

FEBRUARY 1982

PYE 731

PSU'S

80p

# TELEVISION

SERVICING-VIDEO-CONSTRUCTION-DEVELOPMENTS

PYE 731 PSU'S

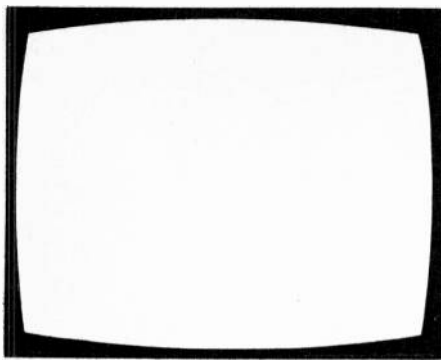


**THE SUMMER OF '39**  
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BY127	0.15	BC140	0.40	BF399	0.30	SN7413N	0.90	PYE 69169/3/697 Tripler	6.68
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BY164	0.50	BC143	0.40	BF399	0.30	SN74141N	1.00	RII 2179/823	6.68
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BY238	0.15	BC148	0.10	BDX32	2.50	TBA3950	1.80	TCE 4000 Tripler	8.00
BYX10	0.15	BC149	0.15	BU206	1.60	TBA950	4.00	TCE 8000 Doubler	3.53
IN4001	0.10	BC153	0.15	BU208/02	2.80	TCA800	4.00	TCE 8500 Tripler	5.60
IN4002	0.10	BC154	0.15	BU326S	1.00	TCA800Q	4.00	TCE 9000 Tripler	7.28
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TIC1150N	2.00	BC178	0.20	ME4003	0.15	TCA830S	2.00	DECCA 80 100 400/350	4.00
BT119	2.00	BC179	0.20	ME5002	0.20	TDA2020/A2	5.00	800/250	4.00
BT120	2.00	BC182L	0.15	ME8001	0.20	TDA2020P	4.00	GEC 100 2000/35	3.00
BYX/71/600	0.80	BC183L	0.15	MUE2955	1.50	TDA2030V	3.60	GEC 100 2000/50	1.10
2N444	1.50	BC184L	0.15	MUE3005	1.30	TDA2010/BD2	4.50	GEC Philips GB 600/250	2.10
TV106/2	1.50	BC186	0.30	MP8113	1.00	TDA2002V	5.00	GEC Philips GB 600/300	2.50
BYX88 2V7	0.10	BC187	0.30	MPSU05	1.20	TCA940E	3.00	ITT KB 200 200 75 25/350	3.00
BZY88 3V0	0.10	BC203	0.15	MPSU55	1.20	We can often supply equivalents to transistors & I.C.'s not listed. Free list on request with any order.		ITT CVC 20 200/400	2.20
BZY88 3V3	0.10	BC204	0.15	TIP2955	1.30			Philips G11 470/250	1.90
BZY88 3V6	0.10	BC205	0.15	TIP3055	1.30			PYE 691 200 300/350	2.80
BZY88 3V9	0.10	BC206	0.15	TIS90M	0.30			PYE 1000 1000/40	0.90
BZY88 4V3	0.10	BC207	0.15	2N2904	0.50			PYE 731 800/250	2.50
BZY88 4V7	0.10	BC208	0.15	2N2905A	0.50			RII 2500 2500/30	1.30
BZY88 5V1	0.10	BC209	0.15	2N2905	0.50			RII 600/300	2.50
BZY88 5V6	0.10	BC212L	0.15	2N3053	0.50			RII 300 300/300	2.50
BZY88 6V2	0.10	BC213L	0.15	2N3703	0.20			TCE 950 100 300 100 16	1.00
BZY88 6V8	0.10	BC213L	0.15	2N3075	0.20			100 150	3.70
BZY88 7V5	0.10	BC214L	0.15	2N3710	0.20			TCE 1500 150 150 100	2.10
BZY88 8V2	0.10	BC225	0.40	2N3055H	0.60			TCE 3000/3500 175/400	2.70
BZY88 8V2	0.10	BC237	0.15	TAA350	0.80			100 100/350	2.00
BZY88 9V1	0.10	BC238	0.15	TAA550	0.50			TCE 3000/3500 600/70	1.00
BZY88 10V	0.10	BC251A	0.15	TAA570	1.80			TCE 3000/3500 220/100	0.70
BZY88 11V	0.10	BC301	0.40	TAA611	1.75			TCE 8000/8500 2500 2500/63	1.50
BZY88 12V	0.10	BC302	0.40	TAA630S	2.50			TCE 8000/8500 700/200	1.00
BZY88 13V	0.10	BC307	0.15	TAA661B	2.00			TCE 9000 400/400	3.00
BZY88 15V	0.10	BC308	0.15	SN76540N	1.50			TCE 9500 220/400	2.20
BZY88 18V	0.10	BC327	0.15	TAD100	2.00			PC97	1.50
