN 8000/8500 (2500/2500/63V)	1.47
THORN 8000/8500 (700/250V)	2.20
THORN 8000/8500 (400/350V)	2.44
THORN 9000 (400/400V)	2.90

WIREWOUND RESISTORS

PREFERRED VALUES

		price each
4W/6W		
	1R-1K5	16
	2K2-3K3	18
	4K7-6K8	20
	10K	25
7W		
	1R-4K7	18
	5K6-12K	21
	15K-22K	20
11W		
	1R-6K8	18
	10K-15K	21
	22K	24
17W		
	1R-10K0	27
	15K-22K	28

RESISTORS

A range of the following at Preferred Values

		Price per 10 pack
0.25W		20p
0.5W	3R3 to 8M2	20p
1W	10R to 10M	36p
2W	10R to 150K	62p
2W	10M	62p

MIXED DIELECTRIC CAPACITORS

Volts DC		
600V	0.1 mFd	38
1000V	0.01 mFd	20
	0.047 mFd	29
	0.1 mFd	32
	0.22 mFd	48
	0.47 mFd	75
1250V	0.1 mFd	45
1500V	0.0022 mFd	19
	0.0047 mFd	20
	0.022 mFd	24
	0.033 mFd	59

SKELETON PRESET POTENTIOMETER HORIZONTAL and VERTICAL

MINIATURE price each 12
100R-220R-470R-1K0-2K2-4K7-10K-22K-47K-100K
220K-470K-1M0

STANDARD price each 12
100R-220R-470R-1K0-2K2-4K7-10K-22K-47K
100K-220K-470K-1M0-2M2-4M7

'MIDGET' CONTROLS

Insulated spindle length 44mm.

LESS SWITCH 39p
Log or Lin.
5K-10K-25K-50K-100K-250K-500K-1M

WITH D.P.S.T. SWITCH
Log: 5K-10K-25K-50K-100K 81p
250K, 500K, 1M, 2M
Lin: 5K-50K-500K

CAPACITORS

AXIAL TYPE

Volt	MF	Price	Volt	MF	Price
10	22	7		4.7	7
	47	7		100	19
	100	8		220	30
	220	11		470	38
	470	16		1000	53
				2200	85
16	1000	20	100	10	12
25	10	7		22	14
	22	7		47	19
	47	9		100	29
	100	10		220	35
	220	17	300	12	30
	470	22	450	1	23
	1000	36		4.7	28
	2200	46		10	28
	4700	80		22	56
40	22	9		33	82
50	500	38			
63	1	7	500V	1	30
	2.2	7			

SLIDER POTENTIOMETERS

Lin or Log			
470R	50p	4K7	50p
1K	50p	10K	50p
2K2	50p	47K	50p

MULTITURN POTENTIOMETERS

100K	
GEC/TCE	50p
PHILIPS G8	50p
DECCA/RANK	50p

THICK FILM RESISTOR NETWORKS

THORN 3500 (5 pin connection)	1.98
PYE 731 (6 pin connection)	2.29
THORN 9000 (Circuit Ref R704/7)	1.98

DISC CERAMIC CAPACITORS

High Voltage

8KV d.c.-12KV d.c.			
	22	180pF	22
39 pF	22	200pF	22
68pF	22	220pF	22
140pF	22	250pF	22
150pF	22		

CONVERGENCE PRE-SET POTS

	each
3 Watt complete with knob	
5R0-6R8-10R-15R-20R	35
50R-100R-200R-500R	35

METRIC CONVERGENCE POTS

Philips G8
5R-10R-20R-50R

TEST EQUIPMENT

Portable Oscilloscope	149.00
TF200 Frequency Metre	155.00
CRT Tester/Rejuvenator	150.00
LABGEAR Colour Bar/Cross Hatch	210.50
LABGEAR Pattern Generator (Pocket Size)	97.50

EAGLE PRODUCTS

Please send large S.A.E. for full EAGLE Catalogue.

Multimeters		
KEW 7N	2,000 opv	4.99
EM5	5,000 opv	8.95
EM10	10,000 opv	10.95
EM50	50,000 opv	19.95
EMC321 Carrying Case for above		2.90
Digital Meter TS1000		42.50
KHP 30N Measuring Probe (30kV) (E.H.T.)		29.95
T1206 2 Station Intercom.		5.95

EAGLE PRODUCTS

SE500 Headphones	3.25
SE540 Headphones with Volume Control	4.95
SE600 Lightweight Headphones	6.95

ELECTRONIC TUNERS AND ASSEMBLIES

NSF173 Replaces ELC	7.20
1043/05/06	
4 P/B DECCA/GEC/ITT	5.80
6 P/B DECCA/GEC/ITT	7.00
4 P/B PYE	9.00
6 P/B PYE	18.00
PHILIPS G8 Tuner	10.60
PHILIPS G8 Ass. (Square/Early)	13.60
PHILIPS G8 Ass. (Sloping/Late)	13.90
PHILIPS G9 Tuner	10.60
PHILIPS G11 Tuner	9.00
ITT/PYE/GEC 7 Button P/B	13.95
GEC 2110 6 way P/B	7.75
U321 UHF Tuner	9.00

SUNDRY TUNER ACCESSORIES

RANK Tuner Push Button 1½" × ½" dia.	30p
RANK Tuner Push Button 2" long × ¾ dia.	30p
RANK Tuner Push Button 2" long × ½" dia.	30p
GEC Tuner Neons 2110 chassis.	14p
Drive Cams	10p each

SWITCHES

4A Double Pole On/Off Switch General Purpose Push/push	82
Philips G8 Push On/Off Switch	1.38
4A Double Pole Rotary On/off	82
A1 Beam Switch (THORN 3500)	50
A1 Controls 5m (THORN 3500)	69
GEC 2110 A1 Control IM5 (Red, Blue, Green)	each 58p
GEC 2040 On/Off Switch	each 68p

THERMAL CUT OUT

THORN 3000 2A Metal	1.30
THORN 8500 2.5 Plastic	1.30
GEC 2040 Metal	2.24

PYE LABGEAR

CM6001 Power Unit (16V or 24V)	11.75
CM6019/WB UHF Masthead Amp(ch21-68)	8.58
CM6040/WB UHF Masthead (ch21-68)	18.06
CM6020 Power Unit (16V)	10.20
CM7025 UHF High Gain M.H.A. 24V (specify group A, B or CD)	14.91
CM7061 Power Unit (12V)	10.84
CM7065/WB VHF/UHF M.H.Amp (12V)	12.80
CM7073 VHF/UHF Dist Amp (8+1)	37.00
CM7053 'Behind the set' UHF Amp. (mains)	10.73
CM7043 'Behind the set' 2nd Set Amp (UHF-2 outputs)	10.06
CM6006 UHF 6 way Passive Splitter	10.72
CM7042 TV Games Combiner	3.31
CM9003 Flush Mount Single Outlet Isolated	1.75
CM9009 Flush TV/FM Diplex Outlet Isolated	3.00
CM7069 Tri Star Amplified Set Top Aerial (ch21-68) UHF	17.60
CM6038 VHF/UHF 625 TV Patt Generator	97.60
CM6052 UHF/VHF Pal Colour Bar Generator	210.50
7056 **TELETEXT ADAPTOR** (Converts any set to remote)	206.00
AMPLIFIED CARAVAN AERIAL (All Channels)	18.50

FUSES

	Pack of 10
1¼" QUICK BLOW	
100ma	48
250ma-500ma-750ma-1A	49
1.5A-2A-2.5A-3A-5A	40
1¼" ANTISURGE	
250ma, 500ma 600ma, 630ma, 750ma, 850ma, 1A, 1.25A	
1.5A, 2A	1.41
2.5A, 3A, 5A	2.18
20m ANTISURGE	
80ma	3.11
100ma, 160ma, 200ma	2.08
315ma, 500ma, 630ma, 800ma, 1A, 1.25A, 1.6A, 2A	1.07
2.5A, 3.15A	1.43
20mm QUICK BLOW	
100ma	45
250ma, 500ma, 630ma, 800ma,	37
1A, 1.25A, 1.6A, 2A, 2.5A, 3.15A, 5A	37
1" MAINS	
2A, 3A, 5A, 10A, 13A	84

MAINS DROPPERS

DECCA 20	2.20
R.B.M. A823	77
R.B.M. 161	85
GEC 2000/2018	70
GEC27840	64
PYE 713/15 3R5/15/45R	1.45
PYE 725/31 3R0/56R/27R	84
PYE 725 56R/27R	82
PHILIPS 50501	88
PHILIPS 210/50511/LINK	64
PHILIPS G8/50832	65
PHILIPS G8 47R section	39
THORN 1500	95
THORN 3500	75
THORN 8000	28
THORN 8500	86

SUNDRIES

ANTIFERENCE Super Set Top		6.80
ANTIFERENCE Car antenna		7.80
ANTIFERENCE Xtra Boost UHF Amp		15.40
ANTIFERENCE SB11 Splitter		2.40
Surface Mounting Aerial Outlets		80
Cable Clips	per 100	1.18
Transductor 90°		2.08
EHT Final Anode Cap		53
Delay Line CTAV 82/DL50/5DL141		2.20
EHT Cable 30kV		25p per mtr.
Coax Plugs	pack of 10	1.80
Focus control GEC/THORN		1.83
PVC Tape		35
FM Plugs		25
PL259 Plugs		40
DECCA 30 Series width control		50
DECCA 3 9R Modulohm		48
KEW Pocket Size 1000 OPV Meter		4.99
Line Connectors		35
6.3V CRT boost trans.		4.36
ANTIFERENCE XG8 High Gain Aerial (State Channel)		17.00
Reducers for PL259		16

N.B We have a full range of aerials and accessories available from the trade counter.

SOLDERING EQUIPMENT

WELLER Iron Kit 15W	3.80
WELLER Iron Kit 25W (inc. tips)	4.89
WELLER Iron 25W	3.80
WELLER 3/16" Single Flat Tips	51
MIN Soldering Iron	5.00
WELLER Heat Gun Kit	14.00
WELLER Heat Gun	11.00
(Pair) Tips for Gun	36
WELLER Cordless Iron	24.78
ANTEX Soldering Iron 25W	4.89
Solder Remover Sucker	6.60
Solda Mop	70
500G Reel Solder	7.00
DIY Type Solder	43
250G Solder	3.50

DATA BOOKS

Transistor Equivalent	
TVT 80 A-Z only	3.25
TVT 80 2N/2S series only	3.60
TVT 80/80 A-Z and 2N/2S together	6.50
LIN IC Books LIN 1	5.60
LIN 2	5.50

SERVICE AIDS

SERVISOL Freeze-It	60
SUPER SERVISOL	75
SERVISOL Foam Cleanser	70
SERVISOL Plastic Seal	68
SERVISOL Silicone Grease	78
SERVISOL Tubes Silicone Grease	1.60
SERVISOL Aero Klene	83
SERVISOL Aero Duster	76
SERVISOL Excel Polish	52
Penetrating Fluid	70
Fire Extinguisher 640G	1.86
Heat Sink Compound 25G	1.00
Silicone Rubber Tube	1.90

ELECTROLUBE PRODUCTS

Electro-Mech lubricant	1.39
Elect. cleaning solvent	1.50
Freezer	1.39
Foam cleanser	1.00
Heat transfer compound	1.07
Silicone compound	1.61
Special contact fluid (Snorkel)	2.07
Permagard	1.43
Elec mech lubricant pen	69

HOW TO ORDER

Add 15% VAT to all Prices.
Add 75p per order P&P – First Class Mail is used whenever possible.

For orders of very small odd items, i.e. IC's, Trans, diodes, – Customers need send only 30p.

For Aerosol's please add 30p per can. (These are very heavy!)

Orders over £25 before VAT are Post Free except when the order contains AEROSOLS.

Carriage on Tubes is as stated on list

ALL ENQUIRIES SAE PLEASE

VAT invoice on request.

We do regret any postal increases but we try our best to give a speedy, and efficient service, at a fair price.

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	1.85
AF181	1.33
AF186	1.48
AF202	0.27
AF239	0.73
AF240	1.40
AF279S	0.91
AL100	1.30
AL103	1.58

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	0.15
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*	0.39
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	1.06
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*	0.43
BF254	0.48
BF255	0.58
BF256L*	0.49
BF257	0.44
BF258	0.52
BF259	0.54
BF262	0.73
BF263	0.88
BF270	0.47
BF271	0.42
BF272A	0.80
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	0.65
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
BR303	1.06
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	3.35
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
BUY77	2.50
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
ME0404/02	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	0.44
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	0.60
TIP31A	0.51
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	0.23
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	0.66
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	0.16
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
2SB337BP	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 (£)
BRC1330	0.93
CA810QM	2.44
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
MFC4008	0.86
MFC4060A	0.98
MFC6040	1.11
MFC8020A	1.10
ML231	3.57
ML232	3.57
NE555	0.72
NE556	1.34
NE566	1.95
SAA1024	5.70
SAA1025	10.35
SAS560A	2.01
SAS570	2.01
SC9503P	1.40
SC9504P	1.38
SL414A	1.91
SL432A	2.52
SL450	5.10
SL901B	4.20
SL917B	5.60
SL918A	5.95
SN72440N	2.21
SN76001N	1.67
SN76003N	2.20

Type	Price (£)
SN76003N	3.32
SN76013N	2.52
SN76023N	3.02
SN76023ND	2.52
SN76033N	3.32
SN76023ND	1.40
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	1.89
TAA621AXI	2.33
TAA630Q	3.91
TAA630S	4.18
TAA661A	2.39
TAA661B	1.75
TAA700*	2.80
TAA840	3.38
TAA861A	0.95
TAA930A	1.43
TAA930B	1.43
TAA960	3.20
TAA970	2.81
TAD100	2.66
TBA120A	0.90
TBA120S*	0.99
TBA120SA	1.02
TBA231	1.12

Type	Price (£)
TBA240A	3.98
TBA281	2.07
TBA395*	2.58
TBA396	2.40
TBA400	2.20
TBA4800	1.84
TBA500*	2.21
TBA510*	2.21
TBA520*	2.98
TBA530P	2.24
TBA540*	2.88
TBA550*	3.13
TBA560C*	3.18
TBA570*	1.29
TBA611B	2.68
TBA641	2.55
TBA641A12	2.55
TBA641B11	2.90
TBA651	2.42
TBA673	2.31
TBA700*	2.50
TBA720AQ	2.38
TBA720Q	2.38
TBA750*	2.18
TBA800	2.05
TBA810AS	2.00
TBA920*	2.80
TBA940	3.52
TBA950	2.08
TBA990*	2.90
TCA270A*	3.55
TCA280A	1.43
TCA290A	3.46
TCA420A	2.10
TCA440	1.67
TCA640	4.26
TCA650	4.26
TCA660	4.26
TCA730	4.10
TCA740	4.04
TCA750	2.53
TCA760	1.52
TCA820	3.29
TDA440	4.16
TDA1003	1.68
TDA1004	2.73
TDA1005	3.04
TDA1022	6.89
TDA1024	0.97
TDA1034	2.98
TDA2610	2.86
TDA2640	2.86
ZN414	1.45

* Indicates Q version is also available.

DIODES

Type	Price (£)
AA113	0.17
AA119	0.21
AA129	0.28
AA143	0.18
AAY30	0.28
AAZ13	0.42
AAZ15	0.35
AAZ17	0.28
AY102	3.85
BA100	0.24
BA102	0.36
BA104	0.19
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
BB104B	0.52
BB105B	0.33
BB105G	0.30
BR100	0.40
BY100	0.35
BY103	0.35

Type	Price (£)
BY114	0.60
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
ITT44	0.08
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
IN4007	0.12
IN5400	0.15
IN5401	0.17
IN5402	0.20
IS920	0.09
IS921	0.11

ZENER DIODES

400mW plastic	3.0-75V	14p each
1/1.3W plastic	3.3-200V	18p each
1.5W flange	4.7-75V	£1.26 each
2.5W plastic	7.5-75V	67p each
20W stud	7.5-75V	£1.31 each
75W stud	7.5-75V	£7.95 each

VDR's, etc.

Type	Price (£)
E295ZZ	
/01	0.28
/02	0.28
E298CD	
/A258	0.25
E298ED	
/A258	0.22
/A260	0.22
/A262	0.22
/A265	0.22
/P268	0.22
E298ZZ	
/05	0.25
/06	0.22
E299DD/P116-P354	all 0.23
E299DH	
/P230	0.72
R53	1.75
VA1015	0.92
VA1026	0.79
VA1033/34/38/39/40/53	all 0.20
VA1055s/56s/66s/67s	all 0.23
VA1074	0.20
VA1077	0.31
VA1091	0.29
VA1096/97/98	all 0.20
VA1103	0.32
VA1104	0.66
VA1108/09/10/11/12	all 0.24
VA8650	1.20
2322 554 02221	0.59
2322 662 98003	0.88

VALVES

Type	Price (£)
DY86/87	0.75
DY802	0.75
ECC81	0.78
ECC82	0.95
ECC83	0.78
ECH81	0.83
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
PC84	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	2.00
PCL82	0.93
PCL83	1.12
PCL84	0.65
PCL86	1.27
PCL805/85	1.00
PD500	3.75
PFL200	1.40
PL36	1.20
PL81	0.94
PL84	0.79
PL504	1.50
PL508	1.85
PL509	3.10
PL519	3.10
PL802	3.25
PY81/P810	0.60

BRIDGES

Rating	Price (£)	Rating	Price (£)
1½A 50V	0.27	2A 100V	0.36
100V	0.28	200V	0.40
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
1000V	1.20	1000V	0.95

10A and 25A ranges also stocked.

RESISTORS

Carbon Film (5%)

	Ea	10 of one value	Mixes of a minimum of 10pcs of any value: 50pc	100pc	500pc
¼W 5.6Ω-330kΩ (E12)	3p	25p	95p	£1.49	£5.40
½W 10Ω-10MΩ (E24)	3p	25p	95p	£1.49	£6.40
1W 10Ω-10MΩ (E12)	5p	45p	£1.95	£3.40	£15.25
2W 10Ω-10MΩ (E6)	9p	80p	£3.60	£6.40	£26.90

Wirewound (5%)

2½W	0.22Ω-270Ω	18p
4W	1.0Ω-10kΩ	22p
7W	0.68Ω-22kΩ	24p
11W	1.0Ω-22kΩ	28p
17W	1.0Ω-22kΩ	33p
Vertical mounting pillars		3p

Presets (†)
0·1W (Vertical and Horizontal)
100, 220, 470Ω, 1, 2·2, 4·7, 10, 22, 47, 100, 220, 470kΩ, 1, 2·5, 5MΩ all 14p each
0·2W (Vertical and Horizontal)
Values as 0·1W all 14p each

FUSES (all packs of 10)

20mm Time Delay (BEAB)

40mA	£3.68
50, 63mA	£2.55
100mA	£1.86
160, 200, 250mA	£1.44
315, 500, 800mA, 1, 1.25, 1.6, 2, 2.5, 3.15, 5A	all £1.19

20mm quick-blow (BEAB)

100mA	68p
200, 250, 315, 500, 630, 800mA, 1, 1.25, 1.6, 2, 2.5, 3.15, 5A	all 56p

2A circuit breakers metal £1.52, plastic £1.48

LABGEAR (Details of full range on request)

TELETEXT ADAPTOR 7056. An amazing box which can be used with any UHF Receiver. £213 + £2.25 P&P + VAT. – ask us for a fully descriptive brochure.
VIEWDATA ADAPTOR 7050. Prices and details on request.

COLOUR BAR GENERATOR
CM6052/DB. VHF/UHF gives standard 8 band colour bars + variable tuning + front panel on/off switch + sync trigger output + blank raster + red raster + crosshatch + greyscale stepwedge + colour bar + centre cross + dot pattern + centre dot. **£223.37**

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2n2F	600V AC	24p	15nF	300V AC	30p
3n6F	1700V DC	60p	22nF	300V AC	32p
4n7F	1500V DC	60p	100nF	1000V DC	46p
10nF	1000V DC	22p	470nF	1000V DC	60p

H.V. Disc Ceramic (†)

1kV	1.5nF	18p
3kV	1.5nF	20p
8kV	10, 22, 47, 82, 100, 120, 150, 180, 200, 220pF	30p
8kV	270, 300pF	39p
10kV	1nF	67p

MULTIMETER
20,000 OPV
AC Range 3-900
DC Range 0·6-1200
Complete with rechargeable batteries.
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CONVERGENCE POTENTIOMETERS
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VHF to UHF CONVERTER CM6022/RA. "Televerta" for DX-ing or uhf receiver use on relay systems, Eire etc. †£28.37

TELEVISION

Time to beat the drum

Here we are with National Teletext Month and you'll all be doing your bit, won't you? – talking teletext and so on. That's the idea anyway, and why not? Teletext certainly seems to need every assistance possible in being put over to and getting accepted by the public. According to a recent survey for example, many people believe that an extra fee has to be paid to receive teletext. There's much confusion between teletext and viewdata, which is understandable but doesn't help matters – and things will get worse if articles about different teletext standards add to the general puzzlement. Whilst it might be reasonably simple to correct misconceptions such as these by talking teletext, the problem of actually selling teletext remains.

For a start teletext is basically an information service, and despite all the glib talk about the information age there are limits to the amount of information people want or need. Then you've either to buy a new set or an adaptor. So there are the problems of cost and motivation. The price differential between teletext (with remote control of course) and non-teletext (no remote control) sets has been considerable in the past – around £325 in 1978. The differential has now fallen to a much more acceptable £130 (£70 for remote control, £50 for the decoder), and will fall further as the prices of sets of teletext decoder chips decreases. But how often do people change sets, especially now that they are so reliable? Adaptors are reasonably priced and work well, but there tends to be some resistance to little boxes that stand atop the TV set, as those of us who recall the early days of Band III know all too well.

One comes to the conclusions that strong motivation is required to pay out the extra £100 or so, and that the process of increasing the market penetration of teletext sets is likely to be slow since it will tend to be geared to the replacement market. Progress to date has not been negligible however. The figures for sales/rentals of teletext equipped sets/adaptors have been roughly as follows:

1977	2,500
1978	7,000
1979	30,000
1980	80,000
1981	300,000 (target)

That targetted increase for 1981 is based on the expectation that the publicity etc. associated with National Teletext Month will have a significant effect – in fact the government has already given the bandwaggon a welcome push by halving the minimum down payments for hire purchase/rental. To double or treble sales/rentals year on year as has already been achieved is good going, and looks feeble only if considered in terms of total TV set placements or of course in comparison with the VCR boom. The later emphasizes the point that whilst VCRs are mainly about entertainment, teletext is about information, a situation one can't see being altered much despite the provision of novel subject matter on some teletext pages.

Information available brings us to the number of lines used for teletext transmissions – two per field so far for Ceefax and Oracle. It's welcome news that Oracle (ITV teletext – Oracle has never seemed a very attractive tag from a sales point of view) is to start using four lines later this autumn, one of the aims being to introduce regional news. Oracle has also started to carry advertisements – at £400 per page per week, or £200-£300 for part of a page, the rate depending on whether the advertiser chooses the page on which his advert is to appear. One might wonder who on earth would ever call up complete advertisement pages, but they could prove popular for holiday ads and the like. More lines will help by increasing the amount of information available and reducing the time taken to gain access to particular pages.

How do you spot the most likely teletext user as he comes into your shop? Well according to a survey carried out recently by Philips he's fairly young, male, affluent and TV-orientated. It seems that teletext is still looked upon as an up-market product, and the problem here is that those with plenty of money don't watch much television. All of which emphasizes once more the difficult problem of the teletext sales pitch. There is also the fact that teletext is an active rather than a passive medium. You have to *use* it – to select your page, call it up and then read it. Shoving a cassette in the VCR and sitting back is not the same thing at all: the cassette will usually present the same sort of thing you'd have watched anyway (or maybe gone to the cinema to see).

What to emphasize then? Well, there's a lot of information on tap, it's constantly updated, and it's free! If it's there for the asking, why not have it? See what you can do!

Teletopics

NEW UK SETMAKER

A TV receiver assembly plant has been set up by Network Industries, a newcomer to the domestic TV field, at Wibsey, Bradford, W. Yorkshire. The initial product is a 12in. monochrome portable which uses a Korean tube, a board made in the Far East and assembled in Turkey, and a moulded cabinet produced by a Plessey subsidiary in the UK. Plans are to install automatic board assembly plant and increase production to 160,000 sets a year, following up with a 14in. colour set which would be produced at a rate of around 40,000 sets a year. The monochrome portable and prototype versions of the 14in. colour set were on show at the recent Harrogate International Festival of Sound.

Network's £2 million plant has been set up with aid from the Bradford Economic Development Unit and a £0·25 million City Council mortgage. The monochrome portable is expected to sell at around £60-£65, while the colour set should sell at around £200.

With Fidelity now active in these fields and Decca/Tatung talking about expansion plans, the UK's TV industry seems to be taking on a new lease of life. Thorn report continued success with their TX series sets, the latest export order coming from Greece – for dual-standard PAL/SECAM sets based on the TX10 chassis. The sets will be supplied in kit form for assembly in a new factory at Attiki near Athens. It's the first time that a dual-standard (PAL/SECAM) version of the chassis has been produced, and prototypes are at present undergoing extensive field tests in Greece.

PUBLIC PRESTEL

An experiment is to be conducted, with government aid, to discover how Prestel can best meet the needs of the general public. Forty sets will be installed in public buildings in Brighton, Gateshead and Kingston-upon-Thames to assess possible use by individuals rather than businesses etc.

Prestel is undoubtedly too expensive for general domestic use. The benefits of the information available in British Telecom's computers could however be made available through public Prestel installations.

PHILIPS SURVEYS TELETEXT

Philips have issued a report summarizing the conclusions reached after a three year research programme into teletext. This involved an in depth investigation into users' needs and reactions and a more recent check on the general public's awareness and understanding of teletext. The latter shows that much remains to be done. A series of 2,000 short interviews showed that whilst 80% of those interviewed were aware of the basic idea of transmitting pages of text on television, only a quarter of these understood the service, over half said they didn't know much about it whilst a further quarter claimed to understand teletext but in fact got it wrong.

User satisfaction on the other hand seems to be high: 34% found it extremely useful and said they wouldn't be without it, 41% found it most useful and 20% found it quite useful as a second source of information to a paper etc. Only 5% regarded it as a seldom used luxury. Teletext was used on average 77 times a week, the average time spent watching teletext being 116 minutes a week. The number of different pages watched per week was 29, indicating that for many users there are several key pages they consult many times a week. About 70% of users experienced interference, though it appears that this is generally a short-term intermittent problem that's not regarded as a major irritation.