BZY88 20V	0.10	BC328	0.15	TBA120AS	0.75			PCF900	1.50
BZY88 22V	0.10	BC337	0.15	TBA231	1.20			PCF802	1.74
BZY88 27V	0.10	BC338	0.15	TBA480Q	2.20			PCF806	1.60
BZY88 33V	0.10	BC547	0.15	TBA520Q	2.00			PCLB2	1.70
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BZX61 12V	0.20	BD133	0.70	TBA550Q	3.00			PL36	2.60
BZX61 13V	0.20	BD134	0.70	TBA560C	2.20			PL81	1.50
BZX61 15V	0.20	BD144	2.50	TBA560CQ	2.20			PL504	1.50
BZX61 16V	0.20	BD159	0.80	TBA570	2.50			PL508	2.50
BZX61 18V	0.20	BD238	0.50	TBA570Q	2.50			PL509	4.00
BZX61 20V	0.20	BD380	0.70	TBA641BX	3.00			PL519	5.00
BZX61 22V	0.20	BD441	0.70	TBA641B11	4.00			PL802	3.00
BZX61 24V	0.20	BD537	0.70	TBA651	3.00			PY88	1.70
BZX61 27V	0.20	BD538	0.70	TBA720A	1.50			PY500A	2.80
BZX61 30V	0.20	BD507	0.70	TBA730	1.50			PY800/801	1.70
BZX61 33V	0.20	BD508	0.75	TBA750	2.00			UCL82	1.10
BZX61 36V	0.20	16181	1.00	TBA750Q	2.00			30F L2/1	1.40
BZX61 39V	0.20	16182	1.20	TBA800	1.00			PCF805	1.20
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AC128/01	0.60	BF152	0.60	TCA900	1.00			4.44MHz Crystals	2.00
AC141	0.50	BF154	0.20	TCA940	2.00			Cut Out TCE 3500	2.50
AC141K	0.60	BF157	0.70	TCA940	2.00			Cut Out GEC	2.50
AC142	0.40	BF158	0.40	TDA1170	2.00			Cut Out TCE 8500	2.00
AC142K	0.60	BF160	0.60	TDA1200	3.00			TV18 Rectifier Stick	2.00
AC176	0.60	BF163	0.60	TDA1270	4.00			TV20 Rectifier Stick	2.00
AC176/01	0.60	BF167	0.50	TDA1412	1.00			VA 1104 Thermister	0.80
AC186	0.40	BF173	0.50	TDA2020	4.00			Transductor TCE 3000	1.50
AC187	0.40	BF177	0.50	SN76115N	2.00			AEG Tuner (Repl Eic 1043/06)	9.00
AC187K	0.60	BF179	0.50	SN76227N	1.20			Aerial Isolator Kit	1.60
AC188	0.40	BF180	0.50	SN76530P	1.00			Philips GB Lopt	12.00
AC188K	0.60	BF182	0.50	SN76651N	1.50			PYE 69 1/697 Lopt	11.00
AD140	1.50	BF182	0.50	SN76003N	3.00			Bush A 774 Lopt	18.00
AD142	1.50	BF183	0.50	SN76013N	2.00			Bush QB23 Lopt	5.00
AD143	1.50	BF184	0.50	SN76013ND	2.00			Pye 731 IF Gain	10.50
AD145	1.50	BF185	0.50	SN76023N	2.00			AB23 Bush Power Panel	20.00
AD149	1.00	BF194	0.20	SN76033N	2.00			PL 802T Transistorised	4.00
AD161/2	1.50	BF195	0.20	SN76110N	2.00			BAHCO TOOLS - Come and see the full range at our shop or send for full catalogue free, on request, with any order.	8.00
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AD262	1.50	BF197	0.20	SN76532N	2.00				
AF121	0.60	BF198	0.15	SN76533N	2.00				
AF124	0.60	BF199	0.15	SN76544N	2.00				
AF125	0.60	BF200	0.15	SN766504	1.00				
AF126	0.60	BF224	0.15	SN76665N	1.50				
AF127	0.60	BF240	0.45	SL901B	6.00				
AF139	0.60	BF241	0.20	SL917B	8.00				
AF239	1.00	BF256LC	0.50						
AL102	3.00	BF257	0.50						
AU107	3.00	BF258	0.50						
AU110	3.00	BF271	0.60						