Deliveries of teletext equipped sets to the trade during the first quarter of this year were 177% up on the equivalent period last year.

THE NEW DECCA CHASSIS

We've been taking a look at the circuitry used in the new Decca/Tatung 120/130 series chassis, which follows the modern trend with UK designs – a single main panel, low component count and low power consumption. Most of the circuitry is packed into a handful of i.c.s. On the signals side there's the now conventional TDA2540 i.f. chip, a TDA3190 intercarrier sound/audio i.c., and a μPC1365C colour decoder chip. A SAWF and single-transistor (type BF959) preamplifier couple the output from the tuner to the i.f. i.c. The RGB output circuits are of the cascode class A variety, with background level stabilisation which is coupled to the beam limiting – this section is on the c.r.t. base panel. On the timebase side there's a TDA2576A sync processor chip, a TDA1170 field timebase chip and a BU500 transistor line output stage with a separate e.h.t. tripler. Perhaps the most interesting feature however is the power supply, which is of the self-oscillating chopper type using a BU426A transistor: most of the control circuitry is incorporated in a new i.c., type TDA4600. A series of articles describing the chassis starts next month.

FUTURE TV SERVICES

TV4, which is due to start in November 1982, is likely to remain on air later than the present BBC/ITV services, with a close down at around 2 a.m. on two or three nights a week. The normal close down will be at 12·30 a.m. Chief executive Jeremy Isaacs is reported to have said that he's not "absolutely overwhelmed by the innovative nature of the programme submissions" so far received from independent producers and the present ITV companies.

The BBC would like to see satellite TV transmissions in operation by 1986, and hopes to lease a satellite channel.

RTE MUSEUM OF BROADCASTING

The Radio Telefis Eireann Museum of Broadcasting (27 Lower Rathmines Road, Dublin 6) has been officially opened. Radio Eireann started broadcasting on New Year's Day 1926, Telefis Eireann commencing operations on New Year's Eve, 1961. The corporate name Radio Telefis Eireann was adopted in 1966. The Museum traces the history of radio and television to the present day, with equipment, photographic displays, sound archives and a recreation of Studio 3 on the night that television broadcasting in Eire started – the studio setting is complete with cameras and vision and sound monitors. The items on display have come from within RTE and from donors nationwide, and go as far back as early trans-Atlantic cables dating from 1858.

The Museum grew from the hobby and personal interest of its Curator, Paddy Clarke, who has restored to working order most of the early sound items on display: it's at present housed in interim premises, the plan being to move eventually to the RTE headquarters at Donnybrook. Individuals and groups can make appointments by 'phoning RTE at 01 693111 ext. 2053 or by writing to the address given above.

NEW MULLARD LINE OUTPUT TRANSISTOR

Mullard have introduced a new line output transistor, type BU508A – it's an up-dated version of the BU208A with the advantage of a simple, low-cost mounting. The BU508A's SOT-93A package can be clip mounted, using only one or two mounting accessories (the BU208A requires up to thirteen accessories). The BU508A has a higher maximum d.c. collector current rating at 8A, though the recommended operating current for both devices is 2·4·5A. The two transistors are otherwise electrically identical.

LATEST VCRs

Sony are apparently making a comeback in the US market with a completely redesigned Betamax VCR. The new machine has front loading and is just over three inches high. Instead of belt drive there are six small motors – the reel drive motor is so small that it fits into the spindle!

In the UK, Mitsubishi have introduced two new VHS machines, Models HS310 and HS302. The HS310 replaces the HS300 and retains all the features of that machine plus a nine-programme/14-day timer and an infra-red remote control handset which fits into a slot in the machine's front panel. A retail price of around £650 is suggested. The HS302 is a "basic" machine with a one-programme/14-day timer and cable remote control. The suggested price is £550.

TELETEXT DEVELOPMENTS

Advertising on ITV's Oracle teletext service started on September 1st – 15% of the pages have been made available for advertising use, the aim being to make the operation self-financing. The use of two extra lines per field for teletext transmissions is at present under test in the Anglia region and is expected to be adopted later in the autumn – this will involve a restructuring of the Oracle page numbers. An experimental regional service is to open in the Scottish Television central region during the autumn: Channel TV will start "some time" later and a full regional service is expected to be in operation by 1984/5.

INTERNATIONAL NEWS BRIEFS

Philips are to start manufacturing small-screen colour tubes in Austria – this will be the first European source of such tubes.

One of the major Korean TV manufacturers, the Gold Star Company, is to start producing colour TV sets in the USA. The plant will be in Alabama, and sets are due to start coming off the lines next July.

VCR BOOM CONTINUES

Estimates of the likely number of VCR sales/rentals in the UK this year are constantly being revised upwards, and now range from 750,000 (City brokers W. Greenwell and Co.) to one million (Mackintosh Consultants). This compares with a figure of around 400,000 for 1980. One of the problems with forecasting at present seems to be the fact that demand exceeds supply – the market is said to be "supply led" – making it difficult to assess the market potential. Apparently Thorn did twice as much business with VCRs in June, on the run up to the Royal Wedding, as they did with TV sets.

Present demand seems to be so great that Japanese manufacturers are diverting production to the UK from other markets – this could explain why VCRs sell at comparatively higher prices in the UK than in the USA. Rental has certainly helped to boost interest, accounting for 70% of VCR placements. 1982 is expected to see a further increase in VCR sales/rentals.

HOME COUNTIES ATV GROUP

A number of amateur television (ATV) enthusiasts have formed a local group for the home counties, with the objects of promoting interest in ATV, arranging demonstrations and lectures for the public and other amateur radio organisations and helping those wishing to become involved. The group will be holding meetings on the fourth Wednesday in each month at The Swan Hotel, High Street, Iver, Bucks (Iver is about twenty miles west of London), starting at 8 p.m. All those interested in amateur television are invited to attend. Further details can be obtained from the acting chairman John Betts (G4HMG) on 0753 651652 or the acting secretary Mike Sanders (G8LES) on 01-398 4618.

VIDEO DISC DELAYS

As we go to press Philips are still being non-committal about the exact date for the launch of their LaserVision disc system in the UK. The problems are understood to relate to the yields obtained from the pressing plants. Meanwhile JVC in Tokyo have announced that there will be some slight delay in the launch of the VHD disc system, which is now expected to be given a world wide launch in mid-1982. The delay in this case appears to relate to achieving compatibility between the three world colour TV standards (it seems that NTSC is the problem!).

NEW TUBE TESTER/REACTIVATOR

Sinclair Electronics have announced the introduction of the Leader LCT910A c.r.t. tester/reactivator on the UK market, at a price of £145 plus VAT, including a range of sockets covering most current tubes. The LCT910A can be used with both monochrome and colour tubes and provides easy measurement of tube condition, reactivation, and provision for clearing shorts. Colour tube guns can be dealt with separately, and gun tracking can be checked. The tester is housed in a briefcase-type carrying case which is handy and provides good protection.

VIDEO STILL CAMERA

Sony have announced details of development work on a project to produce a colour video camera which could replace the conventional chemical-film still camera. The images are stored on reusable magnetic discs: each holds fifty pictures which can be played back via a TV set or printed separately – work on the printer is at an early stage, though the camera itself has been proved and demonstrated. The system seems on the expensive side – £460 is the price envisaged for the camera, though a 50-picture disc would be only £1·40. The system is expected to become available commercially in about two years' time. Film companies, including Kodak and Polaroid, are understood to be working along similar lines.

VCR Clinic

Derek Snelling

Hitachi VT8500

WE'VE had a couple of interesting faults on Hitachi VT8500s recently. The complaints with the first were no colour on playback and no visual search in the reverse direction. As colour problems don't come along all that often, I decided to tackle this fault first. After going round in circles with a scope and a meter for about half an hour however I found myself coming to the conclusion that the machine was in fact o.k. and that I'd become colour blind – everything seemed to check out all right. So I decided to deal with the other fault and come back to the colour one later.

On selecting forward visual search the machine worked, but when reverse visual search was selected the tape stopped and gave out a tortured scream. On removing the cassette housing and operating the machine without a tape the reason for this became apparent – whilst the supply reel began turning to pull the tape backwards on reverse search, the capstan motor continued to go forwards. A check at pin 4 of the microprocessor i.c. (IC901) showed that the reverse signal was coming out and a further check revealed that it was reaching the visual search board. It was not coming out of this board however. In addition, whilst the review output was present on review and absent on cue, the cue output was present all the time, including during play, though slightly low. Further checks revealed that gate one of IC1105 was faulty, giving an output regardless of its inputs. It was also providing a voltage at one of its inputs (pin 2) via an internal fault. This was preventing the output of invertor one in IC1106 going low to reverse the capstan motor. Replacing IC1105 cured the problem – and also cured the colour fault. The only reason I can think of for the latter is that the capstan speed was off during playback.

The second VT8500 exhibited the symptoms of being dead apart from the clock. The first thing to do in cases like this is to check the presence or absence of the 18V, 15V and 9V supplies on the main system control board. In this case we had 18V but no 15V and 9V supplies (the latter is derived from the 15V supply). This didn't necessarily mean that the fault was in the power supply however, since the 15V rail is switched on and off by pin 2 (power control) of the microprocessor. Checks here showed that although switching the operate switch on and off fed a voltage to pin 41, the voltage at pin 2 didn't change. So either the i.c. was faulty or something was preventing it operating normally.

Having had problems with the reset circuit before, we scoped the reset input. This appeared to be normal, so we carried out some voltage checks. These quickly revealed that there was no 5V supply to the i.c. due to ZD055 being short-circuit (it just shows – you should check the obvious things first!). How we were getting an output from pin 2 with no supply I don't know. Unfortunately, replacing ZD055 and switching on again produced the same symptoms – apart from a click from the solenoids at the moment of switch on. Checks showed that the 5V supply to the i.c. was now present, but the output at pin 2 was still unaffected by the operate switch. We decided to disconnect pin 2 so that the power supply would operate (the output from pin 2 turns on Q051, which shunts the zener diode for the 15V supply). We now had the operate and channel lights on and, significantly, a flashing stop light. This is supposed to occur when the dew sensor detects condensation. The output goes to pin 33 of the i.c., and a check here showed that there was a voltage present. By disconnecting the various feeds to this pin one by one we finally tracked the fault down to D920, which is connected between this point and the 5V rail – it was short-circuit. The machine was restored to normal working after replacing this diode and reconnecting pin 2.

Bodgers Again

When I moved to video I thought I'd be leaving the world of bodgers behind. It seems however that video has opened up whole new fields for tampering by the customer and his friends. The latest example we had was a Panasonic NV8600 with the complaint of lines on the picture. Switching on and playing a tape produced a few seconds of poor monochrome picture, then the machine appeared to go into the pause mode, the tape stopping and the picture freezing, with a large band of noise on it (the lines on the picture?). I say appeared to go into the pause mode because on this machine when pause is selected the picture is normally blanked out.

The first thing I noticed on removing the top was a short black wire attached to one of the terminals of the pinch wheel solenoid, the other end just floating. If this free end was touched to chassis (the only place it would reach), the machine began working normally, though in black and white. As the picture quality was poor, I decided to check the heads before going farther – an estimate was required. The heads were badly worn and whilst checking I noticed that the drum was fitted 180° out of position. Having read Steve Beeching's comments on this situation not so long since, I realised that it was probably the reason for the monochrome picture.

It was pretty obvious by now that the machine had been tampered with, but as the machine appeared to work all right with the pinch wheel solenoid in operation we decided that the only major fault was the heads. So an estimate for this and a couple of hours' labour was presented to the customer, along with a note saying we believed that the machine had been tampered with. A few days later the estimate was accepted, to everyone's surprise, and work commenced. First the new head drum was fitted the right way round, then attention was turned to the pause problem. With VCRs, if the machine switches off after a few seconds the cause is usually the absence of pulses from the take-up reel. In this machine these pulses are obtained from a pulley on the counter spindle, and checking here revealed that the belt from the take-up spool to the counter had come off. Replacing this solved the problem. Why however did the machine go into the pause mode rather than stop as it should have done?

At this point I noticed, while rewinding the tape, that both the counter memory and the tape end sensor seemed to be inoperative. Now the common denominator of these three problems is the stop solenoid and its drive circuitry, so I decided to check around here. It didn't take long to discover that the stop solenoid had in fact been unplugged from the mechacon board: reconnecting it finally got the machine going properly. As far as I can see the sequence of events must have been that the counter belt had come off and, unable to sort it out, whoever was messing about had disconnected the stop solenoid. As this didn't completely solve the problem he'd then earthed one end of the pinch

wheel solenoid by means of the added black wire. What I can't see is how the head drum came to be the wrong way round!

Ferguson 3V22

A common fault seems to have appeared in our area with the Ferguson 3V22. Whether it's a batch problem or something more general I don't know. We've had five of these machines in as many weeks with the complaint that the customer stopped the tape but was unable to eject it – in fact none of the keys except stop could be depressed. This usually means that the machine has failed to unload properly, as during the unload sequence all the keys are disabled.

The first problem is to get the top off, as with the Ferguson 3V22 the cassette compartment needs to be in the up position. The way to do this is to remove the two top screws and tilt the top up as far as it will go, then insert a screwdriver in the left-hand side and remove the two screws securing that side of the cassette compartment lid. The top can then usually be removed, but if necessary take out the two right-hand lid securing screws.

On removing the top of the first machine to come along we found that the loading sequence appeared to be complete but the head was still rotating. So, thinking that the loading mechanism was stuck just short of completion, we gave it a prod with a screwdriver (see later). The head then stopped and the keys became functional. Further operation of the machine revealed no problems, so after extensive testing it was returned to the customer.

A week later the machine came back with the same symptom. This time we noticed that there was some play on lever 1 in direction B (see Fig. 1). Further close inspection revealed that the securing screw had come out. To replace this involves removing the spring, the two circlips arrowed, and pushing levers 2 and 3 aside. We've had four more cases of this fault since the first one, and have found that to free the mechanism in order to remove the tape and carry out the repair lever 1 should be pushed in direction A with a screwdriver and released sharply, repeating if necessary. The screw is usually to be found lying by the lever, but if it has fallen into the machine it's essential, when refitting, to make sure you've a screw, a shakeproof washer, a plain washer and a spacer. The latter is most important as without it the lever won't move freely. A spot of screwlock or similar is a good idea.

Foreign Bodies

I'm building up a nice collection of things found in VCRs. We've had a Ferguson 3V22 that wouldn't lace up due to part of a Cindy doll gramophone in the mechanism, another of these machines with a similar fault due to a piece of lego, and a third whose cassette compartment wouldn't go down with or without a tape due to a 2p piece. The worse case however (from the customer's point of view) was an Hitachi machine we had in recently because it wouldn't play. On switching on and selecting play we noticed that the tape didn't lace up. This is usually due to the 2·2Ω resistor we've mentioned before, and sure enough on removing the bottom this was found to be the case. We next turned the machine over to test it, and as we did so we heard a rattling from within. At this point we'd not removed the top, since this is not normally necessary with the fault we'd just dealt with. On pressing eject, out popped an E-type Jaguar, matchbox type!

I had a nasty feeling about what this might have done to the machine, as the heads rotate normally with this fault. Sure enough, on attempting to playback a tape there was no picture, and on examining the heads we found that each had a piece missing. This must have happened before the machine was brought in, or we'd have heard the car hitting the heads. It was not covered by the guarantee of course . . .

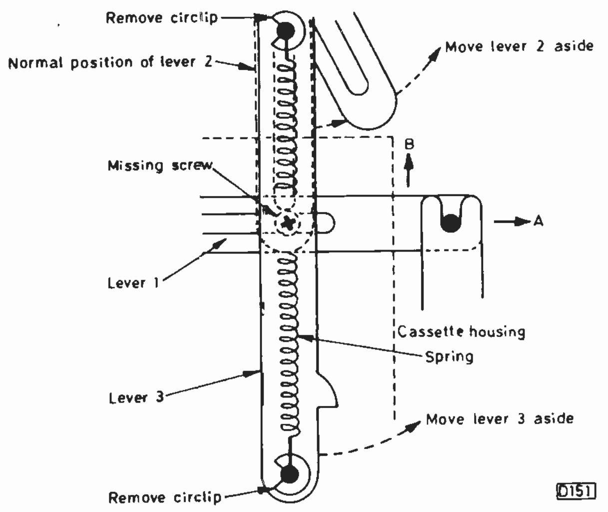


Fig. 1: Troublesome screw in Ferguson 3V22 machines.

Two Bush VCRs

The problem we had with a Bush BV6900 was that it wouldn't eject the tape. Removing the top revealed that the machine was stopping just short of completing the unlacing, and on examining the mechanism we found that at this point the whole thing became stiff. After careful inspection we found that the small wheel at the left-hand side of the loading ring had gone under the ring, jamming it. Freeing the wheel allowed the loading/unloading to proceed freely for a while, then the wheel slipped back under. Thinking that the loading ring was perhaps warped, we fitted one from another machine, aligning it carefully as per the manual. This was no help however and we then noticed that cue would not operate immediately after using review, and that the rewind (review) key was stiff and reluctant to return to its normal position when released.

Further checking here revealed that the failure to operate in cue was because the review mechanism was not returning to the correct position, and that a lever from this part of the mechanism connects (eventually) to the area of the unlacing mechanism where the trouble was being experienced. The problem seemed to be that the grease had become stiff, and stripping the mechanism down as far as possible, removing all the old grease and relubricating cured the trouble. (It took a couple of hours mind you!)

Another Bush BV6900 worked perfectly except on rewind, the key tripping as soon as it was depressed. As the rest of the machine was working normally, suspicion fell on the rewind end sensor circuit. In Betamax machines, the end of the tape is indicated by a piece of foil which alters the inductance of the tape end sensor. This in turn stops the oscillator connected to it. As separate oscillators are used for forward and rewind, the problem was dealt with by checking the rewind oscillator – its output was slightly low. When this was set up in accordance with the manual there was no further problem.

Slow Clock

We had a slightly unusual fault recently on a Sanyo

VTC9300 – the clock ran slow, taking seventy seconds for every minute (without varying). Replacing the TMS1070 i.c. on the timer board cured that.

Miscellaneous Faults

We've also had the usual crop of minor faults – dead Sanyos with either faulty 12V regulators or blown mains fuses, a Panasonic NV7000 with only the eject working due to a faulty cassette lamp, and a Ferguson 3V22 which for the same reason tripped the keys as soon as they were depressed. We also had a Sanyo VTC9300 and a Panasonic NV7000 which would both stop after a few seconds due to the belt which turns the take-up spool having snapped. Unfortunately in the case of the Sanyo machine (a Betamax type) this meant that when eject was pressed the slack tape was not wound back into the cassette – so the customer had a damaged tape as well.

Where's Steve?

Steve Beeching, who started this column off, is at present busy writing a book on VCR servicing for Butterworths.

Letters

DRAWING ARCS

George Wilding, in *Service Notebook* in the July issue, mentions the size of the arc that could be drawn from the collector of the line output transistor. This was common practice in the days of PY81s, PL81s and so on, but is surely not good practice when dealing with solid-state sets, especially those containing CMOS devices. Perhaps the comments should have been qualified to indicate how the arc was produced, so that less well informed readers would be deterred from the screwdriver "collector to chassis" method, causing instant power supply destruction etc. The experienced engineer may be able to judge the situation by the size of an arc drawn by a test meter prod with the meter on an appropriate a.c. or d.c. range (the meter on a.c. would surely be a better indication anyway), but any more brutal methods should be discouraged. Fig. 1 shows the circuit of a simple diode probe which will measure transistor peak collector voltages from 1·5kV peak (line) down to 60V peak – it's also useful for checking video output levels etc.
G. C. C. Wride,
Cheltenham.

George Wilding comments: Sorry for any misunderstanding. It certainly wasn't my intention to suggest that anyone should try checking for the presence of pulses at the collector of a line output transistor with a screwdriver blade to chassis. Checking with the tip of a small screwdriver's blade or the tip of a test prod (with the meter on the highest d.c. range) is standard practice however. Using a d.c. range is better since the equivalent a.c. range is usually of lower impedance.

If you want a positive check for the presence of e.h.t., remove the anode connector and, after making sure that it can't flop about near any earthed metalwork or metalising, switch on. The resulting corona and hiss will prove whether adequate e.h.t. is present. Alternatively, a slight tingle should be felt when a hand is placed in front of the screen.

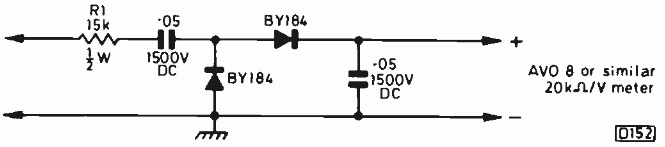


Fig. 1: Diode probe circuit suggested by reader G. C. C. Wride for measuring transistor collector peak voltages. Resistor R1 is included to reduce the initial charging current, i.e. the probe's input capacitance.

Whilst a diode probe of the type suggested can be helpful in showing approximate signal and peak-to-peak waveform values in some circuits, with the component values shown the set should first be switched off – otherwise you could get a large though brief pre-contact arc, followed by a high initial surge. I've experimented with various forms of diode probe linked to a high-impedance meter to check simply for the *presence* of signals and waveforms, and have found that to minimize circuit loading etc. the capacitors should be about 800pF in value (unless checking in field-frquency circuits of course).

If a tripler is suspected of being responsible for the no picture condition, and possibly of fuse blowing or causing a trip to operate, remove the pulse feed to the tripler from the transformer. If this stops the fuse blowing/trip operating you'll still want to know whether there's a normal pulse supply from the transformer. The usual way of checking this is with a screwdriver. The main enemies of transistors and i.c.s are e.h.t. crackovers, inadvertent h.t. shorts and electrolytic shunting actions.

AERIAL TIP

Here's a tip for those who take down their aerials from time to time for alterations or to experiment. They'll probably find that corrosion has taken its toll, and that damage has to be attended to before starting the intended work. Before erecting an aerial I always encase certain parts in Plasticine. This provides protection against the effects of weather for years on end – components will be found to be in mint condition when the Plasticine is eventually removed.

The parts I treat are: (1) the cable connections to the dipole, inside the plastic or hard rubber case (screws, nuts, washers) – make an air-tight seal; (2) the U-bolts that fix the boom to the mast (the thread, washers, nuts or flynuts); (3) the bolts and nuts that hold the mast to the building (the exposed parts); (4) the turnbuckles attached to the guywires (if used); (5) any other additions to the aerial proper, e.g. boosters etc.

Leave the Plasticine well alone after application. It hardens with time but is quite easy to remove.
Victor Rizzo,
Msida, Malta.

RENOVATING A PYE 569 CHASSIS

Whilst reading through a recent issue of *Television* I was reminded of the battle I had when renovating a monochrome Pye hybrid set (569 chassis). Here's how it went.

First I looked over the board for obvious faults. The line output transformer was found to be held in position by a single screw, whilst all the soldered connections were bereft of solder! I put this right, replaced the missing mains fuse and switched on. This produced nothing due to the surge limiter resistor (R59) being open-circuit. A 10W replacement was fitted and a check made for shorts. Switching on again produced h.t. but no e.h.t., and I then noticed that the line output valve's fusible screen grid feed resistor was open-circuit. Resoldering this still didn't produce e.h.t., but drawing an arc from the PL504's anode did. I came to the conclusion that this action must have sealed a dodgy connection, so I went over the line output transformer connections again with a hot iron.

I now had e.h.t. but still no picture, and a check around the video output stage revealed that the output transistor's load resistor was open-circuit. This was replaced, along with the associated resistor to chassis (it looked a bit the worse for wear) – the transistor itself was all right. So I'd a picture but no sync. As the picture could be made to hover on the screen I replaced the PCF802 line oscillator valve. This made no difference, and as the voltage readings seemed to be about right C49 which smooths the valve's h.t. supply was replaced. This time success, and the only other action that seemed necessary in this area was to replace the flyback pulse feedback resistor R69 (27kΩ) – it was charred and had risen in value considerably.

The picture could now be seen to be cramped at the bottom and was rolling. A new PCL805 cured the rolling, and replacing the pentode's cathode bias components (R96, R97 and C76) cured the cramping. This gave me a fair picture, but the field would roll about once every fifteen seconds, regularly. This trouble was eventually cured by replacing VT12 (BC148) in the field sync circuit. As synchronisation had been a bit of a problem, I decided to check over the sync separator circuit to avoid further trouble – the sync separator's base bias resistor R125 (4·7MΩ) was replaced as it was slightly high in value.

I now had a good, rock steady picture. Turning up the contrast only increased the brightness of the display however – the front mounted brightness control was found to be at almost maximum setting. The video preamplifier and a.g.c. circuits are mounted on a subpanel which is at 90° to the main panel. Setting up the presets on this panel cleared the contrast problem and also rid the display of slight graininess. I found that the best way of setting up this panel is to monitor the emitter voltage of VT16 (a.g.c. detector) and the base voltage of VT18 (tuner a.g.c. delay), adjusting RV21 and RV22 for 3V and 6·7V respectively. The adjustments are interdependent and can be a fiddly business in the confined space. Following this I noticed tiny arcing within the PY800 boost diode, so this too went into the bin and the PL504 was replaced in case it had been damaged.

After all this I began to wish I hadn't bothered. I pressed on however – after all there couldn't be anything else wrong, could there? Turning up the volume produced excellent sound, but there was an annoying buzz from the speaker. As there was no hum bar, the h.t. smoothing was ruled out. A replacement audio valve made no difference, so the earthing of the volume control to chassis was checked. This was found to be o.k., and to be sure of the h.t. smoothing I tried extra decoupling on the HT3 and HT4 lines. At this point I noticed that the buzz almost disappeared if the chassis was left in the down position. Extensive checks and extra earth leads to various points and cans failed to remove the buzz, so I called it a day on this one.

By this time I'd a very good working set, especially as the tube was in excellent condition. As a final measure I tidied up the board generally. There'd been a burn up around the line linearity coil, so the connections were made good, the board was cleaned up, and the parallel damping resistor R91 (1·5kΩ) was replaced, using a 4W wirewound component. The front panel was resprayed and the lettering renewed, and I was very pleased with the outcome.

S. Leatherbarrow,
Middleton, Manchester.

PHILIPS G11 TIP

I had a strange fault recently on a set fitted with the Philips G11 chassis, the symptoms being no sound or raster. Ah! I said, attacking the tube base with the Avo, but the voltages here were all present and correct. The power supply and line timebase seemed to be in order, and there was some e.h.t. Well I thought, tackle the sound problem first as the set was almost new and the tube surely o.k. A quick run round the intercarrier sound i.c. revealed that there was no 10·5V supply at pin 2, so I moved over to the 12V stabiliser i.c. (IC5073, type TDA1412) which was producing no voltage at its output pin (pin 2). Replacing this restored the sound and the raster, and I thought I'd better get a few of these three-leg monsters ordered quickly.

The line oscillator is normally powered from the stabilised 12V rail. The input to the 12V stabiliser i.c. comes from the line output stage however, so there's a start up feed (via R2010). It seems that in the start-up mode there's insufficient e.h.t. to produce a raster. So a defective 12V stabiliser i.c. can remove the raster as well as the signals. A bit of a head scratcher, and I thought that other readers might like to be alerted to this possibility.

F. W. Kelly,
Sacriston, Durham.

PREH PUSH-BUTTON UNITS

In your August 1980 issue the use of a Bush push-button unit as a replacement in the Hitachi Model CNP190 was mentioned. Later, in the May 1981 issue, the part number was given (7601 2426). I bought one of these from Manor Supplies and wired it up similarly to the unit already in the TV set but found it wouldn't work. On getting in touch with Manor Supplies I was sent a wiring diagram (see Fig. 2) and found this to be somewhat different from the way in which the original Hitachi unit was wired. Anyway, I'm now able to tune in the channels o.k., and mention this in case anyone else has difficulties when following the same course. The push-buttons are longer than those on the original unit incidentally, but can easily be reduced in size using a fine hacksaw (saw off about an eighth of an inch), smoothing off with a fine file.

R. Jelley,
Abertillery, Gwent.

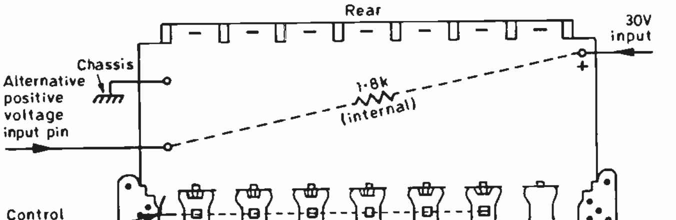


Fig. 2: Connections to the Preh push-button channel selector unit used in the Bush Model TV313. The positive and negative connections may be reversed if necessary. All Preh varicap control units conform to this pinning. The unit is available from Manor Supplies.

TV Pattern Generator

Luke Theodossiou

WITH a variety of TV pattern generators already on the market, we had to think very hard before committing ourselves to yet another design. However, we feel that our approach is both interesting and flexible and can result in a useful instrument contained in a very small case which is equally at home on the bench or in the field.

The heart of the unit is a chip from the Ferranti ULA (Uncommitted Logic Array) range. We've used another device from this range in previous designs – the sync pulse generator i.c. ZNA134. This time Ferranti has produced an i.c. (the ZNA234E) which makes available all the necessary waveforms to produce crosshatch, dot, vertical lines, horizontal lines and greyscale test patterns on a TV screen. The block diagram of the device is shown in Fig. 1. All that is required is a 2·5MHz crystal and a minimum of external components for mixing the video, sync and blanking pulses to give a composite video signal. The device is contained in a 16-pin DIL plastic package.

The circuit diagram of our particular way of using the i.c. is shown in Fig. 2. The outputs from the ZNA234E (IC4) are passed through analogue switches contained in IC2 and IC3 (4066). A particular pattern is selected by activating the CMOS switch from one of seven outputs derived from IC1. This is a 5-stage Johnson decade counter whose active-high outputs are advanced by one on every high-to-low transition on the clock input pin 13. When the counter reaches the eighth position (pin 6) this is fed to pin 15 which is a master clear input. This sets all outputs to low and as soon as the selector switch SW1 is released, the first pattern is selected again.

This method provides a convenient way of dispensing with a 7-way switch and keeps the front panel of the generator much simpler. Of course there is no reason why a mechanical switch cannot be employed if preferred but the p.c.b. was designed to accept the circuit in Fig. 1. Apart from the five patterns generated by IC4, blank raster and white raster are also offered; the former by taking the base of Tr1 to ground and the latter by taking it to +5V via R3. Resistors R4, R5 and R6 increase the edge speeds of patterns containing short-duration pulse components.

The reason why digital gates cannot be used in place of the analogue switches is the greyscale pattern which is of course an analogue signal. It is generated by the i.c. from a digital to analogue converter which acts as a switched current sink providing 8 equal current steps of approximately 60μA per step. With the external pull-up resistor comprising R2 and VR1, 0·3V/step are produced when the effective load resistance is 5kΩ, which is made variable by VR1. The output has a saturation level of 2V and requires a buffer stage before it can be mixed with the sync pulses. This is performed by Tr1. The selected generated pattern is fed to its base, whilst video blanking pulses are added via D1. Mixed sync pulses are applied to the emitter from pin 3 of IC4. VR2 sets the sync/video ratio, whilst VR3 sets the composite video output amplitude. This is coupled to the Astec u.h.f. modulator via D2 which offers a d.c. offset to match the requirements of the modulator.

The power supply utilises a 7805 regulator which allows the unit to operate from any external d.c. source in the range +7V to +15V. A proprietary battery adaptor is suggested. This approach leads to a smaller unit than if a mains supply was to be incorporated. The current consumption of just over 100mA prevents the use of reasonable sized dry batteries.

Construction is quite straightforward using the double-sided p.c.b. The track patterns will be shown next month – Fig. 3 shows the component locations. Start by inserting

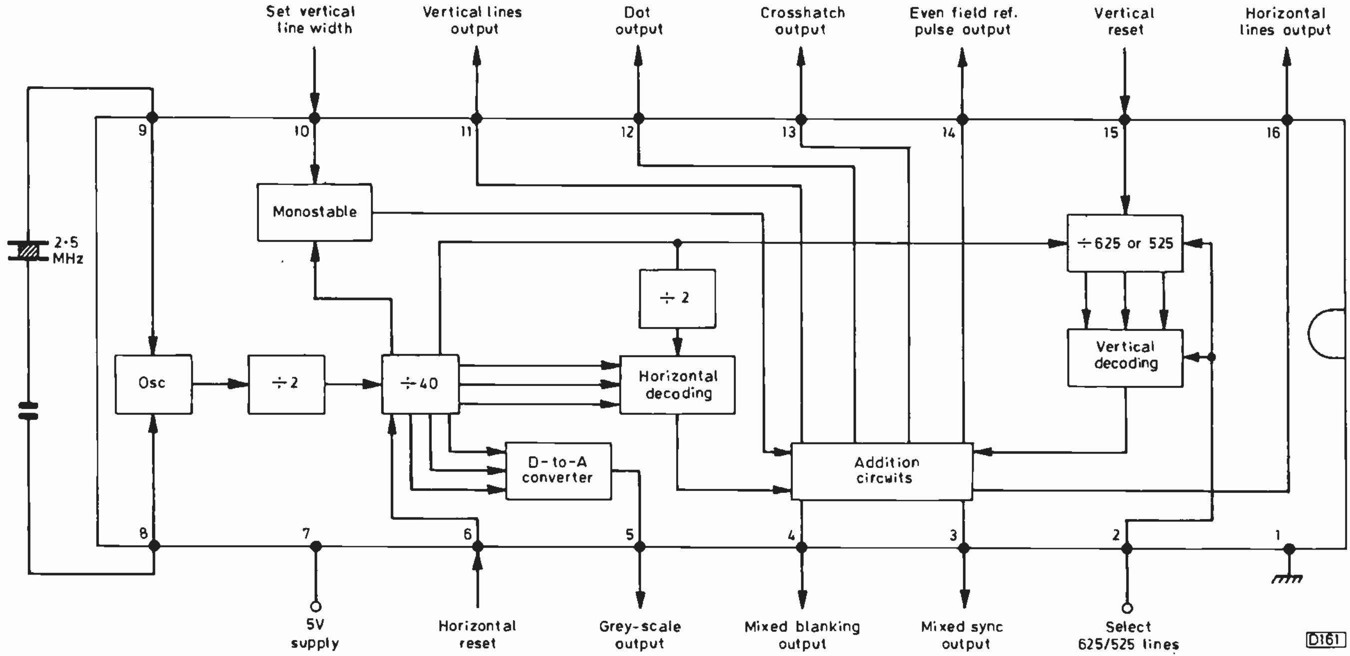


Fig. 1: Block diagram of the Ferranti ZNA234E TV pattern generator i.c.

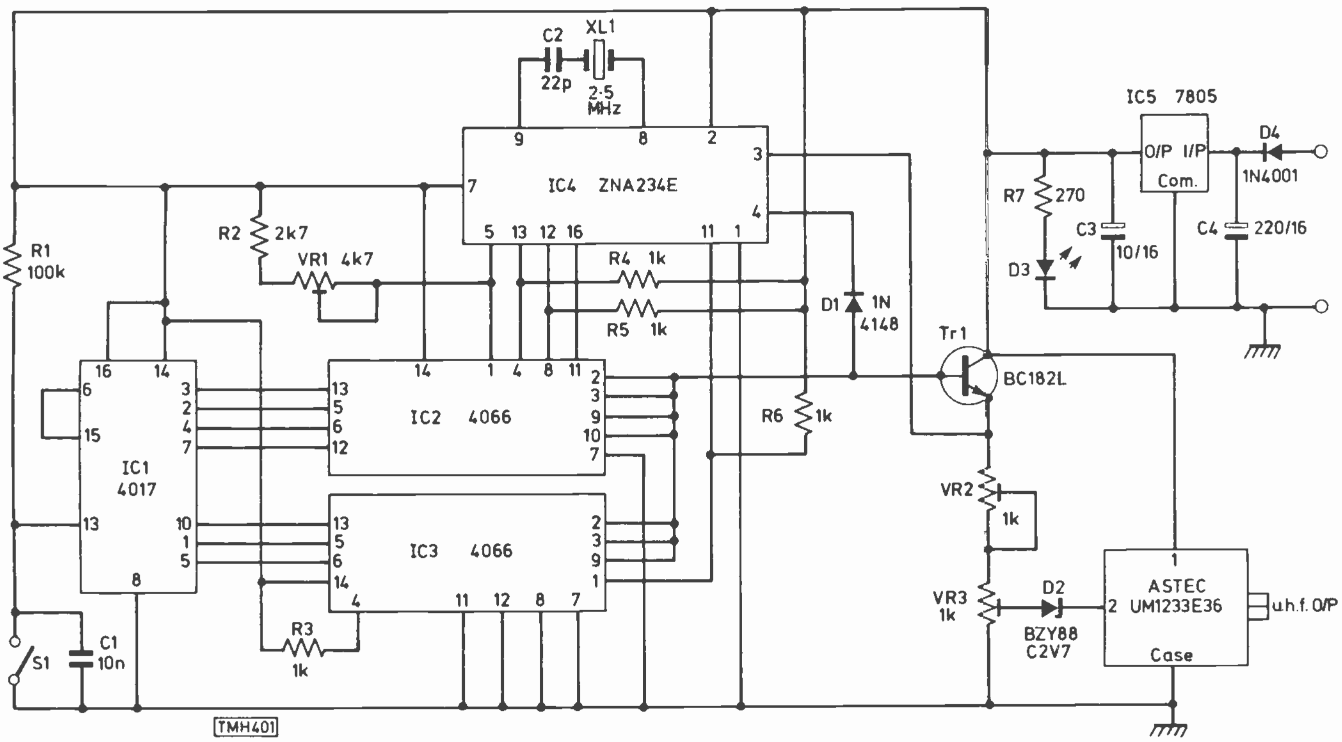


Fig. 2: Circuit diagram of the pattern generator. Pins 6 and 15 of IC4 are connected to chassis.

★ Components List

Resistors: all 0·25W, carbon film, ±5%

R1 100k
R2 2k7
R3 1k
R4 1k
R5 1k
R6 1k
R7 270Ω
VR1 4k7
VR2 1k
VR3 1k
} miniature horizontal-mounting skeleton presets

Capacitors:

C1 10n ceramic plate
C2 22p ceramic plate
C3 10μF 16V radial electrolytic
C4 220μF 16V radial electrolytic

Semiconductors:

D1 1N4148
D2 BZY88 C2V7
D3 0·2" red l.e.d.
D4 1N4001
Tr1 BC182L
IC1 4017
IC2 4066
IC3 4066
IC4 ZNA234E
IC5 7805

Miscellaneous:

U.h.f. modulator: Astec UM1233 E36
SW1: momentary push-to-make switch RS 336-747
Case: RS 509-579
P.c.b. ref. no.: D094
Co-axial output socket
Power input socket: 2·5mm jack socket
Phono socket & screened cable
XL1: 2·5MHz crystal

all the small components, then the i.c.s and finally the modulator. Note that there are a number of top soldered joints including some on i.c.s. A little care should be exercised to avoid overheating or bridging across adjacent pins. Soldercon connectors may be used if desired. The completed unit is then secured to the case using self-tapping screws and finally the power input socket, u.h.f. socket, l.e.d. and switch are secured into place and wired up.

To adjust the unit, connect the output to a receiver and tune in to around channel 36. Select the crosshatch pattern and using a scope adjust VR3 for a 1V pk-pk composite video signal at its wiper. Adjust VR2 for a 7:3 video to sync ratio. The two adjustments are interdependent, so repeat the process until the desired results are obtained. Select the greyscale pattern and adjust VR1 for the lowest step to correspond to black level. These adjustments can be made without a scope by observing the results on the screen.

A slight breakthrough of vertical lines and/or dots may be found on the greyscale pattern. This is due to the use of CMOS switches, but doesn't detract from the usefulness of the greyscale pattern.

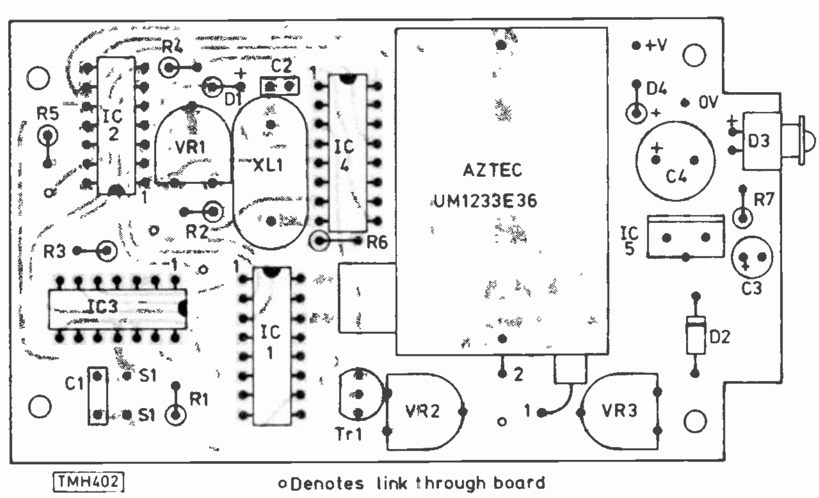


Fig. 3: Component layout.

Practical TV Servicing: Tackling Focus Faults

S. Simon

TO achieve optimum focus with a colour set the voltage applied to the c.r.t.'s focus electrode must be held within close limits. With most tubes, some 4·5kV is required at the focus electrode. Not all tubes require this high focus voltage however, the main exception being some of the older, smaller-sized Japanese tubes, such as the 18in. 470DUB22 used in earlier versions of the Pye 713 series chassis. These are referred to as unipotential tubes, and are operated with similar voltages applied to the first anode and the focus electrode. Anyway, if the focus is not up to scratch and you're in doubt about the tube's focus voltage requirement, refer to the appropriate circuit. In this area as in most others, different sets use different techniques and have different habits, a knowledge of which can be a tremendous asset.

As we said at the start, most colour tubes require a high focus voltage. The method of obtaining this varies however. Things have become rather more standardised in recent years, with the advent of the e.h.t. tripler and the use of the thick-film type of focus unit. If we consider some representative chassis, it will be noticed that the greatest variation occurred in the earlier models – some of which are still around and giving a good account of themselves.

The Philips G6 Chassis

Take the Philips G6 chassis for example, with its valve line timebase and e.h.t. system. The use of a PD500 triode stabiliser to equalize the load on the e.h.t. system under varying conditions (i.e. brightness/beam current varying from high to low) resulted in very good e.h.t. regulation – the picture size didn't vary in accordance with overall brightness variations. For focus purposes, the flyback pulse appearing at the anode of the PL509 line output valve was fed to the anode of a small high-voltage rectifier (type EY51) which charged its 270pF reservoir capacitor to several kV. The output was connected to chassis via a chain of high-value resistors which included the 5MΩ focus control. The slider of the focus control was linked to the appropriate tube electrode via a 1MΩ resistor (R1090), and this is our first service point.

It's usual to find a resistor on the tube base panel to link the focus control to the relevant tube pin, and it's a simple matter to check the value of this resistor. The value may be anything from 100kΩ to around 2·2MΩ, but the resistor will often be found to be open-circuit when checked. Don't omit to make this simple initial check – the resistor is usually readily accessible – or much time may be wasted looking for the cause of poor focus elsewhere.

In the G6 chassis however it was more often one of the high-value resistors in the focus chain that caused the trouble, the two 3·3MΩ resistors on the earthy side of the circuit being particularly suspect. When one of these went high in value or open-circuit, the focus voltage rose. Since the source of the focus voltage was around 5kV, there were no fireworks from the focus spark gap to call attention to the excessive voltage. The focus voltage source is not always this low however. You may for example find that the focus voltage is tapped from a rod VDR which is connected across the e.h.t. supply to provide stabilisation. The two voltages thus track together.

Pye Hybrid Chassis

Whilst the original (dual-standard) Pye hybrid chassis used a low potential source (a TV6·5/3 metal rectifier), in the later single-standard Pye hybrid chassis (with an e.h.t. tripler) the focus voltage was obtained from a slider at the lower end of a long rod-type VDR which had the e.h.t. at one end (via a fairly small 5·6MΩ resistor which was tucked inside the VDR's gondola housing). Faulty focusing with these later chassis should direct attention to the 5·6MΩ resistor, to the VDR rod itself, to the spring slider and to the 100kΩ resistor between the latter and the tube's focus pin. Of these various possibilities, the spring seems to be the most common offender. Fig. 1 shows the circuitry.

Shorter Rod Focus VDRs

It's far more common however to find that the source of the focus voltage is a tapping from within the e.h.t. tripler, i.e. the output obtained at the cathode of the first rectifier diode in the tripler is made available via a separate lead which goes to the focus control network. If the focus control is of the rod VDR type, it's far shorter than that used in the Pye sets since the voltage source is so much lower.

Setmakers who've used this shorter type of VDR rod fed from the tripler include Rank, Decca, ITT and many others, the VDR having one or more high-value resistors in series with it. It's these high-value resistors that most often give rise to incorrect focus voltage. Typical values are 4·7MΩ and 5·6MΩ, but as the values are low compared to the rod itself the actual value is not unduly critical. The direction in which the slider of the focus control has to be moved to restore some degree of focus indicates the end of the rod to which the faulty resistor is probably connected. For example, with the ITT CVC5 series chassis if the lever has to be raised it's the resistor between the top end of the rod and the tripler (R429) that's likely to have gone high in value – but bear in mind the resistor on the tube base, since if this is the faulty resistor the effect will be the same. The value of the former resistor is 4·7MΩ while the latter has a value of 2·2MΩ.

Thick-film Units

More recent chassis use a rotary focus unit with a thick-film resistive element. These are more inclined to give trouble on their own account because the high-value resistors are incorporated within the unit. One has little

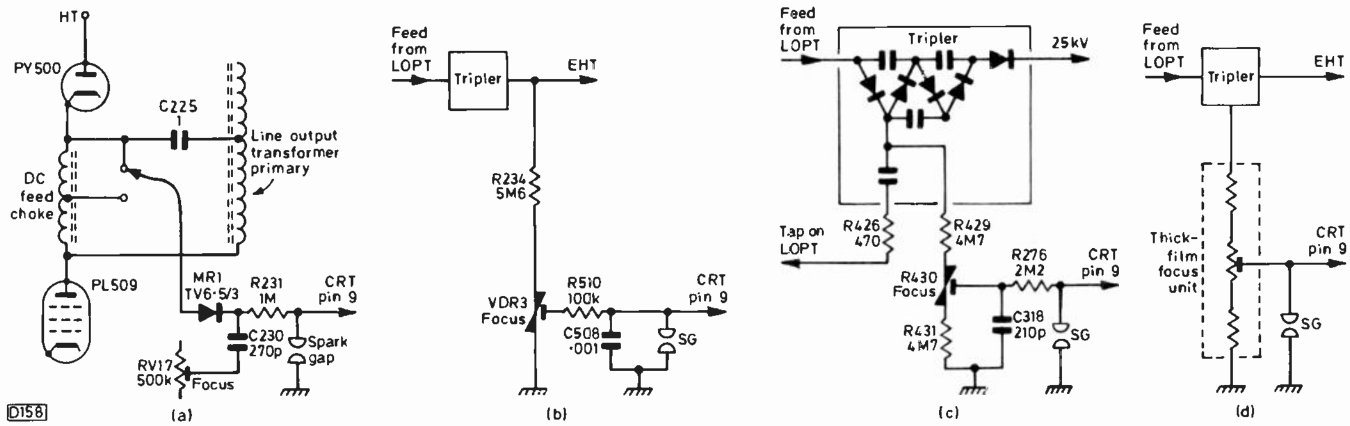


Fig. 1: Examples of different colour receiver focusing arrangements. (a) Circuit used in early (dual-standard) Pye hybrid colour sets. The focus rectifier MR1 rectified the flyback pulses appearing at the cathode of the PY500 boost diode, charging its reservoir capacitor C230 to approximately 5kV. A degree of control was provided by means of the alternative feed to the rectifier from a tap on the d.c. feed choke. The "earthy" end of C230 was taken to the focus control potentiometer RV17, which was connected between taps on the line output transformer carrying negative- and positive-going flyback pulses. Depending on the setting of RV17, these added to or subtracted from the pulses fed to the rectifier. To avoid polarisation of the line output transformer, the PL509 line output valve was a.c. coupled to the primary winding via C225, the feed coil providing d.c. continuity. (b) Circuit used in later Pye hybrid (single-standard) colour sets. The focus voltage was obtained from the slider of a VDR connected, via a series resistor (R234), across the e.h.t. supply. The VDR provides a degree of e.h.t. stabilisation, while the e.h.t. and the focus voltages track together. (c) A rather more common circuit, with the focus VDR fed from a lower voltage source within the e.h.t. tripler. The circuit shown was used in the CVC5 and later ITT hybrid colour chassis. (d) In more recent sets a thick-film focus unit replaces the focus VDR and its series resistors. This example is taken from the GEC C2110 series, which does not employ a series resistor in the feed to the tube's focus electrode.

option therefore but to replace the complete unit. Unfortunately one may well find that the trouble is still present after doing this, and that it's not resolved until the tripler has been replaced. In some chassis in fact the e.h.t. tripler is the first suspect when the focus is poor, the focus unit itself rarely being at fault. This is the case with the Thorn 3000 and 3500 series chassis. With the Thorn 8500 and 8800 chassis one is equally suspicious of the focus unit and the e.h.t. rectifier. The reason for this difference is the robust design of the focus unit used in the 3000/3500 chassis compared to the more flimsy unit used in the 8500/8800 chassis. The small-screen 8000 series chassis is fitted with a unipotential tube, with the focus unit fed from the 630V first anode supply source.

Trouble with the Focus Pin

There's another possibility which seems to be getting more common and was rarely encountered with older sets – poor contact between the tube's focus pin and the base connector. This leads to pitting, due to the sparking that takes place when the contact is poor. The trouble is mainly experienced with Rank sets (Bush, Murphy, Co-op), and seems to be confined to the white moulding bases used in the "BC" series.

The Spark Gap

This sort of thing, plus the possibility of the focus spark gap being bunged up or otherwise conductive when it shouldn't be, adds more items to the check list. If the spark gap persistently sparks across, either the gap is too small and needs cleaning or the focus voltage is excessive. In the latter event the probability is either that the earthy end of the focus control is not connected to chassis or that a resistor at this end has gone high in value. The resistor concerned may be a separate component which can be replaced easily, or the resistive element may be within the control's housing. The possibilities don't end here however, and a merry chase often ensues before the real culprit is located. The spark gap itself may consist of a slot cut in the tube base panel or may be a separate component in the form of a red plastic ring with wires that are a critical distance apart embedded in it. A slot is usual in later sets.

Ground Rules

If the focus is poor and we've only a multimeter for measuring purposes (such a meter will impose a load on the high-resistance focus system), a few ground rules should be followed to save time. If there's a resistor on the tube base, check this first. Then move on to the actual focus circuit or, in the case of the Thorn 3000/3500 chassis, to the e.h.t. tripler. If only a slight movement of the focus lever or adjuster restores normal working, there could be a "hot spot" on the control. If on the other hand the control has to be moved to one end, the resistor (if there is a separate one) at this end is probably in need of replacement. Don't omit to check the goodness of the contact between the base socket and the tube's focus pin.

Related Symptoms

We've talked about poor focus on the assumption that the symptom is quite obvious. It's possible however that the symptoms displayed may be confusing. A check on the picture size can be most revealing: if it's enlarged, no amount of fiddling with the focus circuit is likely to produce any worthwhile result. The enlarged picture, with attendant poor focus, is the symptom of low e.h.t., and it's to this section of the receiver that attention must be turned. If a tripler is used, you may find that it has a hot spot where one of the rectifier elements has gone high-resistance. Replacing the tripler will usually clear all the symptoms in this event.

On the other hand poor focus is often the complaint when the real culprit is the tube. If the emission is low or the vacuum impaired, a clear picture will not be resolved. The clue here is the variation in definition from low brightness, when the picture is fairly well resolved, to the smudging and flaring that occur as the brightness is increased.

Satellite TV Up-date

Roger Bunney

THE government, following a Home Office study on the subject, seems to be willing to authorize the start of a satellite TV service for the UK and is under quite a lot of pressure to do so. What the government doesn't want to do is to get involved in the financing of such a service. A number of companies have already declared their willingness to become involved however, so that shouldn't be too great a problem. With a French/German direct broadcast satellite (DBS) service scheduled to start by 1984, the pressure will be on to start a UK service.