# TELEVISION

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## BACK NUMBERS

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

## QUERIES

We regret that we cannot answer technical queries over the telephone nor supply service sheets. We will endeavour to assist readers who have queries relating to articles published in *Television*, but we cannot offer advice on modifications to our published designs nor comment on alternative ways of using them. All correspondents expecting a reply should enclose a stamped addressed envelope.

Requests for advice in dealing with servicing problems should be directed to our Queries Service. For details see our regular feature "Service Bureau". Send to the address given above (see "correspondence").

## this month

- 177 **Leader**
- 178 **How to be Tetchy** *by Les Lawry-Johns*  
Question: whether to suffer fools gladly, and if not does it matter? That apart, hints on tackling the power supply unit in the Thorn 3000/3500 chassis and various hints and tips.
- 180 **Simple Variac** *by Victor Rizzo*  
A double-wound mains transformer can be adapted to give a wide range of a.c. output voltages.
- 183 **VCR Clinic**  
Reports from Steve Beeching, T.Eng. (C.E.I.) and Mike Phelan on various VCR faults.
- 185 **Readers' PCB Service**
- 186 **Teletopics**  
News, comment and developments, including an interesting new regulated power supply.
- 188 **DX-TV Receiver System** *by Roger Bunney*  
The addition of a front-end unit giving two different bandwidths. The unit, with an upconverter, can be used with a standard 625-line receiver.
- 190 **The Miller-transitron Circuit** *by Keith Cummins*  
One of the most interesting timebase circuits of yesteryear is the Miller-transitron, whose mode of operation is not always fully appreciated.
- 191 **Next Month in Television**
- 192 **VCR Servicing, Part 6** *by Mike Phelan*  
This time replay of the recorded chroma signal.
- 194 **The Summer of '39** *by Chas E. Miller*  
A look at the new models introduced just before the 1939-45 war. Some of the interesting techniques used were never to be seen again in TV sets.
- 197 **Test Report: LOPT Testing** *by Eugene Trundle*  
The LOPT is always suspect when the line output stage fails, but arriving at a positive diagnosis is not always easy. The Jabco tester has been introduced to solve this problem.
- 198 **Long-distance Television** *by Roger Bunney*  
DX reception and conditions, plus news from abroad.
- 200 **Letters**
- 201 **The Pye 731 Series Power Supply** *by John Law, T.Eng. (C.E.I.)*  
Operation of the thyristor regulated power supply used in the Pye 731, 735, 737, 741 and 725 chassis, with detailed guidance on fault finding.
- 204 **A TV Man's Guide to Video, Part 2** *by Harold Peters*  
This time microprocessor-controlled VCRs, the basic controls and some extras, plus notes on the tape itself.
- 207 **Microcomputer Clock-Timer, Part 2** *by Luke Theodossiou*  
Board details plus the rest of the circuitry.
- 210 **Service Bureau**
- 212 **Test Case 230**