The satellite itself shouldn't pose great problems in this era of space labs and so on, neither should receiving equipment. The problem will be what to broadcast and how to finance the programmes. Subscription services are one suggestion, but there's likely to be much debate on this front. The satellites are powered by solar cell arrays of course, their position in space relative to the earth being controlled by the emission of hydrazine gas stored in tanks on the satellite. This emission is earth controlled, the satellite's life span depending on gas usage – the average life is around seven years.

Forty channels within the 11·7-12·5GHz spectrum were allocated for satellite TV use at the 1977 Geneva ITU conference. Most of the countries within the European region were allocated five channels each, with specific polarisation characteristics (either right- or left-hand circular) and various orbit positions (see Table 1). Each channel is capable of carrying a frequency-modulated TV transmission with a bandwidth of 27MHz. The actual channel spacing is 19·2MHz, co- and adjacent-channel problems being catered for by the beamwidth and polarisation characteristics.

The use of a standard 0·9 metre dish aerial is assumed, with the satellite transmitter providing a signal power flux density of at least -103dBW/m^2. This should provide good reception, with an adequate signal/noise figure, for at least 99% of the time. It follows that the use of a larger dish aerial, with a correspondingly higher gain, would increase the area over which reception is possible – something that's likely to cause concern from political and copyright viewpoints!

The service area covered by a satellite transmitter is referred to as its footprint. This is defined by the signal strength of course, and as Figs. 1 and 2 show varies considerably under different assumed reception conditions. Fig. 1 shows satellite footprints for UK and Irish services defined as above: if the use of larger aerials (1·75m) with a signal strength reduced to -111dB/Wm^2 is assumed, the footprints are as shown in Fig. 2. Transmitter powers would be of the order of 100-300W per channel.

Fig. 3 shows the -103dB/Wm^2 footprints for various European satellite services. Comparing the UK and Luxembourg service areas, with the satellites at 31°W and 19°W respectively and with the –3dB (half power) points on current production 12GHz dish aerials being under 2°, it follows that without accurate realignment the Luxembourg satellite's signal will not be received on a dish aligned to receive the UK satellite's signals. This emphasizes the importance of accurate aerial alignment for satellite reception.

The use of f.m. for satellite transmissions offers considerable advantages, particularly reduced transmitter

Table 1: European satellite TV channel assignments.

Band	Orbital position 37°W	31°W	19°W	5°E
11·7-12·1GHz RH polarisation	San Marino chs. 1, 5, 9, 13, 17 Lichtenstein chs. 3, 7, 11, 15, 19	Eire chs. 2, 6, 10, 14, 18 UK chs. 4, 8, 12, 16, 20	France chs. 1, 5, 9, 13, 17 Luxembourg chs. 3, 7, 11, 15, 19	Turkey chs. 1, 5, 9, 13, 17 Greece chs. 3, 7, 11, 15, 19
12·1-12·5GHz RH polarisation	Monaco chs. 21, 25, 29, 33, 37 Vatican chs. 23, 27, 31, 35, 39		Belgium chs. 21, 25, 29, 33, 37 Holland chs. 23, 27, 31, 35, 39	Cyprus chs. 21, 25, 29, 33, 37 Iceland* chs. 23, 27, 31, 35, 39
11·7-12·1GHz LH polarisation	Andorra chs. 4, 8, 12, 16, 20	Portugal chs. 3, 7, 11, 15, 19	W. Germany chs. 2, 6, 10, 14, 18 Austria chs. 4, 8, 12, 16, 20	Finland chs. 2, 6, 10 Norway chs. 14, 18 Sweden chs. 4, 8 Denmark chs. 12, 16, 20
12·1-12·5GHz LH polarisation		Iceland chs. 21, 25, 29, 33, 37 Spain chs. 23, 27, 31, 35, 39	Switzerland chs. 22, 26, 30, 34, 38 Italy chs. 24, 28, 32, 36, 40	Nordic† chs. 22, 24, 26, 28, 30, 32, 36, 40 Sweden ch. 34 Norway ch. 38

*This allocation covers Iceland, the Azores and part of Greenland, with chs. 27 and 35 registered under Denmark.
†Eight wide beam channels assigned as follows: chs. 24, 36 Denmark; chs. 22, 26 Finland; chs. 28, 32 Norway; chs. 30, 40 Sweden.

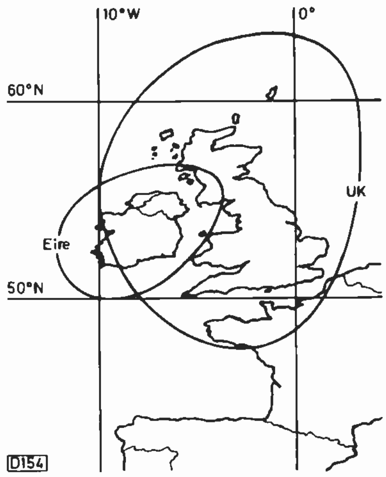


Fig. 1: Footprints for Irish and UK TV satellites, assuming the use of an 0·9m dish aerial for reception and a signal strength of -103dBW/m².

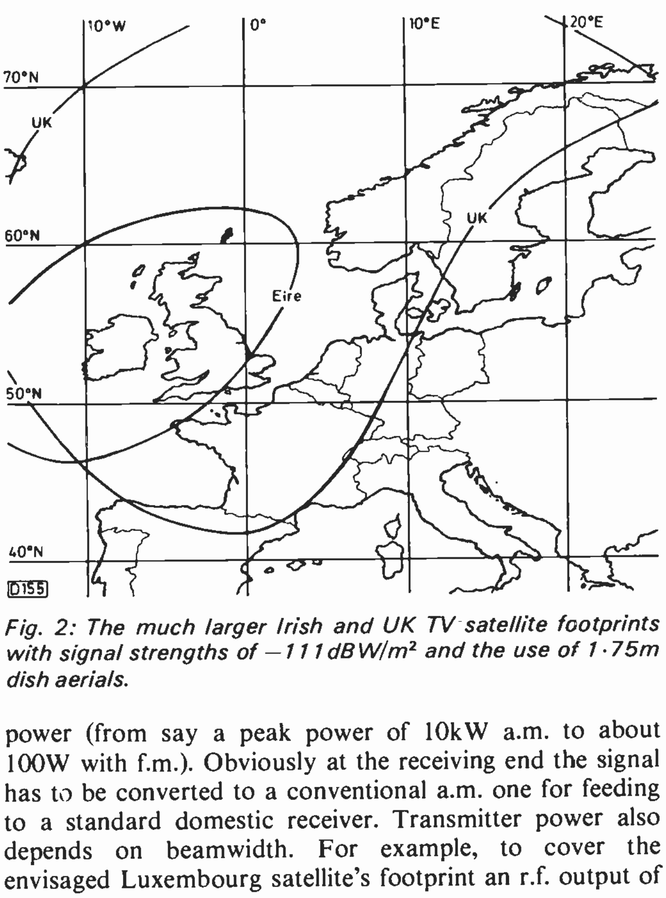


Fig. 2: The much larger Irish and UK TV satellite footprints with signal strengths of -111dBW/m² and the use of 1·75m dish aerials.

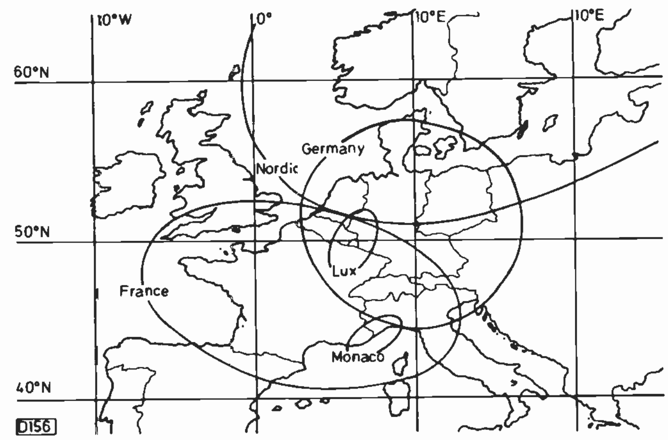


Fig. 3: Footprints for continental European satellites, on the same assumptions as Fig. 1.

power (from say a peak power of 10kW a.m. to about 100W with f.m.). Obviously at the receiving end the signal has to be converted to a conventional a.m. one for feeding to a standard domestic receiver. Transmitter power also depends on beamwidth. For example, to cover the envisaged Luxembourg satellite's footprint an r.f. output of 45W per channel would be required, whilst for the French satellite's vastly increased footprint the comparative figure would be some 375W per channel. For a UK satellite an output of about 270W per channel seems likely.

The channel allocations have been arranged so that only 400MHz of the 800MHz spectrum is used in a specific geographical area. Prototype 12GHz receiver units are already available – at a price and intended for experimental use. They do give an indication of the arrangements such units will employ however (see Fig. 4). The received 400MHz segment has to be down converted at the aerial to allow conventional low-loss coaxial downlead cable to be used. Conversion of the f.m. signal to a.m. and remodulation on to a standard v.h.f. or u.h.f. channel (u.h.f. in the UK) can be undertaken at the aerial or by a set-side unit. Japanese setmakers are likely to follow an NHK design which uses direct s.h.f./f.m. to v.h.f./a.m. conversion within the aerial head unit – this lends itself to mass production and is capable of achieving remarkable noise performance figures. The design shown in Fig. 4 features a noise figure of less than 3·8dB with a 500MHz bandwidth; the u.h.f. i.f. gain is over 40dB.

There is much interest world-wide in satellite TV at present. By the end of the decade it seems certain that several European satellite services will be in operation. Services are also planned for Japan, Australia and Canada. In many countries it's possible at present to receive the 714MHz transmissions from the Russian Stat-T satellite at 99°E – for example Japanese Yagi aerials are being sold in Sri Lanka with 70dB head amplification to feed into standard domestic sets, giving excellent quality Moscow-1 programmes at a cost of around £100! Many enthusiasts in

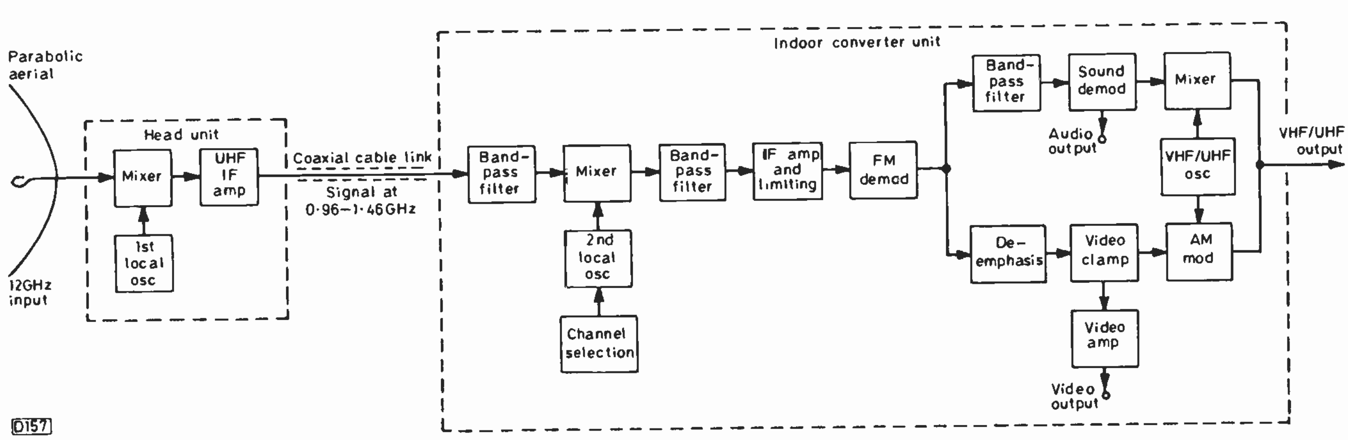


Fig. 4: Block diagram of a Japanese satellite receiver terminal at present in production. The device has separate head and indoor converter units. Other designs carry out most operations at the masthead.

the USA have been jumping the gun, with satellite terminals to receive the 4GHz satellite-distributed signals intended for cable TV operators. With so many backyard terminals coming into use, and with the FCC giving apparent approval to "experimental reception" (because they can't stop it!), signal scrambling is now being adopted.

Aerial riggers and TV engineers will eventually find themselves confronted with various new terms. Here are a few for a start:

G/T (gain/temperature) figure of merit. An overall merit figure for receiving systems, taking into account carrier/noise ratio, the receiver f.m. threshold characteristic, the transmitted EIRP (see below), the bandwidth, thermal noise and various system losses. A typical figure might be 6dB/K for a small receiving system with a 1m dish aerial, a figure of 20dB/K being suggested for a higher performance system to feed into a cable distribution network.

C/N (carrier/noise) ratio. Ratio of the wanted carrier signal received to the noise detected at the same frequency. Noise can arise from rain attenuation, general atmospheric absorption, the alignment accuracy of the receiving/transmitting aerials, the polarisation and receiver noise. Other factors that have to be born in mind are the path loss (typically 200dB) and the noise/bandwidth figure (the wider the bandwidth the greater the noise).

C/I (carrier/interference) ratio. The ratio of the wanted carrier signal received to other possible interference, i.e. signals from other satellites and terrestrial microwave transmissions.

EIRP (effective isotropic radiated power). The satellite's transmitted power taking the aerial gain into account.

FM threshold. The receiver's signal capture point. ■

Letter from America: Tuning in the 'States

Jim Edwards

AS any of you who've visited the States will appreciate, the TV tuning systems used could in many cases be described as "simply light years behind" (sorry Philips!). The rotary switch tuner, now an archaic item to most European eyes, is still common, at least so far as v.h.f. is concerned – and a large proportion of the transmissions are even today confined to v.h.f. The reasons for this are partly the "better the devil you know" approach and partly economic and legislative ones. The economic angle is simple enough: the old turret type tuner has been around a long, long time, so that the product has reached its lowest possible cost. The legislative aspect is the result of the Federal Communications Committee's ruling that "all channels must be equally accessible", which means either a rotary tuner or one button per channel. O.K. so far as v.h.f. is concerned, as there are only twelve channels, but for u.h.f. . . . .

Things had to change following the introduction of u.h.f. transmissions. A detent rotary mechanical tuner for 70 channels is not an easy thing to construct for a start, and that's putting it mildly! So the FCC made a concession, allowing the use of preset tuning for the u.h.f. channels, allocating them to extra positions on the v.h.f. knob. This may sound fairly familiar but it's effect on the market was devastating, allowing the Japanese in with their greater knowledge of varactor tuning. They made fast inroads, though this is past history now.

A common solution today is the use of two detent tuning knobs, one for v.h.f. and one for u.h.f., both controlling varicap tuners via special-law potentiometers, plus band switching etc. To make up for the errors in this system, the tuners have manual fine tuning and strong a.f.t. (a.f.c.). This arrangement works well, but is now slowly being replaced by sophisticated microcomputer based systems – from up-market models down through the ranges. Continuous tuning over u.h.f. is the order of the day for portables.

These microcomputer based systems are being employed in sets with screen sizes from 13 to 26in., and are the main tuning method used by some setmakers. In their most basic form, these systems accept a keyboard entered channel number, translate this into a divider ratio for a phase-locked loop (PLL), carry out band selection and finally set the tuning voltage via the PLL. This can all be done with three chips, including the prescaler and LED channel number drive – the purchasing power of the US setmakers makes it possible to use custom microcomputers. Fig. 1 compares commonly used European and US systems.

A simplification possible in the USA (and Italy!) is the omission of an EAROM. This item is needed in Europe to store the channel-pushbutton allocations, e.g. button one for say channel 23. Since US TV channels are identified in the programming and in the programme listings, the EAROM is unnecessary – though one setmaker adds one for other purposes. Also there's no need to memorize fine tuning information, as the microcomputer can be programmed to carry out a search in the selected channel at every channel change and then carry out a.f.t. correction.

I mentioned custom microcomputers above. By this I mean that the i.c. manufacturer takes a standard microcomputer i.c., e.g. the 8048, and then adds to it a PLL block, an infra-red remote control block, a digital/analogue converter to decode the received modulated pulse signal, l.e.d. drivers and perhaps a power input for time clock purposes. As Fig. 1 shows, this leads to a drastic reduction in the number of i.c.s required in the system, reducing costs and enhancing reliability.

This use of a microcomputer makes many things possible by way of features and options. Simply by changing the ROM, all models from the simplest in the range to the most elaborate can be catered for (you could use the largest ROM version in all models, but this wouldn't be economic!). Thus for a simple set you can use a 1k ROM, providing basic frequency synthesis tuning plus maybe remote control with the addition of a preamplifier. Then for an up-market set you can use a 4k ROM to provide more sophisticated frequency synthesized tuning, e.g. for searching only through previously programmed "favourite" channels, remote control, on-screen displays, built in loudspeaking

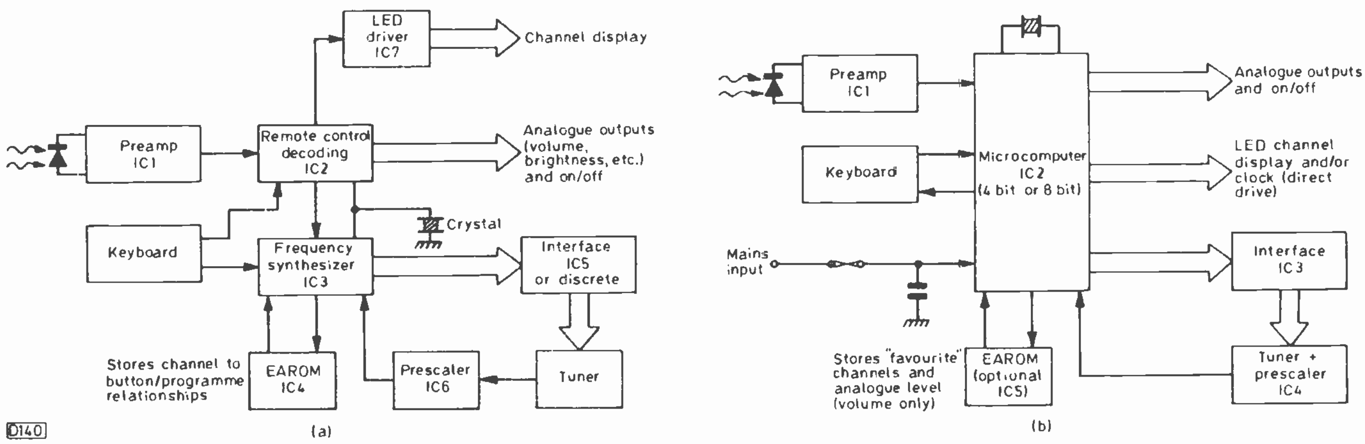


Fig. 1: Modern TV tuning systems, with remote control. (a) Typical European system, using special-purpose i.c.s. (b) System that's popular with US setmakers, with a microcomputer i.c. doing most of the work. With both arrangements an extra i.c. would be required to give an on-screen display, a feature that's becoming popular in the USA.

telephone control, screen up/down movement for a projection TV system, a real-time clock and so on.

Such TV sets now tune to up to 112 channels, taking in the extra frequencies used by the cable networks. The latter feature makes external converter boxes unnecessary, though a descrambler is still required. These TV sets are described as cable-ready, and are starting to become popular as the use of cable distribution increases – they offer the full remote control option with only one remote control transmitter (converter boxes with remote control are available, but they need their own transmitter unit).

To add to all this front end sophistication, the introduction of teletext and allied systems is expected shortly. Unfortunately the lack of a single standard and the add-on costs will slow things down – like the average Briton, the average American is not prepared to pay more than $50 for the benefit he would obtain from the current teletext database. A substantial increase in the data available would increase the access time of course.

Finally a word on the tuners themselves. Tuning is now by and large by means of varicap diodes, which sets the basic design. US tuners are thus now similar to European ones, with a Schottky diode mixer (something that's been employed for a long time in Europe). Integrated v.h.f./u.h.f. tuners are common, with an increasing number incorporating the PLL prescaler to reduce local oscillator leakage radiation and susceptibility to broadcasts of the wrong frequency – in this land of the CB.

Bye for now. Tune in next time when the topic will be comb filters and their use in the NTSC system – if I can find out what they do. Some setmakers are using them to obtain better chroma/luminance signal separation.

Pattern Generator Follow Up

Malcolm Burrell

THE colour pattern generator design we published in the May-July 1979 issues aroused considerable interest. The aim was to provide a comprehensive test pattern for the assessment of receiver performance. With the original hand-wired prototype, it was possible to use many of the patterns generated within the unit in addition to the full pattern. Carrying this feature through to the final published design would have involved quite a bit of extra complication and wasn't considered worthwhile. Many readers seem to want to extend the facilities available however, whilst others have asked about using the coder to enable graphics to be displayed on a normal domestic TV set. We haven't tried this latter possibility, though some comments are given later. The present article deals in the main with the most common requests, for crosshatch and colour bar outputs.

The pattern generator's logic circuitry generates many waveforms at both line and field rate, these being gated to produce separate RGB colour signals and a luminance signal. In fact a complete non-composite luminance signal is present at pin 8 of the logic board, and this may be useful for those wanting only a monochrome pattern.

Switching

Since most of the generators that have been built will have been incorporated in a case of some kind, constructors are unlikely to want to carry out the extensive drilling that would be required if push-button switches are used. The simplest way of getting the extra outputs mentioned above is to use a rotary three-way, four-pole wafer switch plus a little wiring, an extra i.c. and cuts to four tracks on the logic boards.

With a sharp knife, cut the logic board tracks at IC43 pins 6 and 8, IC40 pin 8, and between R17 and output pin 8 (see Fig. 1). Using the switch diagram (Fig. 2), connect cables as indicated and check that with the switch rotated fully anticlockwise the original test pattern appears on the screen.

Colour Bars

Now for some bars. Full screen height colour bars are available at IC10 – pin 8 is green, pin 10 red and pin 6 blue. Since our new switch (SW1) bypasses the summing and blanking circuitry in positions two and three, the bars from IC10 must be fed to an additional 7408 AND gate i.c. (see Fig. 3), blanked and summed (to obtain a luminance signal) before being passed to the coder on the analogue board. In addition, we've bypassed the insertion of the burst gate pulse in the red channel. Fortunately IC43 on the original panel has a spare OR gate, so the gate pulse can be fed in at pin 13: with the red bars fed in at pin 12, the red signal plus burst emerges at pin 11. It will be recalled that we avoided B-Y burst gating. Wire up and check that with SW1 in position two colour bars are displayed.

Crosshatch

A fully blanked crosshatch pattern is present at pin 6 of IC32. This is taken to switch contact 12 via an additional 27Ω series resistor which limits the signal amplitude to be in keeping with the other patterns. At the same time switch

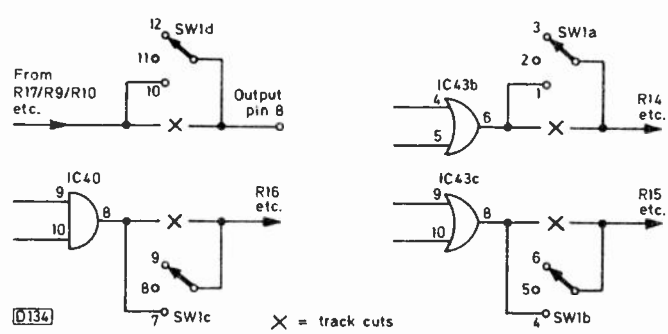


Fig. 1: Modifications required to the original board in order to add a test pattern/colour bar/crosshatch pattern selector switch.

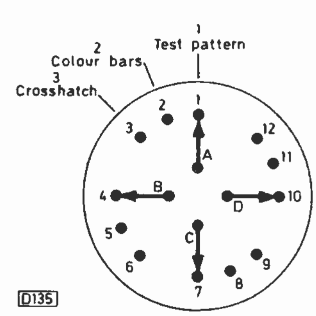


Fig. 2: Connections to the rotary three-way pattern selector switch SW1. Connections viewed from the rear.

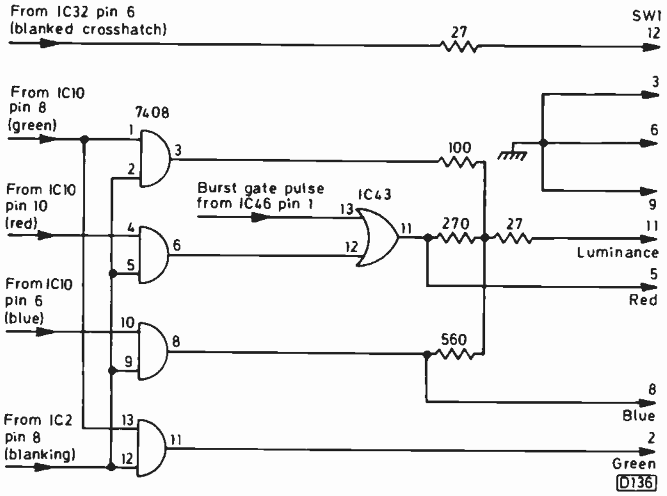
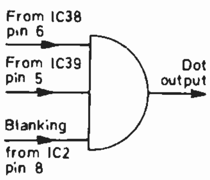


Fig. 3: Extra circuitry required for colour bars.



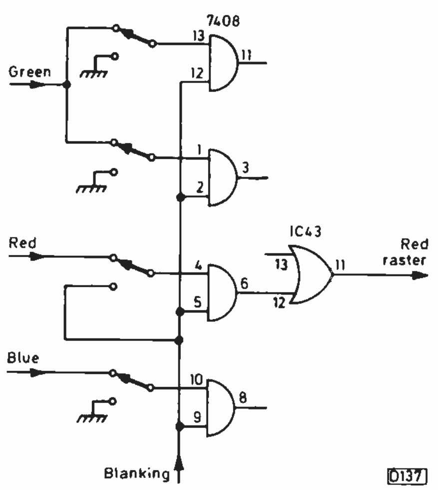


Fig. 4 (left): Use of a three-input AND gate to obtain dots.

Fig. 5 (right): Use of extra switching to obtain a red raster.

contacts 3, 6 and 9 are connected to chassis, grounding the inputs to IC44 to prevent spurious colour on the screen. Switch position three thus gives us a crosshatch display.

Other Possibilities

A check with an oscilloscope will reveal plenty of square waveforms which could be used to form a checkerboard pattern if required. A good 50Hz l.f. pattern could also be produced. Such patterns are of limited appeal. Of greater interest are dots instead of a crosshatch and a red raster.

Vertical grill lines are combined with horizontal lines in OR gate IC18 on the logic board, giving the basic test pattern crosshatch. By taking the inputs to this gate (from IC38 pin 6 and IC39 pin 5) to an AND gate which produces an output only when all its inputs are simultaneously high, only the intersections of the grill lines will be seen, giving dots. The idea is shown in Fig. 4. An additional switch could be fitted to select either dots or crosshatch, with SW1 in position 3.

Many colour pattern generators provide a red raster output, which is useful for checking purity – you don't have to take the back off the set, perhaps unnecessarily, to switch off the other two guns. This facility can be provided by grounding the green and blue inputs to the additional AND gates (see Fig. 5) and feeding the blanking input to the red gate. A more comprehensive check, particularly useful with in-line gun tubes, would be to make it possible to select either red, green or blue rasters. An attempt to produce different colours by earthing the red channel and raising the appropriate input during the active picture time to logic one was successful, though the setting of the subcarrier oscillator to obtain blue was for some reason more critical.

All or some of the patterns so far mentioned can be incorporated, depending on how elaborate you wish to make the switching. It's essential however that the test pattern generator is working correctly as originally designed before any attempt is made to carry out modifications.

Those who wish to use the coder alone experimentally should note that it's desirable to include the original chroma blackout combination of IC44, IC36 and IC40, and that all the inputs to the coder, except luminance, are at TTL level.

Problems and Corrections

We still get the occasional letter from a constructor having difficulty in getting the generator going correctly. Most problems arise on the logic board, and the many odd effects which faults produce are almost always due to dry-joints, particularly on the top printed circuit, and missed through-links. There were one or two mistakes on the original circuit diagram (see corrections in the June 1979 issue), but the boards themselves have been tried and tested as a practical design. It's inadvisable to build such a complex circuit without using these boards, since the effects of stray coupling can be disastrous.

The following corrections are in addition to those listed in the June 1979 issue and apply to the logic board circuit diagram (the note on frequency gratings in the June 1979 issue should be disregarded when using boards D062/3).

IC39 pin 7 goes to earth; pin 6 is not connected.

IC8 pin 9 goes to IC42 pin 1; pins 1, 6 and 12 of IC8 go to IC42 pin 5.

IC15 pins 5 and 11 go to IC20 pin 10 (not 12); IC14 pins 2 and 6 go to IC20 pin 12.

Pins 2 and 3 (the latter was not shown) of IC7 are strapped together so that it acts as an inverter.

Once again we emphasize that the boards themselves are correct (D062/3).

If the width of the left-hand border is excessive, alter the value of R1 to compensate.

A point worth noting is that the pin configurations for BC212 and BC212L transistors (the latter were specified) are not the same. Typical voltage readings are as follows: Tr1 emitter 2·75V, base 1·9V, collector 0·75V; Tr2 emitter 4V, base 3V, collector 2·5V; Tr3 emitter 4V, base 3V, collector 3·5V. Some slight variation does not necessarily indicate a fault.

One or two readers have mentioned that the yellow and red colour bars are incorrectly rendered – in particular the yellow bar can be too orange or green. We suggest altering the value of R9 on the analogue board in steps of 100Ω or so to get the best rendition. We've also heard that changing the value of R25 can be effective. In bad cases try shunting R16 with a 470kΩ resistor.

The simple sync pulse generator for the economy version of the pattern generator was described in the August 1979 issue. Unfortunately there's an error on the circuit diagram. Possibly many will not have noticed that there's no front porch on the sync pulses. A slip of the pen combined with counting i.c. pins back-to-front resulted in pins 4 and 9 of IC3 being linked instead of pins 9 and 13.

Finally, individual requirements vary and it's not always possible to guarantee deviations from published designs: television is a fascinating hobby however, and a little experimentation is what it's all about! ■

Long-distance Television

Roger Bunney

IT'S all been happening again! Signals from far and wide – North America, Africa, the Middle East, even the Caribbean. Apart from the relatively local European stations that is. Before going into this month's delights however a recap on June.

June 7th will most certainly go into propagation history, with the reception in both Holland and the UK of the USSR on channels R6 through to R11 via SpE during the period 1540-1710GMT. Ryn Muntjewerff (Holland) and others were fortunate in receiving relatively good quality signals from several of the TSS transmitters. Mike Allmark (Leeds) also received the TSS ch. R7 signal, plus many USSR amateurs at 144MHz (2 metres). On the same day f.m. radio signals from Jerusalem (90·2MHz) at 1700 and from BFBS Akrotiri, Cyprus (92·1MHz) at 1915 were heard in Holland. On the 7th and the 11th UK and Israeli radio amateurs were in contact on 144MHz. Remarkable conditions, and congratulations to all concerned.

After a slowish start, July produced some amazing reception. SpE events are listed below.

3/7/81 RTVE (Spain) chs. E2, 3.

4/7/81 RTVE E2, 3, 4; RAI (Italy) IA, B; NTV (Nigeria) ch. E3 at 1915 over much of the UK via double-hop SpE, with a clear view of the clock (with NTV identification) at 1930.

5/7/81 Private Italian station NCT (Udine) on ch. E3/IA.

6/7/81 RTVE E2, 3, 4.

7/7/81 RAI IA.

8/7/81 An excellent, prolonged opening. JTV (Jordan) E3; MTV (Hungary) R1, 2; TSS (USSR) R1, 2, 3, 4; TVR (Rumania) R2; JRT (Yugoslavia) E3, 4; RAI IA, B; RTS (Albania) IC; also 144MHz radio amateurs from this area.

9/7/81 RTVE E2, 3, 4; JRT E3, 4; RAI IA, B; TVP (Poland) R1; NCT E3/IA; JTV E3; plus many unidentified signals on all channels and 144MHz radio amateur signals from SE Europe.

10/7/81 A day to be remembered! A prolonged SpE opening continued for most of the day, from early morning to 2400. Switzerland E2; RAI IA, B; RTVE E2, 3, 4; ORF (Austria) E2a; RTP (Portugal) E3; BR Grunten (W. Germany) E2; TVP R1, 2; CST (Czechoslovakia) R1; SR (Sweden) E2; RTVE-Canary Is E3; *Puerto Rico ch. A2 plus unknown ch. A3 video* (see later). Mike Allmark in Leeds also logs RTVE E6 Alfabia, Majorca and E7 Grenada at 1645 and RTM (Morocco) ch. M5 at 1647. Moroccan 144MHz amateur radio signals also heard.

11/7/81 TSS R1, 2; MTV R1, 2; RTVE E2, 3; JRT E3; RAI IA; JTV E3.

12/7/81 TSS R1; ORF E2a.

13/7/81 TVP R1; TSS R1; RAI IA; RTVE E3; CST R1; SR E2.

14/7/81 RAI IA; RTVE E3; RTP E3.

15/7/81 DFF (E. Germany) E3; RAI IA, B; TVR R2, 3; RTVE E2, 3, 4; RTP E3; RTS IC; JRT E3; TVP R1, 2.

16/7/81 Hugh Cocks logs NTV ch. E3 at 1630-1700BST.

17/7/81 NRK (Norway) E2, 3; MTV R2, RTVE E3; RTP E3; TSS R1; ORF E2a.

18/7/81 TSS R1, 2; RAI IA, B; RTVE E2, 3, 4; many unidentified signals.

19/7/81 RTVE E2, 3, 4; RTP E3.

20/7/81 TSS R1, 2, 3; TVP R1, 2; SR E2, 3, 4; JRT E3; RTVE E3; many unidentified signals.

21/7/81 MTV R1, 2; TSS R1; RTVE E3; RAI IA; JRT E3, 4; TVR R2.

22/7/81 RTVE E3; Hugh Cocks logs system M chs. A2, 3 again – see later.

23/7/81 RAI IA; MTV R1; TSS R1; an Auroral event from 1815.

24/7/81 RAI IA; RTVE E2, 3, 4; RTP E3; TSS R2; TVP R1; MTV R1; CST R1; NRK E2, 3, 4; TVR R2; Cyril Willis and others log ZTV (Zimbabwe) ch. E2 via TE at very good signal levels, with sound, from 1810-1831BST; Hugh Cocks strikes again with system M signals on chs. A2, 3, 4 – see later.

25/7/81 RAI IA, B; RTVE E2, 3, 4; a very strong Auroral event from 1435-1800 (first phase 1430-1800, second phase 1835-0030); RTE (Eire) Gort ch. B; suspect system M signals on chs. A2, 3 via Auroral propagation; Ray Davies logs Auroral interference noises through Band III reaching to ch. E29 u.h.f.! – another record?

26/7/81 RTVE E2, 3, 4; RAI IA; RTP E3; French language sound heard on ch. E2 (SW harmonic or CLT Lebanon?).

27/7/81 RTP E2, 3; RTVE E2, 3, 4; TVP R1, 2; CST R1; TSS R1, 2; SR E3; JRT E3.

29/7/81 RTVE E2, 3.

30/7/81 DR (Denmark) E2, 3; RTVE E2, 3, 4; modified EBU pattern seen on ch. E4/IB at 2029 for five minutes, suspected from an Italian private station; also NTV ch. E3 again very strong at 1700.

31/7/81 NRK E2, 3, 4; SR E2; TSS R1; RTVE E4.

There has also been tropospheric reception, with signals on the 7th from Denmark and W. Germany in Band III and at u.h.f., and again on the 27th through to the 31st with central European signals. The evening of the 30th/early 31st was perhaps the most rewarding, with E. German Band III/u.h.f. signals and Hugh Cocks receiving TVP ch. R12 with co-channel interference and CST ch. R7 (at 0740).

The reception on July 10th was most unusual. System M signals appeared at 2200 at Hugh Cocks's East Sussex location during an RTVE opening, though the signals were not visible here at Romsey. At 2220, audio became apparent, in Sussex very clear but at Romsey just above the noise level (both of us using SX200N scanners). Ch. A3 appeared in Sussex but there was only RTVE news here on ch. E4. Ian Becket (Buckingham) also logged ch. A2 video, which was also seen in Derby. The system M signals faded at approximately 2315. My only consolation at missing the A2/3 signals was reception of RTP with co-channel RTVE Canary Isles signals on ch. E3. Confirmation that the ch. A2 signal came from Puerto Rico (WKAQ, San Juan) was obtained by monitoring the audio, which included local news in Spanish.

Wednesday July 22nd produced double-hop SpE signals from N. America on chs. A2 and A3 between 1845-1905, with a clear "CBC News" identification on ch. A2 (CKCW-TV) – the origin of the ch. A3 signal is unknown. Friday the 24th again produced N. American double-hop SpE signals: Hugh logged them between 1945-2110 on chs. A2, A3 and (just) A4. The ch. A2 signal differed from the Wednesday one in having a positive frequency offset rather than a negative one.

So July was an incredible month! Apart from my own loggings, the above list is supplemented by receptions noted by Brian Fitch (Scarborough), Simon Hamer (mid-Wales), George North (Walton), Hugh Cocks (East Sussex), Ray Davies (Norwich), Mike Allmark (Leeds), Ed Baker (Northumberland) – and especial thanks to Cyril Willis (Cambridge) who kept a detailed log over the period 19-27th when I was on holiday.

In Australia Robert Copeman and Anthony Mann have both reported excellent SpE conditions – it's thought that the drop in sunspot activity may have a bearing on the conditions of late. Robert has recently moved from Sydney to Melbourne, where DX-TV conditions are somewhat better. During a recent trip he took his portable on a tram at Ballarat (70 miles north of Melbourne) and received several good strength Band I SpE signals – he wonders whether this is the first tram DX?!

New EBU Transmitter Listings

France:

Troyes	TF1	1000kW e.r.p. ch. 27.
Gex	TF1	900kW e.r.p. ch. 27.
Mezieres	TF1	500kW e.r.p. ch. 29.
Vittel	TF1	50kW e.r.p. ch. 29.
Metz	TF1	1000kW e.r.p. ch. 37.
Avignon	TF1	250kW e.r.p. ch. 42.
Ussel	TF1	150kW e.r.p. ch. 42.
Besancon	TF1	400kW e.r.p. ch. 47.
Autun	TF1	500kW e.r.p. ch. 48.
Grenoble	TF1	100kW e.r.p. ch. 56.
Chaumont	TF1	50kW e.r.p. ch. 31 (increased e.r.p.).

All with horizontal polarisation.

Hungary:

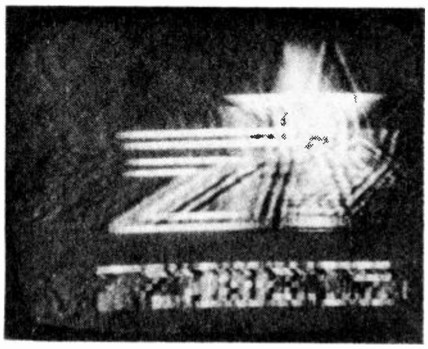
Szentes MTV-2 480kW e.r.p., ch. 23; Kekes MTV-2 880kW e.r.p. ch. 36. Both with horizontal polarisation – listed for optimists! Nagykanizsa ch. R1 reduced to 50kW e.r.p. and Pecs ch. R2 to 25kW e.r.p.

Amateur TV

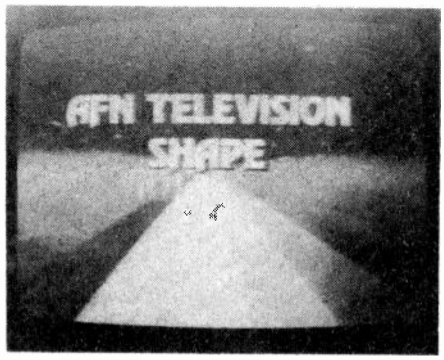
Several interesting leaflets have been sent to me by a firm that supplies ATV equipment – Fortop Ltd., 13 Cotehill Road, Werrington, Stoke-on-Trent, Staffs. The equipment includes a 425-445MHz/ch. 38-40 converter, an inexpensive 435MHz vision transmitter and other items. Send a 9 × 4in. s.a.e. for details.

News Items

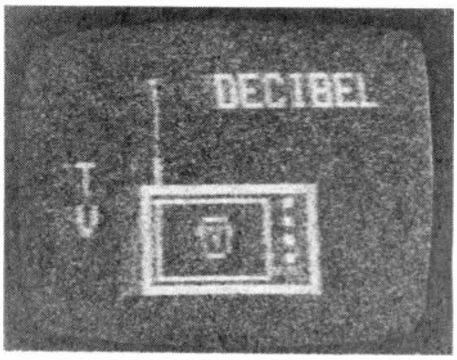
Australia: Subscription TV services are due to start in Melbourne and Sydney by late summer 1983, with the transmissions scrambled and the viewer hiring a descrambler. Scrambling may take the form of segmented video with the syncs removed. The present ethnic service on chs. 0 and 28 is to go commercial to make it self-financing. TV station GTW11 (Geraldton, WA) suffered considerable interference recently, thought to have come from US naval equipment on the USS Midway which was on exercise off the coast. Station manager Bruce Carty intends to take out a Supreme Court writ against the three navies concerned to prevent further problems . . .



ZTV (Zimbabwe) Gwelo ch. E2 station identification, received in Holland by Ryn Muntjewerff.



AFN-TV Shape identification (ch. 34). Photo courtesy Alan Reekie. The transmissions are on system M.



Decibel TV, a Dutch pirate TV station specializing in adult films. Photo from Ryn Muntjewerff.

W. Germany: John Tellick reports that the French/German satellite consortium intends to start DBS TV transmissions by January 1st 1984.

Nigeria: The Bendel TV station is due to come into operation this October.

Israel: The government is to start its own ch. 59 transmissions to counter the transmissions from the pirate TV ship Odelia. In the same area, Jordan is to increase its TV transmissions.

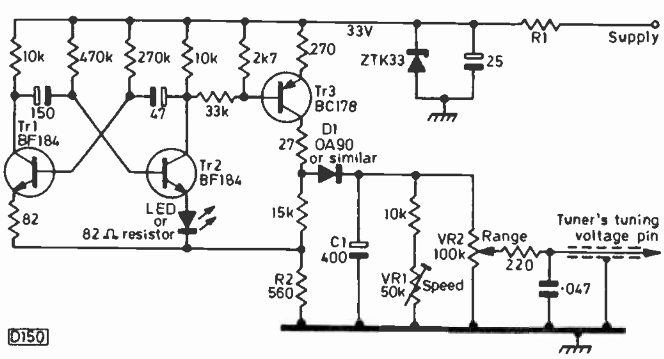
Eire: Following our report last month of a pirate operator on ch. C calling itself "Channel 3", it seems that an ex-BBC transmitter is being used, located at the Camelot Hotel, Malahide, Dublin, with a coverage of five miles. The plan to transmit feature films has been halted as a result of legal action by US film companies.

Spain: An application to run twelve private commercial TV stations covering 80% of the population has been made by an ex-director of the government RTVE network.

France: Private f.m. radio stations seem to be coming into operation in large numbers. An independent TV service, "Tele Ici et Maintenant", is likely to come into operation shortly.

Luxembourg: A Belgian air force jet demolished the upper section of the Dudelange TV transmitting mast on July 31st, killing three people (including the pilot). The mast is used for the ch. E7, E21 and the external E27 TV services. A temporary service has been started from aerials at a greatly reduced height.

USSR: The new Moskva satellite TV distribution network operates at 3·6-4·2GHz, with a 40W transmitter but a narrower beam than the Ekran wide-angle system, which operates on ch. 51 and can be received in eastern/southern Africa, the Middle East, west and north Australia and east of a line running through Libya, Poland and the Baltic.



D150

Fig.. 1: Band-sweeper circuit used by Brian Williams. The value of R1 depends on the supply voltage. The LED can be mounted on the front panel to give a visual indication that the circuit is operational. VR1 controls the sweep rate and VR2 the sweep range (l.f. – h.f. as the slider is "raised").

Tropospheric signals can be received at Lahti, Finland, some 120 miles over the horizon, under good conditions. Ekran's 200W transmitter feeds a 25dB gain array, consisting of 90 small helical arrays, giving an e.r.p. of approximately 63kW, with a beamwidth of 9° (–3dB) aimed at 70°N.

From Our Correspondents . . .

Brian Walsh (6 Hucknall Close, Romford, Essex, RM3 9QS) has access to several East European language reference sources (including Russian) and has kindly offered to assist readers with signal identification problems. If you write, enclose an s.a.e.

Gosta van der Linden (Holland) reports that there's apparently a ch. E2 transmitter in operation in Iceland. Enquiries are being made. I received a 10W relay in the early 70s but this was later replaced by a Band III transmitter. The picture was clear however, which shows what even small transmitter powers can achieve via SpE. The Belgian army has a 34W relay transmitter in operation at Ophestan on ch. E12.

The chaotic TV situation in Italy is now well known. During a recent visit to Florence, John Tellick noted twelve local "private" stations in operation – they remain on air, with programmes or test transmissions, for 24 hours a day, presumably to ensure that other stations don't claim any vacant air space. John has received the NCT Udine private station (ch. E3/IA) back home in Surbiton.

Brian Williams has sent in a circuit (see Fig. 1) which serves as a low-cost spectrum analyser or "band sweeper". He's found it very very useful for DX checking at his Penarth location. The basic idea is that C1 is periodically charged and discharged, providing a band-sweep tuning voltage to feed to a varicap tuner. Tr1 and Tr2 form a slow-speed multivibrator which switches Tr3 on and off. When Tr3 conducts, C1 charges quickly via D1 etc. from the 33V rail. When Tr3 is off, C1 discharges slowly via the parallel potentiometer network. The charging time is about three seconds and the sweep time two minutes, h.f. to l.f. The LED is included to show the charge. Due to the exponential discharge curve, the sweep is slowest at the l.f. end: to partially offset this effect, R2 is included.

Alan Reekie reports that regular reception of the 525-line (system M) transmissions from the AFN-TV transmitter at Shape is possible at his location in the southern suburbs of Brussels – despite, as he says, the modest power (1·5kW e.r.p.). The transmissions are on ch. 34, with vertical polarisation. NTSC colour bars are radiated between 1200-1400 (local time) on Mondays-Fridays, followed by programmes until close down after 2300. The weekend test transmissions are from 0830-0930 when programmes start.

A white "AFN" symbol is superimposed from time to time, presumably to prevent unauthorised copying (similar to the Italian RAI practice). The only vision identification is at the start of programmes (see accompanying photo), though there are audio identifications – "you're watching AFN, Shape" – during many breaks between programmes.

Alan uses a Grundig TV set which switches automatically between the 4·5/5·5MHz sound signals (Grundig have dual-standard sound i.f. modules for systems B/M and B/I). He mentions that the pull-in range of the TDA1170 field timebase i.c. used in his set is such that the field frequency control can be set for perfect sync with both 50 and 60Hz signals. With the height control set for a 625-line picture however the height will be about 20% short on 525-lines. To overcome this problem it's necessary to reduce the resistance between pin 7 of the i.c. and chassis.

Ridley Relents

Les Lawry-Johns

RIDLEY'S been a valued customer of mine for many years, and a friend to be even more valued when the wind has blown against us which, fingers crossed, it hasn't done for a considerable time. Throughout the colour boom Ridley stuck to his monochrome set, saying that colour had no fascination for him at all. Anyway, I'd just sold a 22in. Pye colour set (K30 chassis) to a chap who'd come to buy a pair of headphones when Ridley came in.

"You'll never guess what I want" he said.

"I think," I said carefully, "you've decided it's about time you had a colour set. Why?"

"I was out at Bob's place last night and he put his set on to catch the golf highlights and you know, Leslie, it does look better in colour after all. So I thought I'd pop in and give old Les a shock, and here I am."

"You certainly have Ridley. If you can do a U-turn anything can happen."

"Well what do you suggest? It's got to be British of course."

"Of course. What about a nice 22in. Pye set like the one that chap's just chosen – with a bit of help of course."

"Is it British? I thought they were part of that Dutch lot."

"Well yes. European co-operation and all that. The tube's French, but we'll insure it for four years so you've nothing to worry about. Have a look and see what you think" I said, busy unpacking one from its box. Up on the bench the picture appeared in a matter of seconds and Ridley was clearly impressed with the clarity of the picture and sound.

So we piled it into the van and installed it in its appointed place in Ridley's lounge. Switching on didn't produce the fine picture we expected however. It immediately started to trip. Hrrrump bonk it went.

"Oh dear" said Ridley. "It doesn't like living here". "'Course it does" I said. "Probably didn't like the journey. Jet lag or something."

"That's just fine" said Ridley. "Can't travel half a mile before it starts huffing and puffing. My old set could travel to Cornwall and back without turning a hair."

I knew I had to do something, so I took the back off and stared at the large panel. Employing the latest of servicing techniques, I gave it a sharp tap with the end of the screwdriver, somewhere around the centre section. The set stopped huffing and puffing, produced a perfect picture and talked to us nicely enough. "There you are. You just have to show them who's boss." I tapped it some more, thinking that the something or other that was playing about would play about some more, but it didn't. The set continued to behave impeccably, which was just as well since I've not yet become an expert on the K30.

If Ridley had any doubts he kept them well hidden and seemed pleased with the performance (the set's, not mine). So another sale was made and another triumph was notched up by my screwdriver.

More Puffing

Back at the ranch Honey Bunch told me that another old friend had phoned to say that his set was playing about. So I rang him to ask what was up.

"Hallo Len. What are you moaning about now?"

"It's this set of mine Les. It comes on and then goes hrrump and goes off and won't come on again till I press the red button at the back. It'll go for some time and then starts to bugger about all over again. You know it's too bloody big to put in the car, so you'll have to stir yourself and come down. Oh yes, and bring one of those colour portables with you. Dot wants one for the kitchen so she doesn't have to watch football."

So we prepared to do battle with Len's 26in. Ferguson (3500 chassis). Pile in everything just in case, including a spare power panel, and don't forget the portable and the battery for the remote control unit. Off we set, wondering whether the portable would show symptoms of jet lag when we arrived.

First we demonstrated the portable, which performed perfectly. So Dot (Len's wife) took it off to the kitchen, proclaiming that Len wasn't going to watch it even if the big set did huff and puff.

The 3500 wouldn't play up when we wanted it to. So we switched it off and tried again after taking some liquid refreshment. This time it did play about, and as the red button cut out seemed to restore normal operation we changed this first. No difference of course.

As there was plenty of voltage on the body of the chopper transistor when the set went off we turned our attention to the 30V line. There was only 30V instead of about 45V at the 1,000µF reservoir capacitor, i.e. at the input to the 30V regulator, but the voltage increased to normal when we prodded the capacitor, the set coming to life again. The electrolytic usually dries up, preventing the set working altogether, but on this occasion there seemed to be a poor leadout contact. A replacement capacitor cured the huffing and puffing – presumably the act of pressing the red button had momentarily interrupted the supply and sealed the poor contact.

I've been Struck

We've had some pretty severe storms of late, so it was no surprise when Mr. Allen phoned to say he'd been struck by lightning. Not really him you understand but his set, another large Ferguson – this time with the more up-to-date 9800 chassis.

When I arrived he pointed to a heavy chrome ornament. "That was on top of the cabinet. Must have attracted the lightning to the set" he proclaimed. I've found it best over the years not to disagree unless it's absolutely necessary, since I don't know all that much about these things. So I nodded my head and then shook it in sympathy. "Funny thing lightning. Scares me stiff. Never know what it's going to get up to next." "It struck my umbrella once" said Mr. Allen. "There was nothing left but the wood. Made me feel quite funny at the time." I tut-tutted as I removed the set's rear cover.

It seemed to be perfectly all right until I took a closer look at the upper left mains input subpanel. A diode here was in two halves, while a resistor was a small, charred mass. I thought at first that the diode was the one in series with the thyristor h.t. rectifier/regulator, and then realised that this is on the lower power board. The damaged diode was the first one (W810) in the start-up circuit, the resistor being the following 470Ω one (R814). The path appeared to have been via W810, C810, R814 and VT810, which appeared only as three small wires with no transistor body to contain them.

A small voice inside my head told me not to muck about with the set there and then, but to take it back to the shop as it was going to be a long story. The voice was right, because when I ignored it and replaced the damaged components the set immediately began to trip like mad.

So we hauled the monster into the van and subsequently spent several unhappy hours on the bench. A replacement power panel was eventually fitted. This stabilised the supply lines (the line output transistor had been replaced earlier in the proceedings, along with quite a few associated components which had been dealt a deadly blow). We then had a raster but no signals, and naturally thought that the tuner must have been the first casualty. In the event, the tuner seemed to be about the only item completely unharmed. This is not quite true of course, but we had to replace two i.c.s on the signals board before normal reception was restored, suggesting that there'd been a sudden and drastic increase in the supply voltage.