OUR NEXT ISSUE DATED MARCH WILL  
BE PUBLISHED ON FEBRUARY 17

# MANOR SUPPLIES

**NEW MKV CHEQUERBOARD & PAL COLOUR TEST GENERATOR FOR TV & VCR.**

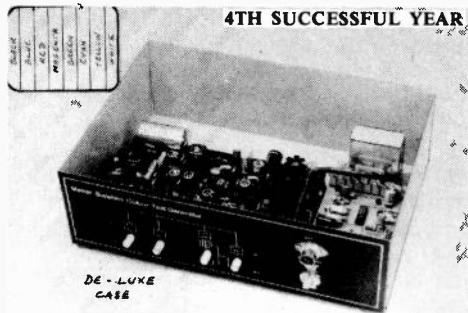


- ★ 40 different patterns and variations.
- ★ Broadcast transmission accuracy (fully interlaced sync pulses with correct picture blanking).
- ★ EBU colour bars, BBC colour bars, whole rasters & split bars (specially useful for VCR service), white, yellow, cyan, green, magenta, red, blue and black.
- ★ Chequerboard.
- ★ Mono outputs with border castellations, cross hatch, grey scale, vertical lines, horizontal lines and dots. UHF modulator output plugs straight into receiver aerial socket.
- ★ Additional video output for CCTV & VCR.
- ★ Facilities for sound output.
- ★ 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.

**PRICE OF KIT £80.50.**  
**DE LUXE CASE (10" x 6 1/4" x 2 1/4") £8.50**  
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ALL ABOVE PRICE INCLUDE VAT 15%.

## PAL COLOUR BAR GENERATOR (Mk 4)



- ★ Output at UHF, applied to receiver aerial socket.
- ★ In addition to colour bars R-Y, B-Y etc.
- ★ Cross-hatch, grey scale, peak white and black level.
- ★ Push button controls, battery or mains operated.
- ★ Simple design, only five i.c.s. on colour bar P.C.B.

**PRICE OF MK4 COLOUR BAR & CROSS HATCH KIT £40.25 P&P £1.20. DE-LUXE CASE £5.95.**  
**ALUMINIUM CASE £3.30, P&P £1.20, BATT HOLDERS £1.70 P&P 85p, ALTERNATIVE STAB. MAINS SUPPLY KIT £5.55 (Combined P&P £1.80).**

**MK 4 DE LUXE (BATTERY) BUILT & TESTED £66.70 + £1.80 P & P.**  
**MK 4 DE LUXE (MAINS) BUILT & TESTED £80.50 + £1.80 P & P.**  
**VHF MODULATOR (CHI to 4) FOR OVERSEAS £4.60.**  
**EASILY ADAPTED FOR VIDEO OUTPUT & C.C.T.V.**

(ALL PRICES INCLUDE 15% VAT)

### MANOR SUPPLIES TELETEXT ADAPTOR KITS

**MK1 (Texas XMII) £170.20 p.p. £2.80** Further details on request.

Goods available if in stock immediately over shop counter (Mail order between 3 days and 2 weeks according to method of payment).

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"TELEVISION" TV PATTERN GEN. (Parts available) Pack Price £34.00 p.p. £1.40.

"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) 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).

MODULATORS: ASTEC UM 1233; E36 £6.68, MULLARD REMO 201-£31.00 p.p. 80p.

**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.

CROSS HATCH UNIT KIT, AERIAL INPUT TYPE, INCL. T.V. SYNC AND UHF MODULATOR. BATTERY OPERATED. ALSO GIVES PEAK WHITE & BLACK LEVELS. CAN BE USED FOR ANY SET £12.65 p.p. 60p. (ALUM CASE £2.60 DE LUXE CASE £5.50 p.p. £1.00.)