Mr. Allen also appeared to have been struck by lightning when I presented him with the bill. When he recovered, he told me that lots of funny things had happened up and down his road as a result of the storm – and not only to TV sets. Cookers wouldn't cook, freezers wouldn't freeze, and one house will have to be completely rewired because the wiring vanished, leaving only trails of dust where the cables had been.

"All the copper just vapourised – puff" said Mr. Allen impressively.

"You were lucky it only got to your TV set then Mr. Allen, very lucky."

Who Needs Friends?

You may recall that one of our customers lives in a back-to-front house in a quiet and select area. He's a bookie or turf accountant rather, and seems to travel around the world a lot. So we go for some time without hearing from him. He turned up the other day however. Strode in demanding to see the books and claiming to be the Vatman – to the consternation of a couple of customers who were in the shop at the time. I explained to them that he wasn't really an angry Vatman but only a friend having his little joke. This seemed to amuse them as one was actually a Customs and Excise man on his day off.

It appeared that his old Dynatron was giving trouble again, so I promised to visit him later. For his part he promised to remove the twenty thousand screws that hold the back on before I arrived. The set's a CTV25, with a VCR in the top, the chassis being a 733 or 743 (I can never remember, they all look like the 725 to me). It has the vertical panels and centre power resistor and fuse in the h.t. line, and it appeared that the 56Ω section of the power resistor was open-circuit. There was a fairly low resistance reading at the end of this that feeds the line timebase, so suspicion centred on the line output transistor which proved to be short-circuit.

After a struggle we removed the timebase panel completely and then attempted to remove the transistor. Attempted is the operative word. The screws were stuck fast and no amount of heating, twisting or turning would shift them, and time was slipping by. At last I gave up and took the panel back to the shop (not having the courage to remove the set itself).

On the bench the comedy continued, until the screws were just bits of metal with holes in the top and there seemed no possibility of cutting a slot with a hacksaw. At this point son-in-law Douggie appeared.

"No problem" said Douggie, who although Greek claims to have mastery over every language including ancient Chinese. "Wait while I get my socket set."

He returned with a tool box and his brother Soffie. With a socket under each screw to support the panel, Soffie held a screwdriver (standard blade) on the screw and Douggie dealt it several almighty blows with a hammer to cut a slot in the top. The process was repeated, before my horrified but fascinated gaze, on the second screw. The screws then offered no further resistance, and the transistor was changed in a trice.

As I soldered the base and emitter contacts, my eyes were attracted to the myriad of fine lines fanning out from the source of the operation. Many tracks were in need of repair, and the panel presented a somewhat different appearance when it was at last ready for operation.

"Thanks Doug. I wouldn't have thought of doing that myself. Glad you popped in."

"No problem" said Doug.

In fact the set worked quite well when the panel was refitted and the power resistor was replaced. Once I'd located the remote control unit that is.

STATION OPENINGS

The following relay transmitters are now in operation:

Backbarrow (South Cumbria) TV4 (future) ch. 50, BBC-1 ch. 57, Granada Television ch. 60, BBC-2 ch. 63.

Beer (Devon) BBC-1 ch. 55, Westward Television/Television South West ch. 59, BBC-2 ch. 62, TV4 (future) ch. 65.

Belper (Derbyshire) BBC-2 ch. 56, TV4 (future) ch. 62, BBC-1 ch. 66, ATV ch. 68.

Collafirth Hill (Shetlands) Grampian Television ch. 41, BBC-2 ch. 44, TV4 (future) ch. 47, BBC-1 ch. 51.

Fetlar (Shetlands) BBC-1 ch. 40, Grampian Television ch. 43, BBC-2 ch. 46, TV4 (future) ch. 50.

Fintry (Scotland) Scottish Television ch. 24, BBC-2 ch. 27, TV4 (future) ch. 31, BBC-1 ch. 34.

Fishguard (Dyfed) Sianel 4 Cymru (future) ch. 54, BBC-Wales ch. 58, HTV Wales ch. 61, BBC-2 ch. 64.

Kirkfieldbank (near Lanark) TV4 (future) ch. 53, BBC-1 ch. 57, Scottish Television ch. 60, BBC-2 ch. 63.

Methven (near Perth) BBC-1 ch. 22, Grampian Television ch. 25, BBC-2 ch. 28, TV4 (future) ch. 32.

Millbrook (Southampton) Southern Television/Television South ch. 41, BBC-2 ch. 44, TV4 (future) ch. 47, BBC-1 ch. 51.

Penny Bridge (South Cumbria) Granada Television ch. 23, BBC-2 ch. 26, TV4 (future) ch. 29, BBC-1 ch. 33.

Strathallan (Scotland) BBC-1 ch. 39, TV4 (future) ch. 42, BBC-2 ch. 45, Grampian Television ch. 49.

All the above transmissions are vertically polarised.

SERVICE BRIEFS: ITT

Hybrid colour chassis: The original yellow moulded type of mains filter capacitor (C257) continues to give trouble. To avoid any further problems the later grey moulded type (part no. 081066) should be fitted whenever one of these sets is serviced.

CVC20 chassis: When replacing the field output transistors, the associated diodes D7/8 should be mounted on end and stood off the board to reduce their operating temperature.

CVC25/30 series: Where BD807 transistors are used in the field output stage (T8/9) to replace FT3055 transistors, the field scan coupling capacitor C22 must be increased in value from 2,200μF to 3,300μF to prevent cramping at the top and/or bottom of the raster.

Note that different EW modulator transformers are used in the CVC25 and CVC30 chassis: use of the incorrect type will result in poor EW correction and failure of the EW driver transistor T13 (BD238).

ITT 80 chassis: In cases of random channel change, check that C3 on the remote control receiver panel (CMC90) is 1,000μF (not 100μF). If the problem persists, replace the focus spark gap SG1001 on the c.r.t. base panel.

Tuning drift can be caused by the emitter-follower transistor T2 on the remote control receiver panel. Suitable replacement types are the BC337 or BFY50 (originally type BC546A). If drift still occurs, change R9 to 3·3kΩ (originally 470kΩ) and connect a 1N4148 diode between the base and emitter of T2 (on the copper side of the board), with the diode's cathode to the base of T2.

If C23 on channel selector type VCA45/1 fails (Model CS0624/1), cut link WL3. C23 is omitted in later production.

When fault finding, the 125V h.t. supply can be isolated from the line output stage by removing scan coil plug B. The h.t. supply should then rise to 145V. A 150W (240V) bulb can be connected across the h.t. rail (from socket B1 to chassis) as a substitute load: the power supply should not shut down and the h.t. should read approximately 125V. Intermittent power supply shut down during passages of loud music can occur if coils L407 and L409 in the line output stage are incorrectly positioned so that they touch each other or surrounding components. They are mounted beneath the BU208A line output transistor's heatsink assembly.

SERVICE BRIEFS: PHILIPS

G11 chassis: "Background slush" on sound has been a problem, due to short-wave interference. An earlier modification was to use a screened quadrature coil (L5025) in the detector circuit. An alternative approach is to use a ceramic filter kit which is now available from Philips Service. Care is required in fitting this kit, which replaces L5025/C5023/C5027/C5028/R5026. In addition to the ceramic filter, the kit includes a 100pF capacitor and two resistors (220Ω and 120Ω).

TX chassis: A major alteration to the field oscillator circuit has been introduced to improve the height stability with change of temperature. Panels incorporating the modification are coded HU30. The revised design involves deletion of the constant-current charging transistor TS505 (type BC584C) and associated component deletions/value changes.

VCR Servicing

Mike Phelan

TIME to go into VCR servo systems in further detail. As mentioned last month, the speeds of both the tape and the head drum must be closely controlled during recording and playback. Why? First the situation when recording. The tape speed must be constant and, for compatibility, must be the same on all machines made to the same standard.

Capstan Servo on Record

Fig. 13 shows the capstan servo system in outline. It's mostly contained in the purpose-designed MSM5816 i.c. (remember that we're using the basic JVC HR3330 machine to illustrate these articles). Within this i.c., the frequency of the 3·71Hz pulses picked up from magnets on the capstan flywheel is compared with the frequency of pulses derived from a 2·51MHz crystal oscillator after division down to 3·71Hz.

The system works like this. The low-amplitude pulse from the pickup head is fed first to a NAND gate which is used as an inverting amplifier – it's part of IC3. The amplified pulse from this gate goes into the MSM5816 i.c. at pin 2. It's then converted into a trapezoid as a result of the action of the *RC* network connected to pins 13 and 14. The trapezoid thus produced is one of the two inputs to the following sample and hold gate. The output from the 2·51MHz crystal oscillator is divided down to produce a positive-going 3·71Hz pulse which is the other input to the sample and hold gate. When the machine is running at the correct speed, this 3·71Hz pulse coincides in time with the centre of the trapezoid's falling slope (see Fig. 14). The slope voltage at this point is sampled and charges the 0·01μF capacitor connected to pin 15. This voltage controls the motor via IC5, X12 and X2 which provide current amplification.

If the motor should tend to slow down, the pulses from the flywheel will arrive at a slower rate and the trapezoid will arrive progressively later compared to the timing of the reference pulses. As a result, the pulses will climb up the ramp, the output voltage at pin 16 will rise, and the motor will be speeded up until equilibrium is restored. Simple! The converse happens should the speed of the motor tend to increase. The trapezoid then comes along early, the pulse falls down the ramp and the output voltage decreases. The idea is similar to that of another phase-locked loop with which we should be familiar – flywheel sync.

This arrangement takes care of long-term speed variations but not of short-term ones under load – remember that the capstan is pulling the tape through a fairly obstacle-strewn path (all those guides and things). This problem is resolved quite simply. Notice (Fig. 13) that the motor is fed via an 0·47Ω resistor which is connected between the inverting and non-inverting inputs (pins 6 and 5 respectively) of IC5. The voltage developed across this resistor is proportional to the current drawn by the motor. Any increase in the load will result in the voltage developed across this resistor increasing. As a result, the ratio of the voltages at IC5's input pins alters and the output rises.

Drum Servo on Record

Now to the drum servo. The head drum must rotate at a speed of 25Hz so that one complete field is recorded per rotation by each head. As well as this however the video tracks must always be recorded with the field sync pulse in the same place, i.e. the relationship between the field sync pulse and the rotational position of the head drum must be fixed. This is done by comparing a 25Hz trapezoid derived from magnets on the head drum flywheel with a pulse obtained by dividing the field sync pulses on the incoming video signal by two (by using a monostable multivibrator whose period is longer than 20μsec). See Fig. 15. This monostable multivibrator (MMV) is followed by another one whose period is adjustable. The adjustment is called the "record switching point", and determines where the field sync pulse appears on the recorded track. This part of the circuit is contained in IC1 (AN301), the final pulse output appearing at pin 8. The pulse goes to the sample and hold gate in IC2 (AN318), this part of the servo working in the

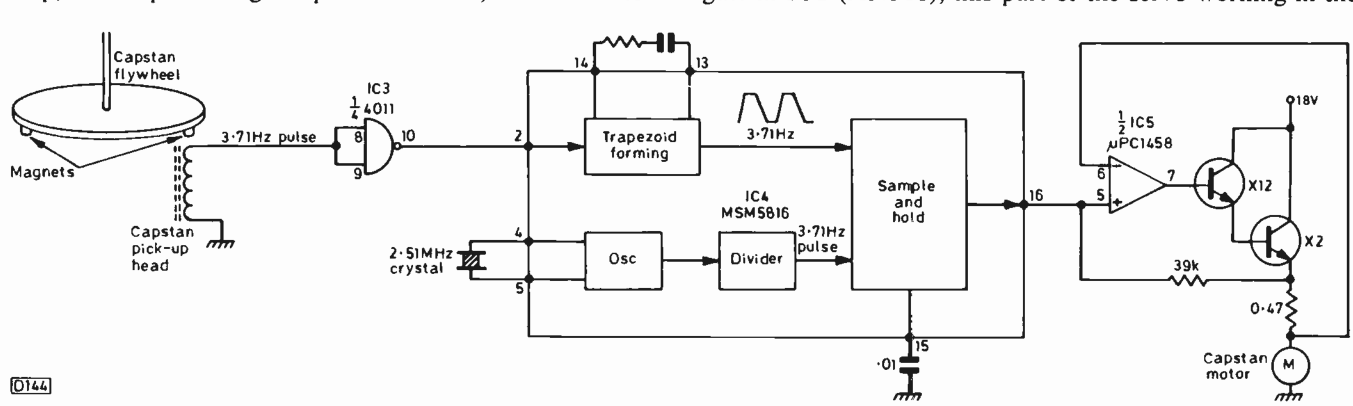


Fig. 13 (above): Block diagram of the capstan servo system used in the JVC HR3330 and similar VCRs.

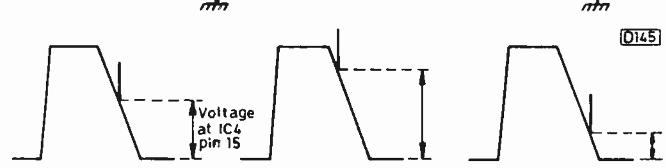


Fig. 14 (right): Relationship between the trapezoid and the reference pulse under various conditions.

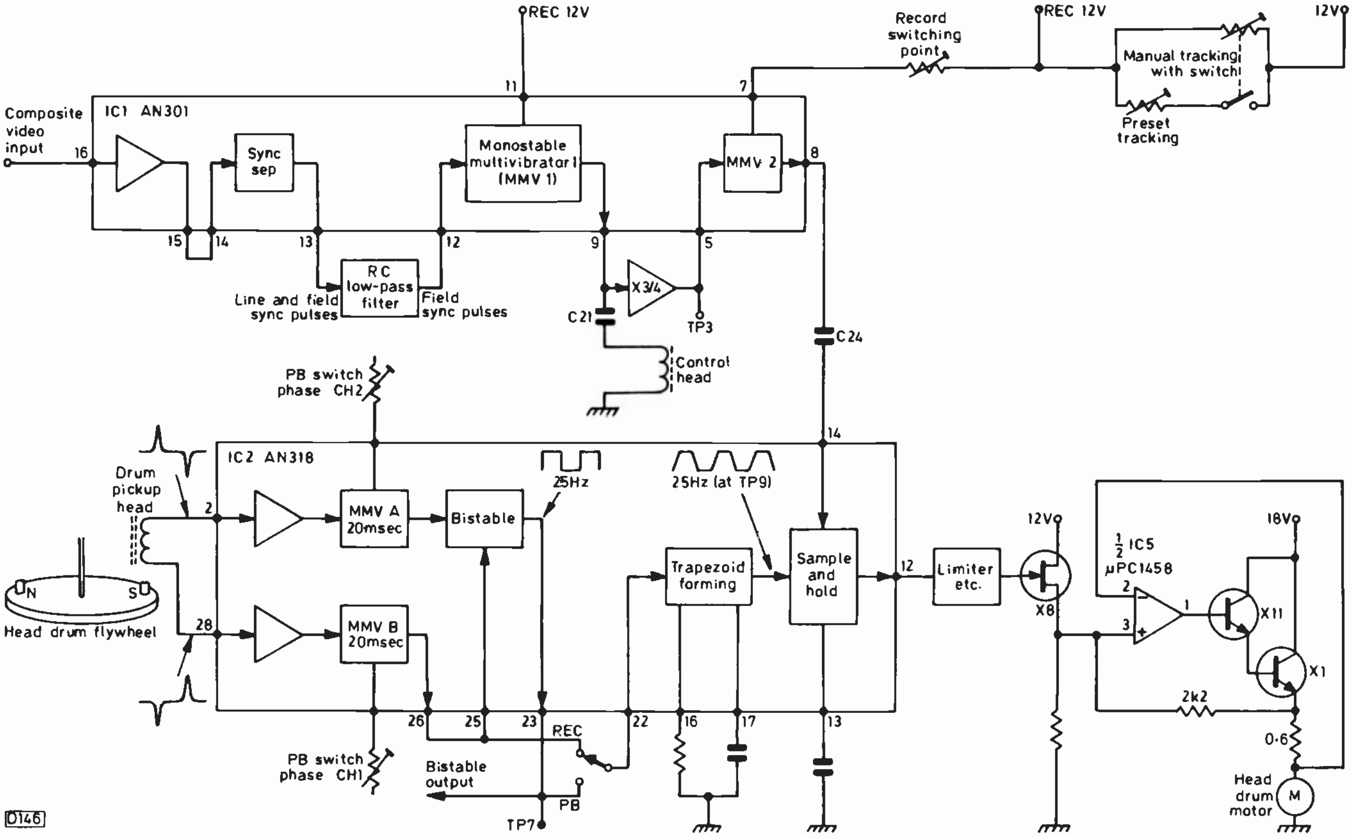


Fig. 15: Block diagram of the drum servo system used in the JVC HR3330 and similar machines.

same way as the capstan servo, with the output from pin 12 being amplified to drive the motor.

The two magnets on the drum flywheel are of opposite polarity, so that the pickup head feeds alternate positive- and negative-going pulses to the amplifiers and monostables in IC2. We'll come back to the bistable and "PB switch phase" potentiometers in a moment – they're used on playback. The tracking control also has no effect in the record mode. The pulse from the first monostable in IC1 is also fed to the control head to be recorded on the bottom edge of the tape (the control and audio heads are in practice a single assembly).

It's time to explain the "REC 12V" labels here and there in Fig. 15. Those of us with experience of audio tape recorders will doubtless know that the record/playback switch has many contacts. With a video machine we would require switching on different panels, and the outcome would be something like the 405/625 line switching on a dual-standard colour set. In the machine under discussion there's one switch on the audio/servo board – some functions are directly switched, but many are operated by sending a "record 12V" supply around the machine, the supply being present only on record. The REC 12V supply to the first monostable in IC1 (pins 9/11/12) brings the monostable into operation on record.

Fig. 16 summarizes the timing of the drum servo reference signal path on record, and will make the reason for the presence of the various monostables clearer. Fig. 17 is a similar diagram for the feedback signal.

Operation on Playback

We'll look next at the servo requirements during playback. The tape must again run at a constant speed, so we don't have to switch anything in the capstan servo system. The drum servo must run at the same speed as when recording, but in addition its position must be accurately controlled so that the heads scan the recorded video tracks centrally, taking into account any variations in track spacing as a result of tape stretching and the inevitable slight wow and flutter that are always present. This is done by using the control pulses from the tape as a reference to be compared with the trapezoid derived from the pulses from the drum magnets.

This involves a minimum amount of switching (see Fig. 15). The REC 12V supply is removed from the first monostable in IC1 so that the field sync pulses are *not* passed to the control head; it's also removed from the tracking control circuit so that the latter now determines the period of the second monostable in IC1, giving adjustment of the sample pulse position. When the manual tracking control is turned off, the preset control is switched in – this will have been set to give optimum results on the machine's own tapes (the manual tracking control may need adjusting when playing prerecorded tapes).

The bistable in IC2 now feeds a squarewave to the trapezoid circuit instead of the input coming from monostable B. The two playback "switch phase" controls adjust the periods of monostables A and B separately, and thus the relationship between both the rising and falling edges of the bistable's output and hence the position of the head drum.

Head Switching

When a tape is being played back, as one head scans the tape the other rotates in fresh air – except for an overlap of a few lines. To avoid picking up noise, the head not in use is switched off. This is the main purpose of the bistable. Later, when we come to examine the head preamplifiers, we'll see

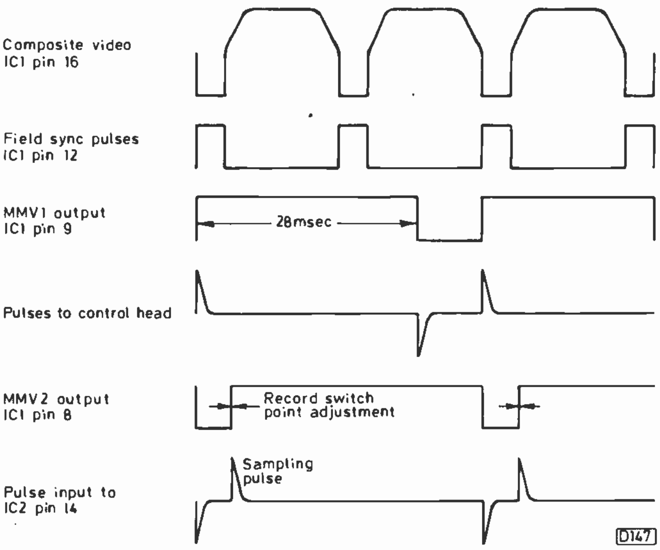


Fig. 16: Drum servo reference path signals in the record mode, showing the time relationships.

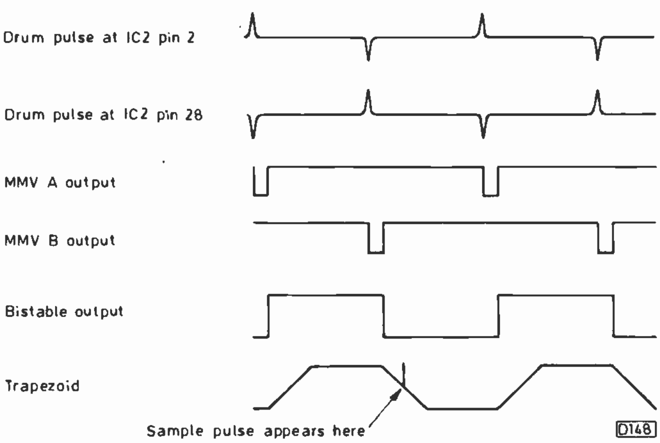


Fig. 17: Timing of the drum servo feedback path signals in the record mode.

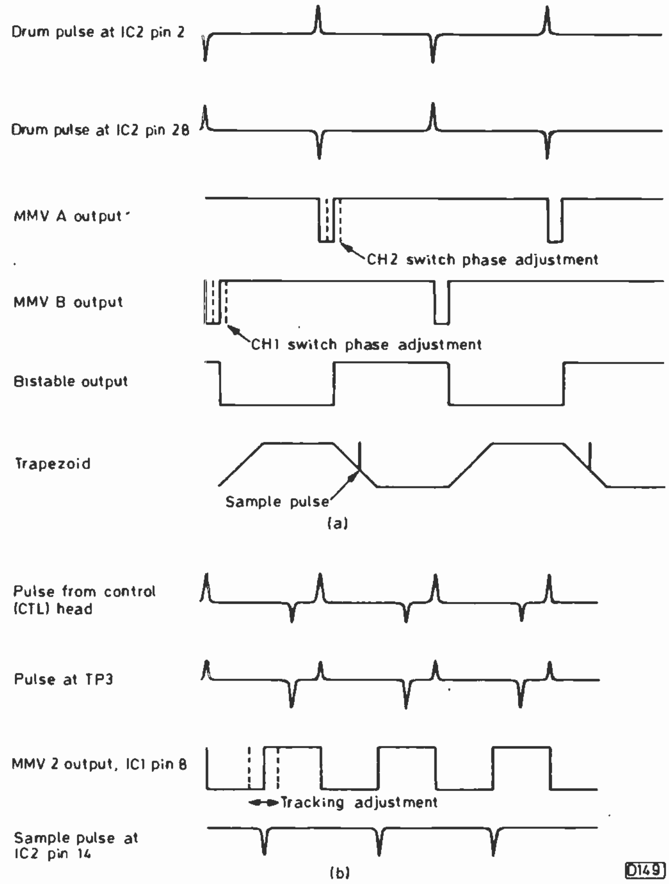


Fig. 18: Drum servo signal timing in the playback mode. (a) Feedback path, (b) reference path. Not to same time scale.

how this is done. Suffice it to say here that every time the bistable changes state one head is switched out and the other one in. The heads are not switched during record of course. The playback "switch phase" controls are adjusted on playback so that the switching (a slight horizontal disturbance on the picture) appears in the centre of the bottom castellations of a test pattern, the two switching points (referred to as CH1 and CH2) overlapping. They will then be visible only if the height control of the set being used to display the picture is reduced. Don't start twiddling yet!

The output from the bistable is in all modes fed to the mechanism control (abbreviated mechacon in the manuals) system to tell it that the head is rotating – if not the stop solenoid operates.

Fig. 18 shows the drum servo timing.

Alternative Approach

This concludes our look at the VHS servo system as used in the JVC based machine. One point deserves mention however. We could just as easily have controlled the tape position during playback instead of the drum position – the narrow angle of the video tracks means that the effect is the same. This indeed is the technique used on the Philips N1500/N1700 series machines, and next month we'll describe the simpler servo system they use.

Vintage TV: Ferguson 842T/843T

Vivian Capel

PERHAPS surprisingly, the UK's largest TV manufacturer for many a year was not active in the TV field before the 1939–45 war. The first Ferguson TV models seem to have been the post-war 841T and 841T/12. Shortly after came the 842T and 843T, the subject of the present article – 9 and 12in. consoles respectively. They were housed in simple, elegant cabinets with nicely grained wood and horizontal fluting across the loudspeaker aperture. Three black, skirted knobs for brightness (coupled with the on/off switch), volume and contrast were mounted beneath the screen. The usual presets were at the back of the cabinet.

T.R.F. receiver circuitry was employed, the sets being designed for reception of the Alexandra Palace transmissions. The amplifying valves in the receiver section were EF50s – red-coloured, metal-cased valves with B9G bases. Pin contact with the holder was frequently a problem with these valves – we'd no silicone grease in those days to keep oxidation at bay. Cleaning with carbon tetrachloride would cure the problem but would not prevent it recurring. The gain was not all that high – the sets were intended for service area use – and this was particularly a problem with any sets that were converted to operate at higher frequencies. Being large in size, the r.f. section took up most of the chassis space – unlike the compact r.f. strips that followed in later years when miniature valves came into use.

Most sets that employed EF50s had little gain to spare unless they were used well within the service area. If the complaint was poor contrast therefore, quite a few of the valves usually had to be replaced – we would check the whole lot on a tester, replacing those that were well down but trying out replacements for those that were doubtful to see if a new one made sufficient difference to warrant the expense of renewal. Sometimes the valves used in the sound section could be switched over to the vision circuit if they were well up to standard. Since the EF50 had been designed for radar use however large numbers were unloaded on the surplus market at a nominal cost. These could often be used to save an expensive repair bill.

The first two r.f. stages amplified both the sound and vision signals. The third stage amplified the vision signal and provided a tap-off point for the sound channel in its cathode circuit. There was a fourth vision only r.f. amplifier and two sound only r.f. amplifier stages. EF50s were also used in the video output and sync separator circuits, EB41 double-diodes being used for detection and interference limiting in each channel.

In the 9in. set the field sync pulses were integrated and applied to the field oscillator. This wasn't considered to be good enough for the 12in. model, which employed an integrating diode (a WX6 "Westector") to give improved interlace. With a simple integrator the capacitor is not fully discharged on alternate fields when the pulse arrives half way through a line (405-line system): thus alternate pulses are unequal in amplitude and the result is uneven triggering and poor interlace. The use of the diode gave integrated field sync pulses of closer amplitude and thus more accurate oscillator synchronisation on successive fields.

The contrast control varied the cathode bias applied to the first r.f. amplifier valve. The system used for volume control was most unusual – the potentiometer varied the first sound r.f. amplifier valve's screen grid voltage! This meant that the noise and hum in the following stages were not controlled, with the result that the sound-to-noise ratio was poor at low volume control settings. Since the control was not in a signal path however and the wiper was decoupled, noise due to dirt on the track was less likely when it was operated.

Power Supply Arrangements

The power supply components were mounted on a separate chassis which was connected by means of a lead and an eight-pin plug. Whilst the earlier 841T used a mains isolating transformer with the valve heaters fed in parallel, the 842T and 843T employed a series heater chain with a thermistor to limit the current surge at switch on. The h.t. was derived in a novel manner (see Fig. 1) – from an autotransformer. This was not unusual with a half-wave rectifier circuit, but the 842T/843T used a full-wave rectifier that produced around 300V across the reservoir capacitor C49. The result was an economical, non-isolated system with full-wave rectification.

Another unusual feature (see Fig. 2) was the use of a separate e.h.t. generator. It was more common to derive the e.h.t. from the line flyback, as later became the standard practice, or from a mains step-up/rectifier arrangement as in the earlier 841T. Separate e.h.t. generator circuits were usually encountered only in projection receivers. The PL33 valve was used in a self-oscillating circuit (frequency

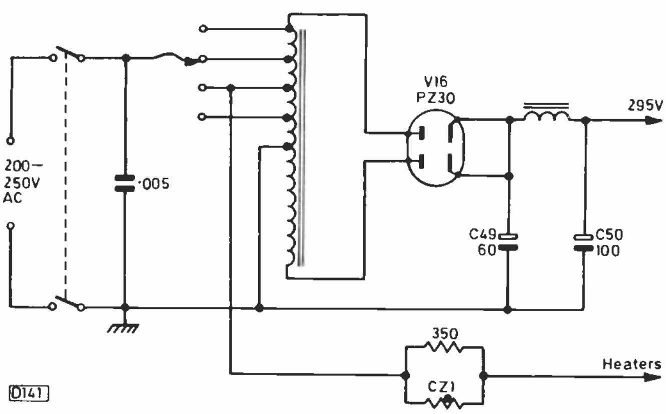


Fig. 1: The power supply circuit. Note the use of an auto-transformer in a full-wave rectifier circuit.

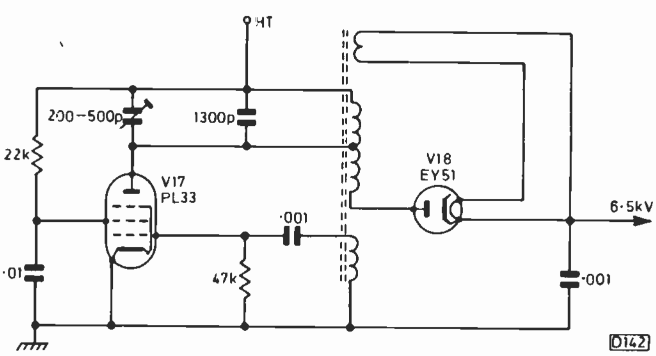


Fig. 2: The e.h.t. generator circuit, consisting of a tuned oscillator driving a rectifier.

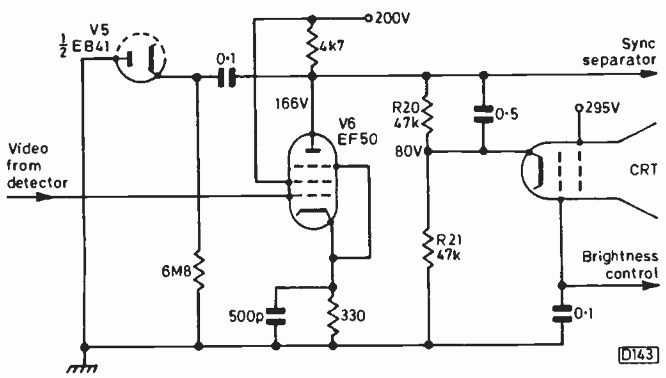


Fig. 3: The video circuit. Potential divider R20/R21 set the d.c. level at the cathode of the c.r.t. The vision interference clipper diode V5 operates in conjunction with an RC network that has a long time-constant.

approximately 80kHz), with an overwinding to feed the EY51 e.h.t. rectifier: its anode circuit was tuned by a fixed capacitor which was shunted by a trimmer to provide adjustment of the e.h.t. voltage. This was 6·5kV, which was not outstanding considering the trouble taken to get it!

As the c.r.t.s were of the tetrode type, the problem of supplying the first anode arose. This should be operated at about 200V above the cathode voltage. Since the main h.t. line was around 290V, this was applied to the first anode while the cathode was taken to a d.c. potential divider (see Fig. 3) connected between the anode of the video output pentode and chassis. The divider consisted of two 47kΩ resistors (R20/21), so the centre point produced half the voltage at the anode of the video output valve. Since the later voltage was 166V, the voltage at the cathode of the c.r.t. was about 80V, giving the required first anode/cathode difference. The 0·5μF coupling capacitor ensured that the video signal was not greatly attenuated by the presence of the voltage divider network.

Timebases

Without the complication of flyback e.h.t., the line timebase was simple indeed. Another EF50 was used as a blocking oscillator, driving a PL38 which had a simple two-winding output transformer to feed the scan coils. The field generator again consisted of an EF50 used as a blocking oscillator. The field output transformer was *RC* coupled to the anode of the PL33 field output pentode, with a.c. feedback to linearise the scan. Neither the field nor the line timebase was provided with a linearity control.

A far cry from the TX9 and TX10!

Servicing Switch-mode Power Supplies

Derek Snelling

MOST recent TV chassis employ some form of switch-mode (chopper) power supply – examples that spring to mind are the Rank T20/T22 series, the ITT CVC20 and subsequent chassis, the Decca 70 series, the Philips KT3 and K30 and the Thorn TX10. The reason for this is the high efficiency and small size of a chopper system – very important with the trend to ever lower power consumption in TV sets. There is quite a bit of design flexibility: a switch-mode power supply can provide mains isolation, as in the TX10 chassis; it can be run synchronously with the line timebase as in the KT3/K30 series etc.; or it can be a self-oscillating circuit running at some other frequency as in the Rank T20/T22 and other chassis that use the Siemens type circuitry.

Unfortunately many engineers treat switch-mode power supplies with some trepidation, partly because their operation is not fully understood and partly because, being active switching circuits (unlike the "passive" series regulator for example), they call for different fault-finding techniques. The aim of the present article is to explain the basic operation in simple terms and to outline appropriate fault-finding methods.

In a switch-mode power supply the smoothed output from a bridge rectifier is chopped up to provide pulses at line frequency or some higher frequency. These pulses are rectified and smoothed to provide the regulated d.c. output. This may seem rather nonsensical, but the reasons for doing things this way are logical enough. First, at the higher frequency of the chopper's output the smoothing components can be quite small – reservoir/smoothing capacitors of only say 100μF. Secondly, by varying the mark-space ratio of the chopper's output, i.e. the ratio of the time during which it conducts to the time during which it's switched off, we can control the power fed into the set and thus regulate the supply. And thirdly, since the chopper transistor acts purely as a switch, being either fully on or fully off, it's working under the most efficient conditions and the losses are minimal.

To achieve all this a switch-mode power supply requires a switching device, i.e. the chopper transistor, to switch the power on and off, a means of switching the chopper transistor on and off at the required frequency (either a separate oscillator can be used or the chopper can form part of a self-oscillating circuit), and a means of sensing the load and, by feedback action, controlling the ratio of the chopper's on/off times.

Self-oscillating Circuits

We'll look first at the self-oscillating type of chopper circuit used in the Rank T20/T22/T26 series chassis. This type of circuit was originally devised by Siemens, and its first appearance in a commercial set seems to have been in the Tandberg CTV2 series chassis. Though the idea is far from new, it has been gaining favour with set designers recently – it's used in the latest Decca and Grundig chassis for example, and in the GEC/Hitachi 30AX chassis.

The circuit used in the Rank T20/T22 chassis is shown in Fig. 1. The mains input is applied to the bridge rectifier 7D14-17, which produces some 300V across its reservoir capacitor 7C13. The chopper transistor 7VT2 is connected across this supply, via 7R10 in its emitter circuit and the primary winding (16-10) of the chopper transformer 7T1. 7D1 rectifies the pulses developed across the primary winding of 7T1 when 7VT2 conducts, developing a regulated 200V supply across its reservoir capacitor 7C2.

Though the chopper is self-oscillating, it's not self-starting. To get it going, a positive pulse is applied to its

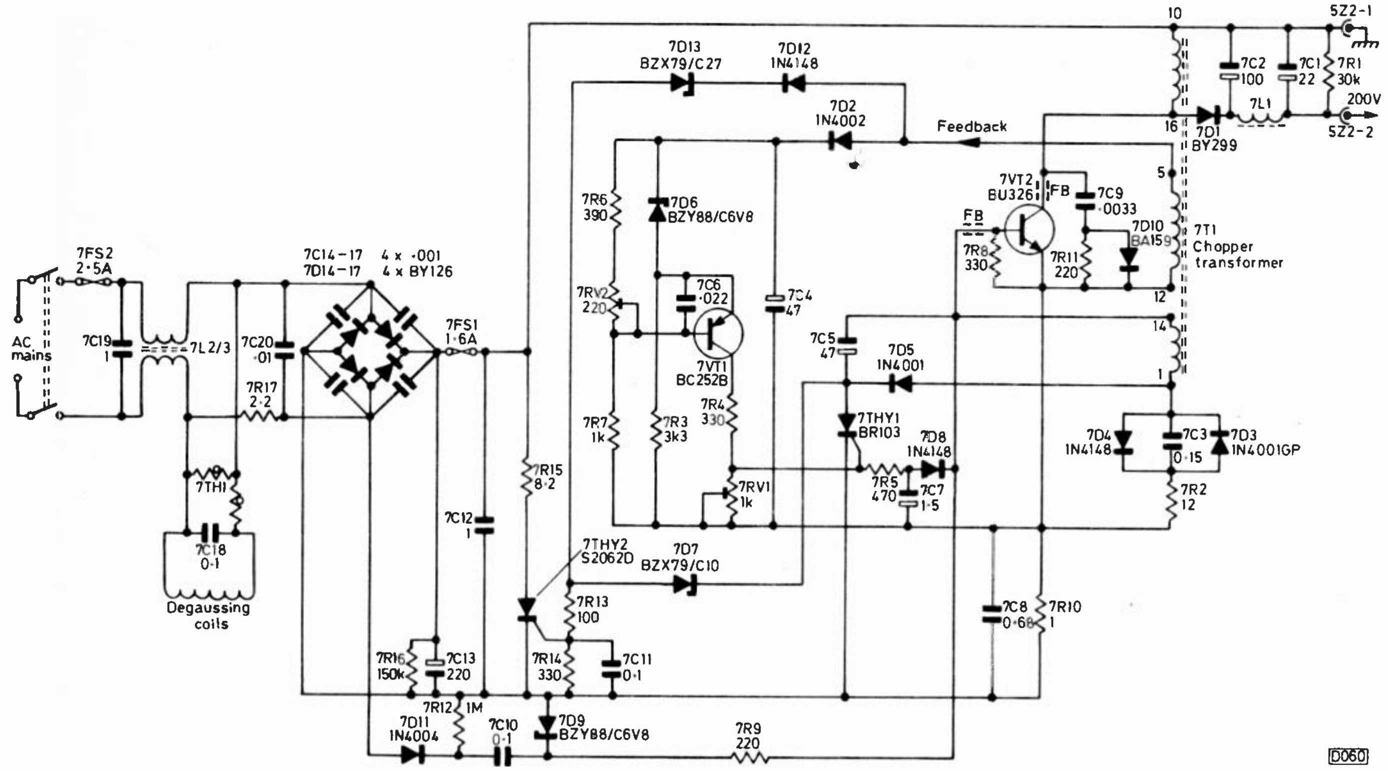


Fig. 1: Self-oscillating switch-mode power supply circuit used in the Rank T20/T22 chassis.

base via 7D11/7C10/7R9. Once it starts up, oscillation is sustained by feedback from winding 1-14 on the transformer. Regulation is effected by switching 7VT2 off before it would do so left to itself. Thyristor 7THY1 provides the switch-off action, firing to short-circuit the base and emitter of 7VT2 via 7C5/7R10.

The main complication is in controlling 7THY1's switch-on time. The sawtooth developed across 7R10 when 7VT2 conducts is applied to the gate of 7THY1 via 7RV1. When the sawtooth is sufficiently positive, 7THY1 conducts. Regulation is effected by applying a variable bias to 7THY1's gate. The rectifier circuit 7D8/7C7 provides the basic bias, which is modified by the action of 7VT1 whose collector current flows via 7RV1. The load is sensed by winding 5-12 on the transformer, the output from this being rectified by 7D2/7C4 to control, in conjunction with zener diode 7D6, the conduction of 7VT1.

The circuit oscillates at about 25kHz. Protection is provided by the crowbar thyristor 7THY2, which fires to blow fuse 7FS1 in the event of excessive current flow or excessive output voltage. These conditions are sensed at its gate, via 7D7 and 7D13 respectively.

Fault Finding

If the mains fuse 7FS2 (2·5A, uprated from 1·6A originally) is found to have blown, the things to check are the mains filter capacitor 7C19, the bridge rectifier diodes and the reservoir capacitor 7C13. If the h.t. fuse 7FS1 has blown on the other hand the prime suspects are 7VT2, 7D1, 7C2 and 7THY2 – the latter may be defective, or may have been triggered, due to a power supply fault or a fault in the crowbar circuit. How do you tell which? After checking the components mentioned, disconnect the power supply from the rest of the set (by removing the output plug 5Z2) disable the crowbar (lift one end of 7R15), fit a new fuse and switch on. Measure the h.t. If this is about right (it might be a bit high with the circuit unloaded), the fault lies in the crowbar circuit. Normal load conditions can be simulated by connecting two 60W bulbs in parallel across the output. Note that it's essential to disconnect the power supply from the rest of the set before disabling the crowbar, since if the h.t. is excessive damage may occur in the line output stage. The disconnection must be made after 7R1, as otherwise there's no load at all and the power supply won't operate.

If the h.t. supply is found to be high, try adjusting 7RV2. If this has no effect, 7VT1 and the associated components will have to be checked as necessary.

If 7VT2 has to be replaced as a result of it going short-circuit, 7THY1 and 7VT1 must also be replaced as they will probably have suffered damage.

Should the fuses be intact and the power supply fails to operate, check that a start pulse appears at the base of 7VT2 at switch on. If this is absent, check the components in the start-up circuit. If present, check 7VT2, 7THY1, 7R10 etc. – and 7R17 of course!

If the h.t. voltage is low but returns to normal after disconnecting 5Z2, check for faults in the line timebase.

These simple steps will resolve the vast majority of faults. If the problem is more elusive, the use of a variac to enable the mains voltage to be increased gradually is a great help.

The circuit used in the Tandberg CTV2 chassis differs from the Rank one in two main respects: first of all a transistor start-up circuit is used, and secondly there are extra windings on the chopper transformer to provide the set with extra voltage lines. As in the Rank circuit, if the chopper transistor fails, the control thyristor and transistor should be replaced.

Separate Oscillator Circuits

In the other basic type of switch-mode power supply circuit the chopper transistor receives its variable mark-space ratio drive waveform from a separate oscillator. We'll look at two circuits of this type, one which doesn't drive the line output stage (ITT CVC20) and one which does (Thorn TX10).

The ITT circuit, shown in simplified form in Fig. 2, is simpler than the one we've just looked at since most of the operations are carried out within the TDA2640 i.c. This contains the oscillator, the pulse-width modulator (to vary the mark-space ratio of the output), the comparator (to sense the output), and the slow-start and protection circuits. The variable mark-space ratio output pulses are obtained at pin 6. These are fed to a driver transistor (T11) which is transformer coupled (L8/9) to the chopper transistor (T12). The chopper drives transformer L11/12/13, the primary winding L11 forming its load. The rectifier circuit D18/C51 provides a stabilised 125V h.t. rail, and since the circuits supplied by this are in parallel with L11 the circuit is referred to as a parallel chopper. Of the other two windings on the transformer, L13 provides a 20V supply (after rectification by D17/C50) while L12 is used to sense the output. D16/C45 provide the feedback voltage for the comparator circuit, which is also fed with a 6·2V reference voltage obtained from zener diode D802. The comparator controls the pulse-width modulator and in turn the mark-space ratio of the output.

To provide excess current protection, the voltage developed across R89, which is in series with the chopper transistor, is fed back to pin 12. When the voltage at this pin exceeds 0·7V the current trip operates.

The other input comes from a winding on the line output transformer. This supplies pulses to pin 2, via R816, to synchronise the oscillator. The pulses are also rectified by D803/C809 whose output is applied to pin 8. The over-voltage circuit compares the voltage at pin 8 with the reference voltage at pin 9: if the voltage at pin 8 exceeds the voltage at pin 9, the over-voltage trip operates.

When either of the trips comes into operation, the duration of the output pulses at 6 is reduced for approximately half a second, after which the pulses are restored to their normal width. If the fault has then cleared, normal operation continues. If the fault persists, the trip process is repeated. After several trip cycles, usually 5-10, the power supply shuts down completely and can be restarted only by switching the set off for a few seconds then switching on again.

Servicing Procedures

If F3 blows at switch on, check the chopper transistor. If this is short-circuit, check R80 – it had a habit of going open-circuit on earlier sets, blowing the chopper transistor.

If the set is tripping, remove the scan coil connection plug (S) – this removes the supply to the line output stage. If the pulsing stops when the set is switched on again, the fault is in the line output stage. If the trip still operates, there's probably a fault in the power supply.

The trip will operate under any of the following three conditions: TDA2640 faulty; voltage at pin 8 excessive; voltage at pin 12 excessive. As the power supply is pulsing, the voltage at pin 12 must be measured with a scope. If the pulses exceed 6·2V, the fault is either in the current sensing circuit (R89/R810/R809/R805) or there's excessive current flowing through the chopper transistor. If the pulses at pin 12 are o.k., remove the scan coil plug, lift one end of R812, and check the output voltage. If this is normal, the fault is in the over-voltage circuit (D803/C809/R817/R812). If the voltage is high, try adjusting R808. If this has no effect, the i.c. is probably faulty. If the trip continues to operate with R812 disconnected, check the voltage at pin 9. If this is not 6·2V, suspect D802 or the i.c.

If the power supply appears to be dead, check the voltage at pin 1 of the i.c. This should be 12V. If not check R79 or the i.c. Then check the voltage at the collector of T11. If this is zero, check T11 and the i.c.

The TX10 Circuit

To bring us right up to date, Fig. 3 shows a simplified circuit of the switch-mode power supply used in the Thorn TX10 chassis. The chopper itself, TR701 and its load transformer T705, is again of the parallel type and in this chassis provides mains isolation (in conjunction with transformers T702/3/4 and the network R701/C701). TR721 is the chopper driver transistor, and the control circuitry is incorporated in IC801, type TDA2582, which is similar to the TDA2640 but of more recent design. The oscillator in IC801 is synchronised to the line frequency by the sync processor i.c. IC791 (type TDA2576), the line-frequency signal from pin 10 of IC791 entering IC801 at pin 14. As the whole circuit is synchronised to the line frequency, the line drive for the BU208B line output transistor is taken from a winding on the chopper transformer.

The chopper primary circuit has some interesting features, with D704/C711 forming a boost/damping circuit, excessive energy being returned to the mains bridge rectifier's reservoir capacitor C708 via D702.

Various trips are incorporated in IC801. If the supply voltage at pin 9 falls below 9·4V a low-voltage trip (not shown) operates. Excessive beam current is detected by linking the earthy end of the e.h.t. winding to pin 6 (via R868 etc.). This trip operates when the voltage at pin 6 exceeds 0·7V (negative). Excessive output voltage and excessive chopper current are detected at pin 7. Transformer T703 senses the chopper current, the current pulses in the secondary winding being clipped by D733 and applied via D727 to pin 7. To sample the output voltages developed by the chopper transformer, pin 7 is linked to the anode of D728 via R810. This trip operates when the voltage at pin 7 exceeds 6·2V. The power supply will start up again via the slow-start system in IC801 shortly after one of the trips has operated. If the fault condition is still present, the trip will again operate. After 8-14 cycles, the set will shut down until switched off for a few seconds.

There is no fault history to date with the TX10 of course. The following brief servicing guide has been adapted from notes given in the Thorn manual.

In the event of no sound or raster, first check the mains input fuse FS701. If this has blown, check D701 and its reservoir capacitor C708. If FS701 is o.k., check FS702. If this has blown, check the chopper transistor TR701 and its emitter circuit for shorts. If both fuses are intact, the set is probably in the tripping mode. In this event, check the 150V line with an Avo 8 or similar meter. If the voltage attempts to rise (to some 40V or more) when the set is switched on, the fault is on the secondary winding side of the chopper transformer T705. If the voltage does not rise the fault is on the primary side. In the latter event check D702/3/4, C711/2, L702 and the primary printed circuit for cracked copper. In the former event, unload the transformer until the tripping stops.

Conclusions

So there we are! Switch-mode power supplies lend themselves to methodical trouble-shooting once you appreciate what does what. One fortunate thing – chopper transformers very rarely give trouble. ■

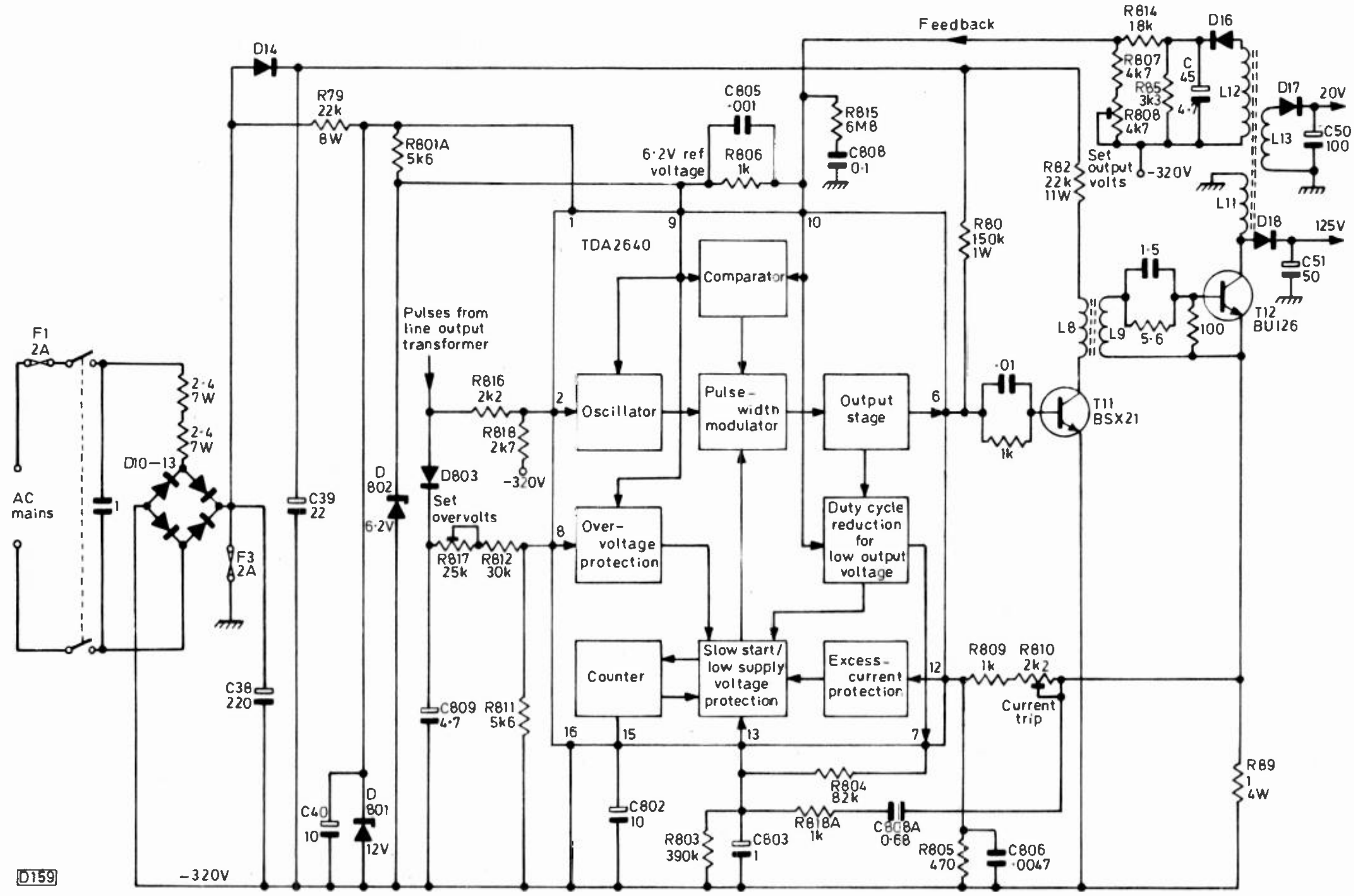


Fig. 2: Chopper circuit (simplified) used in the ITT CVC20 chassis.