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UHF SIGNAL STRENGTH METER KIT £21.60 (VHF version also available). ALUM CASE £2.00 DE LUXE CASE £8.50 p.p. £1.80.

CRT TESTER & REACTIVATOR PROJECT KIT FOR COLOUR & MONO £29.40 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.

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DECCA 80, SERIES, IF FRAME TB £7.90 each p.p. £1.40.

GEC SERIES I MONO PANELS £2.10 p.p. £1.30.

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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.

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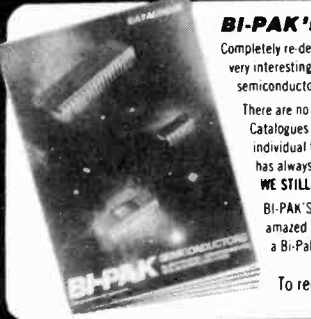
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CA3065	2.20	SN76003N	1.75	SN76666N	70	TAA661B	1.20	TBA550	1.58	TCA270SD	1.25	TDA2523	2.20	UPC1025H	2.95
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AC186	41	BC109C	20	BC183L	10
AC187	28	BC114	12	BC184/L/BC	10
AC187K	28	BC116A	12	BC204	10
AC188	28	BC117	20	BC208	13
AC188K	37	BC119	24	BC209	10
A0143	82	BC140	32	BC212	9
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AF121	58	BC158	10	BC238A/B/C	8
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AF125	35	BC160	25	BC252A	12
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TIP41C	48	2SC2028	1.82	PCF84	77
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2N3055	80	2N3056	80	PCF94	1.13
2N3702	11	2N3703	11	PCF95	1.13
2N3703	11	2N3704	11	PCF96	1.13
2N3704	11	2N3705	11	PCF97	1.13
2N3705	11	2N3706	11	PCF98	1.13
2N3706	11	2N3707	11	PCF99	1.13
2N3707	11	2N3708	11	PCF100	1.13
2N3708	11	2N3709	11	PCF101	1.13
2N3709	11	2N3710	11	PCF102	1.13
2N3710	11	2N3711	11	PCF103	1.13
2N3711	11	2N3712	11	PCF104	1.13
2N3712	11	2N3713	11	PCF105	1.13
2N3713	11	2N3714	11	PCF106	1.13
2N3714	11	2N3715	11	PCF107	1.13
2N3715	11	2N3716	11	PCF108	1.13
2N3716	11	2N3717	11	PCF109	1.13
2N3717	11	2N3718	11	PCF110	1.13
2N3718	11	2N3719	11	PCF111	1.13
2N3719	11	2N3720	11	PCF112	1.13
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2N3721	11	2N3722	11	PCF114	1.13
2N3722	11	2N3723	11	PCF115	1.13
2N3723	11	2N3724	11	PCF116	1.13
2N3724	11	2N3725	11	PCF117	1.13
2N3725	11	2N3726	11	PCF118	1.13
2N3726	11	2N3727	11	PCF119	1.13
2N3727	11	2N3728	11	PCF120	1.13
2N3728	11	2N3729	11	PCF121	1.13
2N3729	11	2N3730	11	PCF122	1.13
2N3730	11	2N3731	11	PCF123	1.13
2N3731	11	2N3732	11	PCF124	1.13
2N3732	11	2N3733	11	PCF125	1.13
2N3733	11	2N3734	11	PCF126	1.13
2N3734	11	2N3735	11	PCF127	1.13
2N3735	11	2N3736	11	PCF128	1.13
2N3736	11	2N3737	11	PCF129	1.13
2N3737	11	2N3738	11	PCF130	1.13
2N3738	11	2N3739	11	PCF131	1.13
2N3739	11	2N3740	11	PCF132	1.13
2N3740	11	2N3741	11	PCF133	1.13
2N3741	11	2N3742	11	PCF134	1.13
2N3742	11	2N3743	11	PCF135	1.13
2N3743	11	2N3744	11	PCF136	1.13
2N3744	11	2N3745	11	PCF137	1.13
2N3745	11	2N3746	11	PCF138	1.13
2N3746	11	2N3747	11	PCF139	1.13
2N3747	11	2N3748	11	PCF140	1.13
2N3748	11	2N3749	11	PCF141	1.13
2N3749	11	2N3750	11	PCF142	1.13
2N3750	11	2N3751	11	PCF143	1.13
2N3751	11	2N3752	11	PCF144	1.13
2N3752	11	2N3753	11	PCF145	1.13
2N3753	11	2N3754	11	PCF146	1.13
2N3754	11	2N3755	11	PCF147	1.13
2N3755	11	2N3756	11	PCF148	1.13
2N3756	11	2N3757	11	PCF149	1.13
2N3757	11	2N3758	11	PCF150	1.13
2N3758	11	2N3759	11	PCF151	1.13
2N3759	11	2N3760	11	PCF152	1.13
2N3760	11	2N3761	11	PCF153	1.13
2N3761	11	2N3762	11	PCF154	1.13
2N3762	11	2N3763	11	PCF155	1.13
2N3763	11	2N3764	11	PCF156	1.13
2N3764	11	2N3765	11	PCF157	1.13
2N3765	11	2N3766	11	PCF158	1.13
2N3766	11	2N3767			