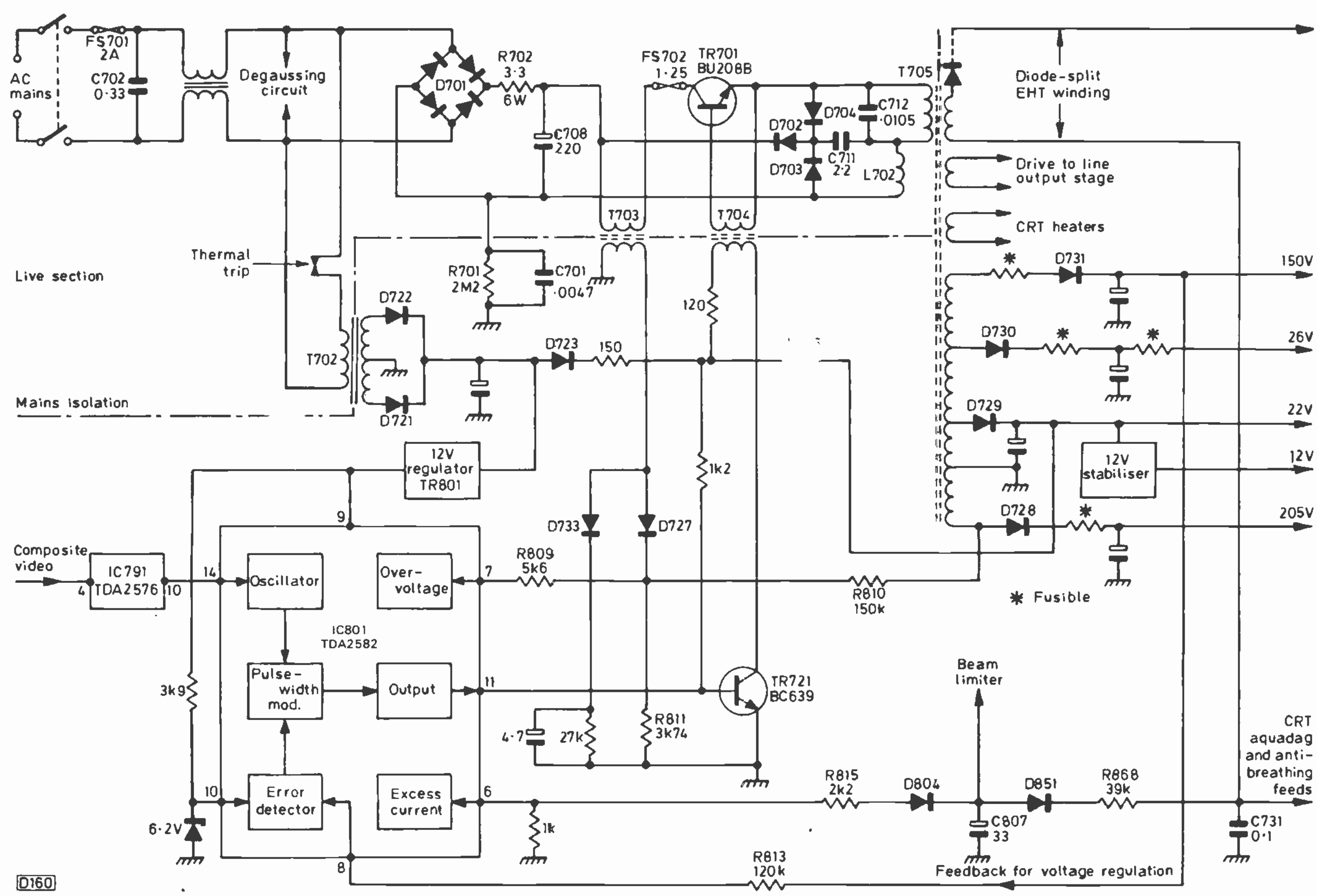


Fig. 3: The Thorn TX10's power supply circuit (simplified).

Colour Portable Project

Part 6

Luke Theodossiou

THE remote control transmitter which we are describing this month concludes the construction of the receiver. The only remaining task is the interwiring, testing and setting up.

It was originally intended to make available a ready-built unit which has the advantage over a d.i.y. version of being aesthetically more pleasing and therefore finding ready acceptance in the living room. Unfortunately our negotiations with the supplier proved fruitless and we are therefore forced into building one. One of course is likely to save money which is always a plus point, but also, with a little patience and a steady hand, the recommended case can be made to look quite attractive. Down to business.

Circuit Description

The circuit diagram of the transmitter is shown in Fig. 1. They can't possibly get any simpler than this, can they? The internal oscillator is set at around 190kHz by C1, R3 and R4. By using the specified tolerances on these components, the operating frequency range (160-220kHz) is never exceeded.

The keyboard switches momentarily connect one of the row input pins (from the group 8 to 15) with one of the column input pins (from the group 16 to 23). The i.c. then does the rest and produces a pulsed, coded output at pin 5.

The output stage uses a Darlington npn transistor to drive three infra-red emitting diodes connected in parallel. The *RC* combination R1 and C2 serves as a reservoir to allow a high peak current to flow through the diodes. The complete circuit is powered from a standard 9V PP3 bype battery.

Construction

Construction of the p.c.b. will pose no problems but note that the battery lead, C2, D1, D2 and D3 are all mounted on the copper side of the board. The ceramic capacitor C1 should be bent towards IC1 after soldering, to below the height of the i.c. The battery lead should be passed through the battery compartment on the bottom section of the case before soldering. Fig. 2 shows the component/switch layout and Fig. 3 the p.c.b. track pattern.

The case itself will require a carefully positioned cutout to allow the switch push-buttons through – refer to Fig. 2. The four threaded pillars have to be cut away using a

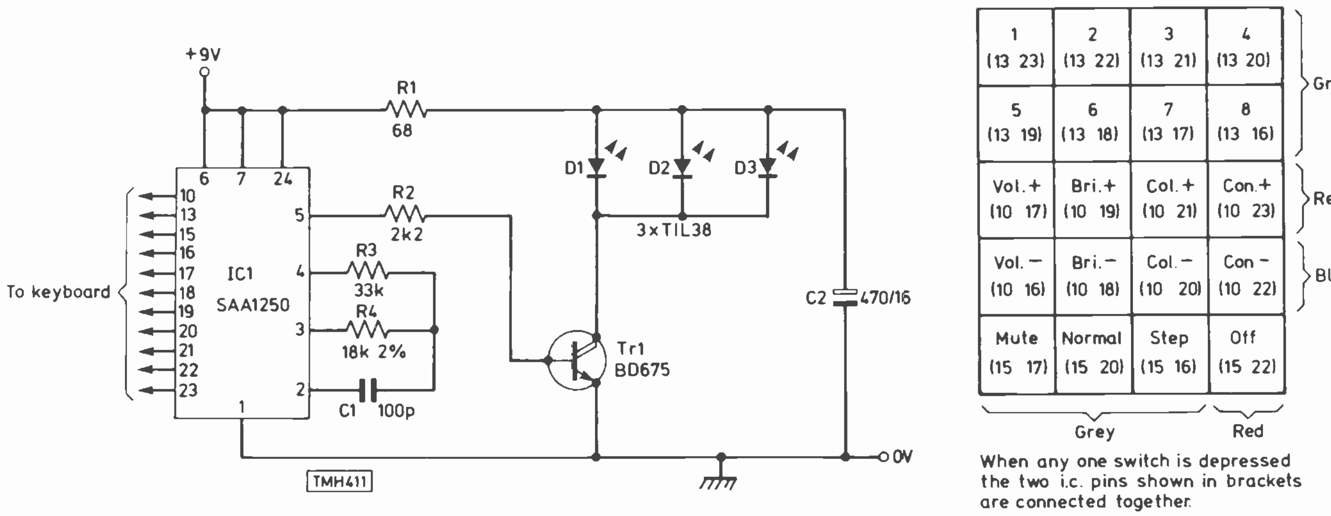


Fig. 1: Remote control transmitter circuit and switch details.

scalpel, as will the little notches on the side of the case which are designed to support vertically-mounted p.c.b.s. Space is at a premium since the switches determine the overall size of the board and we are using a rather small case. Finally three holes are drilled in the aluminium front panel to allow the infra-red diodes to protrude slightly. The board is fixed to the top of the case by two self-tapping screws. A thin piece of foam glued to the battery compartment will help support the bottom end of the board when the whole unit is assembled.

Now that we have lost the screw pillars, the only way we can secure the two halves of the case is by a few drops of cyanoacrylate adhesive. Obviously the transmitter will have to be tested first but once it is found to be working satisfactorily there is really no reason why the box needs to be opened up again. It is just possible that if only three or four drops of adhesive, strategically placed, are used the box may be prised open, but we haven't tried it.

On our prototype a range of about 30 feet was achieved which should be sufficient for most applications.

Next month we shall be describing how to put the whole receiver together.

★ Components List

R1 68Ω carbon film, ±5%
R2 2k2 carbon film, ±5%
R3 33k carbon film, ±5%
R4 18k metal film, ±2%

C1 100p ±2% ceramic plate
C2 470μF 16V axial electrolytic

D1, D2, D3 TIL 38
Tr1 BD 675
IC1 SAA1250

P.c.b. ref. no.: D084
Instrument case with integral PP3 battery compartment: RS stock no. 508-560.

P.c.b. keyboard switches:
5 off red RS stock no. 337-598
11 off grey RS stock no. 337-611
4 off blue RS stock no. 337-605

Battery lead suitable for PP3 battery
PP3 battery

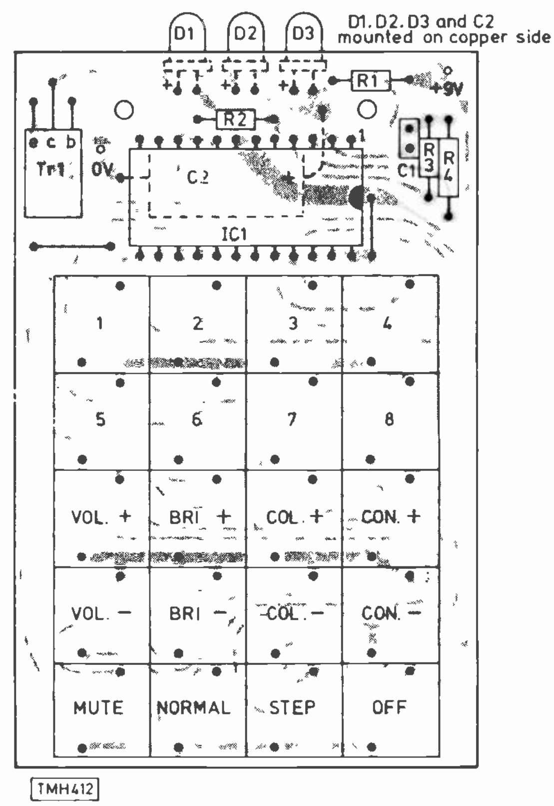


Fig. 2: Component/switch layout.

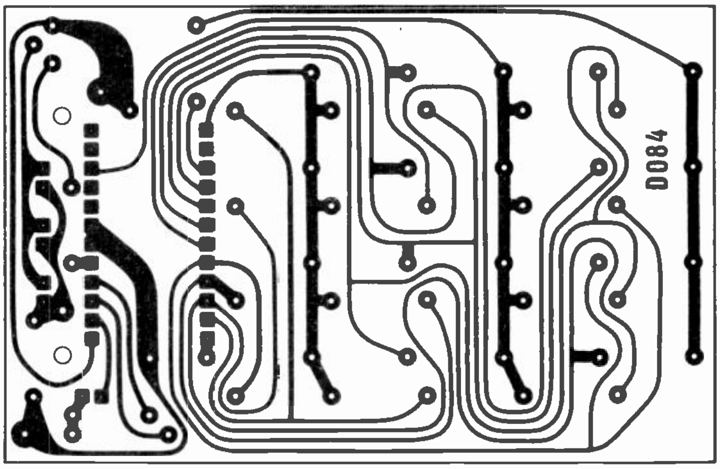


Fig. 3: PCB track layout – scale 1:1.

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RANK A823A CHASSIS

This is a Rediffusion colour set fitted with the Rank A823A chassis. It was working normally when suddenly the picture became darker and slightly enlarged. The colours were also affected, with broad horizontal bands. The obvious thing to do was to check the tube voltages, which revealed that the first anode voltages were low. All components in this circuit, from the line output stage to the tube pins, were checked and found to be in order. The h.t. is correct, and the line driver stage seems to be operating normally.

One half of the line output stage has failed. Replace the short-circuit BU105-01 transistor, along with both flyback tuning capacitors (6C5/6) – these must be of the correct type. When the repairs are complete, reduce the h.t. slightly and rebalance the line output stage with 6L4/5 – the procedure is given in the manual. If 6R6 is not fitted, the cores can be adjusted for a minimum width raster.

THORN 1500 CHASSIS

There are four-five $\frac{1}{8}$in. curved black and white lines at the extreme left-hand side of the screen on this set.

The first thing to do is to check C98 (0·1μF) which decouples the screen grid of the line output valve. If this is o.k., check the scan-correction capacitor C90 (0·1μF) and if necessary the continuity of the pulse winding D-E on the line output transformer. If you are very unlucky, the transformer could be responsible.

ITT VC200 CHASSIS

There's a reduced width raster with no picture. Also no sound, only warbles and birdies. The voltage at the cathode of the 20V supply rectifier D9 is only 13V.

There are no signals due to the low l.t. supply, in turn due to the low line scan since the 20V rectifier is fed from a winding on the line output transformer. If you're sure that the PL504 line output valve is good, it's likely that R159 (10MΩ) in the width circuit has gone high in value. Replace it with two resistors whose values add up to 10MΩ. If necessary check the width control and the third harmonic tuning capacitors C135/C141 (both 270pF, 8kV).

THORN 1500 CHASSIS

I'm having difficulty with a sound distortion problem on this set. The PCL82 audio valve has been replaced, also the associated components, including the h.t. smoothing components and the volume control.

We've had problems with defective audio output transformers on these sets, the symptoms being lower than normal volume with some distortion. The d.c. resistance of the primary winding should be 270Ω: anything lower indicates shorted turns. A scraping loudspeaker cone can also be responsible for distortion of a characteristic nature. We assume that the components you've replaced include R80 (10MΩ) which biases the grid of the triode section of the valve – if it goes high in value, a positive voltage builds up at the grid, causing distortion. If the problem is actually vision-on-sound buzz, check the setting of the ratio detector balance control R84, the detector diodes W5/6 (for equal forward resistance) and the electrolytic C65. If all else fails it might be worth checking the sound i.f. transistor VT11. This can become faulty, causing much reduced volume with some distortion.

SABA H CHASSIS

The problem with this set is flyback lines, some 25 in all, terminating before they actually reach the extreme right-hand edge of the screen. To start with the lines are not conspicuous with full colour saturation, except when there's a dark background. After about twenty minutes however the lines are present even with full colour saturation, while monochrome reception is a problem due to excessive contrast.

Transistor T776 (BC237A) in the field flyback blanking circuit is almost certainly the culprit, it's collector voltage providing a quick check. Under normal operating conditions the voltage should be 28·5-30V. It can fall drastically after the set's been on for twenty minutes to half an hour, the picture darkening at the same time. The transistor is easy to replace, being situated at the centre top of the timebase panel.

RANK A640 CHASSIS

On advancing the setting of the contrast control on this set (Bush TV161 series) to obtain a satisfactory picture I get field slip on dark scenes – a problem I understand is common with these sets. The voltages in the field timebase, sync separator, video and a.g.c. circuits seem to be about right, and I've changed the video amplifier and sync separator anode load resistors and 2C48 which decouples the sync separator's screen grid.

We find that the following components are suspect for this: 2C44 and 2C45 which decouple the screen grid and the cathode of the video section of the PFL200 valve, the black-level correction diode 2MR9 and the field sync diode 3MR3. If necessary, check the values of the 470kΩ resistors 2R78/2R42 in the sync/a.g.c. circuit.

HITACHI CSP680

There is a blue convergence problem with this set – looking at the test card, the blue convergence is o.k. at the centre but towards the sides of the screen the blue sweeps upwards. Adjusting the convergence controls has no effect at all on the problem.

The usual cause of the trouble on this and similar early Hitachi colour sets is the 3·3μF electrolytic capacitor C853 on the convergence panel.

RANK T20 CHASSIS

The fault was no results with the line output transformer burning. The latter was replaced and the set came on for a few minutes, though with bad regulation. The line then collapsed a couple of times and the raster disappeared, the h.t. supply shutting down. The line output transistor was

found to be leaky (not short-circuit). Replacing this restored the picture for about thirty seconds, though with lack of width and poor regulation. The line then collapsed and we were back to square one, with a defective line output transistor (leaky). Cold checks have revealed nothing amiss, and replacing the 1Ω resistor (5R8) in series with the base of the line output transistor simply lost us another transistor. The tripler has also been changed.

In cases like this we've often found that if there's no detectable damping or loading on the line output transformer the flyback tuning capacitor is responsible. It's 5C14 (0·0091μF) in this chassis.

TELETON CPL142

Whenever there are horizontal lines on the picture, the verticals become wavy. Any suggestions?

The sync separator is on the sync/video board LA. Check the components associated with the sync separator transistor TR209, particularly C208 (4·7μF) which couples the video signal to its base. The flywheel sync circuit is on the audio/horizontal board LD. Components worth checking here are C912 (2·2μF) in the flywheel filter circuit, the discriminator diodes X901/2, and C911 (10μF) which decouples the supply to the line oscillator.

BUSH CTV25

The picture gradually became brighter and it's now no longer possible to turn it down using the brightness control. The control and the associated components have been checked and seem to be o.k. There are also two or three light bands across the screen – their position varies.

Both problems are likely to be to do with the PL802 luminance output valve, which seems to be working at the wrong point. Check the valve (a solid-state replacement type can be tried) and the two clamp diodes in the brightness/d.c. restorer circuit (6D1/2, use OA91s as replacements). If necessary check the blanking transistor 6VT6 in the PL802's cathode circuit, also the transistor's base circuit components (6D9/6R68). A more remote possibility is that 9R5 has gone high in value, increasing the c.r.t.'s first anode voltages – there should be about 740V on pins 4, 5 and 13 of the c.r.t.

THORN 1600 CHASSIS

There's an odd fault here – the c.r.t. heater won't light up, though it's not open-circuit and the feed resistor R164 from the line output transformer is o.k. We had the same problem a few months ago, when the 32V supply reservoir capacitor was found to be open-circuit. Replacement restored normal operation, but on odd occasions the picture would disappear briefly then return before complete breakdown occurred. We then found that there was no voltage at the collector of the driver transistor VT17 in the shunt stabiliser circuit. This component and the associated 6·2V zener diode were replaced and all voltages appear to be correct except for the a.c. voltage across the heater winding on the line output transformer. The voltage here is just over 1V. All the components in the area seem to be o.k. however, and a very good e.h.t. spark can be drawn.

On these sets it's always worth checking R157 (39Ω) in the shunt stabiliser circuit. It's part of the "mains dropper", and can go open-circuit without too much obvious effect. If this is o.k., there's 32V across C128, and the heater connections are all in order, the line output transformer is suspect. Note that the heater is fed with a "spiky" waveform whose r.m.s. value is correct for the heater but won't be measurable with anything other than a true-r.m.s. reading meter, i.e. a hot-wire or moving-iron type.

WALTHAM W125

When the set is first switched on the e.h.t. squeals for four-five minutes: it then works all right except that the picture is pasty, pale and rather expanded. Also the contrast control turns the picture off when turned anticlockwise.

Thoroughly clean around the area of the tube's e.h.t. connector to ensure that there's no discharge. Then check on the insulation of the e.h.t. stick's housing and replace the stick itself. This will clear up the large picture effect and improve the general "attack". Replace the PCL84 video valve and reset the nearby preset contrast control to suit.

VDU ADAPTATION

We have a 12in. monochrome portable (Thorn 1690 chassis) we're using as a computer VDU, in conjunction with a u.h.f. modulator. It gives reasonable results and a true monitor would cost much more. There are two problems however. First there's excessive line scan, causing loss of some characters. Secondly the display would be better if we could feed in a composite video signal – but where?

It should be possible to reduce the line scan by inserting a low-value inductor in series with the line scan coils, shunted by a resistor of just sufficiently low value to reduce any ringing. Some experimentation will be required however. We suggest you try feeding the external video to the base of the video driver (VT5) or video output (VT7) transistor via a 100μF d.c. blocking capacitor (negative lead to the video source). Disconnect the detector diode W1 to prevent noise from the i.f. strip affecting the display.

TELEFUNKEN 711 CHASSIS

When the set is switched on, the bottom half of the picture is folded up, resulting in a bright line across the centre of the screen. The bottom half will then flick up and down, finally settling in either one or the other position.

The field timebase in this chassis is rather unusual. The output stage consists of four transistors (T458/T459/T461/T462) in a bridge configuration. Each pair of output transistors has its own driver stage, which is preceded by a phase-splitter. Failure of driver transistor T456 or the output pair T459/T461 will result in the bottom of the picture folding up, so these transistors should be checked, the main suspects being the output transistors. If necessary check the flyback diode D451 (1N4001) which is in series with the 28V supply to these two output transistors and can go intermittent, also the current limiting resistor R483 (6·8Ω) which gets very hot and can become dry-jointed where it rests in little metal "legs" protruding from the chassis.

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ITT CVC32 CHASSIS

When the set is switched on it pumps for a while then dies (no sound or raster). There's voltage at the output from the mains bridge rectifier and from D15, but the h.t. voltage fluctuates with the pumping. The BU126 chopper transistor seems to be in order. As there doesn't seem to be anything obviously wrong with the set, I'm not sure what action to take next.

The "pump and die" effect is initiated by the TDA2640 power supply chip when there's a heavy load on the h.t. line. The main suspect is the e.h.t. tripler – disconnect from the line output transformer and see whether the tripping ceases. Unfortunately the line output transformer itself can be damaged by a faulty tripler, in which case normal working will be restored only when both these items have been replaced.

B AND O 3400 CHASSIS

The problem is field collapse, with some 30V measured at the field scan coils.

This can be a nasty problem on these sets, since the fault is usually due to multiple failure of the transistors in the rather inaccessible field timebase. First make sure that the 74V supply is present at 2R55, then check and replace as necessary 0TR1, 2TR7, 2TR9, 2TR8, 2TR6 and 2TR5.

TEST CASE

226

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.

In our trade a "bounce" is a set that keeps coming back – not necessarily with the same fault and, in the case of chargeable repairs, seldom or never with adequate financial recompense for the second and subsequent calls. One of our children of sorrow is a certain Philips colour set fitted with the G8 chassis. It's no stranger in the workshop!

On its most recent visit the symptom written on the job card was no sound or picture, and h.t. fuse FS5557 (800mA) on the line scan panel was found to have blown. Much work has been done on this receiver on previous occasions, and it was difficult to get anyone interested in it! Finally a technician got around to inserting an ammeter in place of the fuse. The reading he got was about 1A, and this was maintained when the e.h.t. tripler was disconnected. In the interval before the h.t. fuse (FS1391, 800mA anti-surge) on the power supply panel blew, an ominous crackling noise was heard coming from the direction of the line output transformer. Now line output transformer failure is not uncommon on this chassis, so the technician went off to the stores for a new transformer and a couple of fuses. The fuses were there, but no transformer. The stores are one of your present scribe's many burdens, and he lamely explained to the man with the fuses and the scowl that there'd just been a run on the one he'd got in stock! So the set was put on one side to await a replacement transformer.

When the new transformer arrived it was given to John to fit. Now John is a much put upon soul, and after carefully fitting the transformer he discovered that the symptom was still there, much as before . . . The technicians present went into a huddle and bandied various theories and expletives about. The upshot was a majority vote that the transformer in question was being loaded down. This was born out, so we thought, by the fact that with no line drive the output stage drew no current. A look was taken at the line drive, but the shape and amplitude of the waveform were good. No shorts or leakage could be detected when in situ tests were made on the two BU205 line output transistors, so one by one the transformer's secondary windings were disconnected from the circuit.

We finally arrived at the situation where only the primary winding (pins 11 and 13) was connected, but the sizzle was still there and 1A still flowed in the h.t. supply to the line output stage. Another transformer (we'd ordered two) was tried, with just the primary connected – symptoms the same! So the flyback tuning capacitors across the line output transistors were replaced. Still no change. At this point John washed his hands of the affair, lock, stock and l.o.p.t. The original diagnosis man was called in and he retired to his corner with the offending G8. He eventually emerged with the culprit – and it was something we had to obtain from Philips Service! What was it, and how long before the set returned to the workshop with another, totally different fault? Get next month's issue and see!

ANSWER TO TEST CASE 225
– page 605 last month –

The problem last month was the apparently simple one of lack of width on a monochrome Thorn set fitted with the 1500 chassis. The scan-correction capacitor is very often responsible for this fault on the 1500 and 1400 series chassis, but in our case the component proved to be o.k. All the common causes (and some uncommon ones!) had been checked, with no result. An experiment was then carried out – altering the value of the harmonic tuning capacitor by adding another one in parallel.

This restored normal results, suggestiong that the line output transformer itself was at the heart of the trouble. The d.c. resistances of the windings were checked and found to be within 10% of the figures given in the manual. This is not a conclusive test however, so we decided to fit a replacement. Now these jellypot transformers are very reliable – so much so that we don't carry any stock of them. A replacement had to be obtained therefore, and on fitting it the fault was finally cured. Probably a few shorted turns had been responsible for the trouble. TV life is full of surprises . . .

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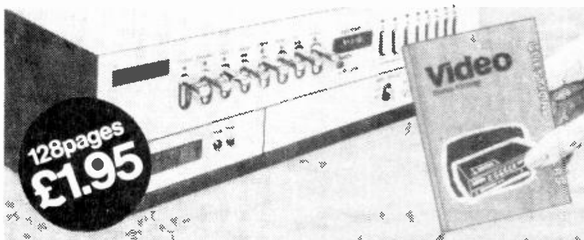

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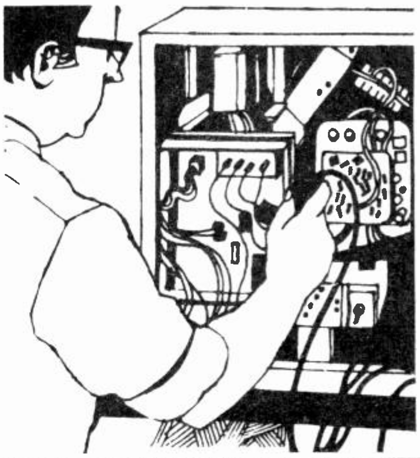

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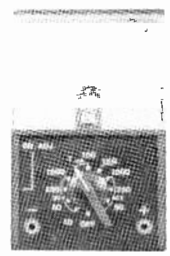

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