# P. V. TUBES

Telephone: Accrington (0254) 36521

## REPLACEMENT ELECTROLYTICS

DECCA 30 (400/400/350V)	2.98
DECCA 80 (400/350V)	3.15
DECCA 100 (800/250V)	3.15
DECCA 1700 (200/200/400/350V)	4.83
PHILIPS G8 (600/300V)	2.21
PHILIPS G9 (600/300V)	2.21
PHILIPS G11 (470/250V)	2.90
PYE 6917/1 (200/300/350V)	2.39
PYE 731 (600/300V)	2.31
RBM A823 (2500/2500/30V)	1.28
RBM A823 (600/300V)	2.30
RBM 2146 (300/300/350V)	3.15
RR1 T20A (200/400V)	2.00
ITT CVC5/9 (200/200/75/25)	2.47
ITT CVC 20 (220/400V)	2.00
GEC 2110 (600/250V)	1.94
GEC 2040 (1000/2000/35V)	1.19
GEC 2040 (300/300/150/100/50)	4.10
THORN 3500 (400/40V)	30
THORN 950 (100/300/100/16/275V)	1.83
THORN 1400 (150/100/100/100/150/320V)	2.79
THORN 1500 (150/150/100/300V)	2.01
THORN 1500 (12/300V)	31
THORN 3500 (175/100/100/400/350V)	2.48
THORN 3500 (1000/63V)	85
THORN 3500 (1000/70V)	84
THORN 8000/8500 (2500/2500/63V)	1.54
THORN 8000/8500 (700/250V)	2.31
THORN 8000/8500 (400/350V)	2.56
THORN 9000 (400/400V)	3.05

## WIREWOUND RESISTORS

PREFERRED VALUES		
4W/5W		price each
1R 1K5		20
2K2-3K3		20
4K7-6K8		20
10K		25
7W		
1R-4K7		21
5K6-12K		21
15K-22K		21
11W		
1R-8K8		24
10K-15K		24
22K		24
17W		
1R-10K0		28
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	38p
2W	10R to 10M	82p

## SKELETON PRESET POTENTIOMETER HORIZONTAL and VERTICAL

MINIATURE	price each 14
100R-220R-470R-1K0-2K2-4K7-10K-22K-47K-100K	
220K-470K-1M0	

STANDARD	price each 14
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	81p
Log: 5K-10K-25K-50K-100K	
250K, 500K, 1M, 2M	

## SLIDER POTENTIOMETERS

Lin or Log	55p	4K7	55p
470R			
1K	55p	10K	55p
2K2	55p	47K	55p

## MULTITURN POTENTIOMETERS

100K		
GEC/TCE		55p
PHILIPS G8		55p
DECCA/RANK		55p

## THICK FILM RESISTOR NETWORKS

THORN 3500 (5 pin connection)	1.80
PYE 731 (6 pin connection)	2.20
THORN 9000 (Circuit Ref. R704/7)	1.88

## CONVERGENCE PRE-SET POTS

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

## METRIC CONVERGENCE POTS

Philips G8	
5R-10R-20R-50R	35

## EAGLE PRODUCTS

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

SE500 Headphones	3.75	
SE540 Headphones with Volume Control	5.50	
SE600 Lightweight Headphones	7.95	
Multimeters		
KEW 7N	2,000 $\Omega$ pV	5.25
EM5	5,000 $\Omega$ pV	9.95
EM10	10,000 $\Omega$ pV	11.50
EM50	50,000 $\Omega$ pV	19.95
EMC321 Carrying Case for above		2.25
Digital Meter TS1000		44.50
MM20 20,000 $\Omega$ P.V.		21.95
MM50 50,000 $\Omega$ P.V.		25.95
MM100 100,000 $\Omega$ P.V.		30.50
Case for MM100		15.95
T1206 2 Station Intercom.		8.95

## DATA BOOKS (No VAT)

Transistor Equivalent	
TVT 80 A-Z only	3.75
TVT 80 2N/2S series only	4.00
TVT 80/80 A-Z and 2N/2S together	7.50
LIN IC Books LIN 1	5.95
LIN 2	5.95

## ELECTRONIC TUNERS AND ASSEMBLIES

Mullard ELC1043/05	7.80
Mullard ELC1043/06	7.80
4 P/B DECCA/GEC/ITT	5.80
6 P/B DECCA/GEC/ITT	7.00
4 P/B PYE	8.00
6 P/B PYE	10.00
PHILIPS G8 Tuner	10.50
PHILIPS G8 Ass. (Square/Early)	13.50
PHILIPS G8 Ass. (Sloping/Late)	13.90
PHILIPS G9 Tuner	10.50
PHILIPS G11 Tuner	9.00
ITT/PYE/GEC 7 Button P/B	13.95
GEC 2110 6 way P/B	7.75
US21 UHF Tuner	7.90
THORN 8800 SELECTOR (HMV Model 2725/6 way round button)	
THORN 9000 SELECTOR	11.40
US22	7.20
HITACHI 4 way Chan. Selector	8.00
RR1 T20A 6 way Chan. Selector	8.75

## SUNDY TUNER ACCESSORIES

RANK Tuner Push Button $\frac{1}{2}'' \times \frac{1}{2}''$ dia.	36p
RANK Tuner Push Button 2" long $\frac{1}{2}''$ dia.	36p
RANK Tuner Push Button 2" long $\frac{1}{2}''$ dia.	36p
GEC Tuner Neons 2110 chassis.	14p
Drive Cam	each 10p

## 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 1M5 (Red, Blue, Green)	each 58p
GEC 2040 On/Off Switch	each 88p
On/Off Switch G11/G12	1.58
On/Off Switch GEC 2040/TCE TX9-10	1.08

## THERMAL CUT OUT

THORN 3000 2A Metal	1.80
THORN 8500 2.5 Plastic	1.80
GEC 2040 Metal	2.50

## PYE LABGEAR

CM6040/WB UHF Masthead (ch21-68)	18.08
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
CM7053 'Behind the set' 2nd Set Amp (UHF-2 outputs)	10.08
CM7045 UHF 6 way Passive Splitter	10.72
CM7042 TV Games Combiner	3.31
CM8003 Flush Mount Single Outlet Isolated	1.75
CM8009 Flush TV/FM Diplex Outlet Isolated	3.00
CM7069 Tri Star Amplified Set Top Aerial (ch21-68) UHF	17.50
CM8038 VHF/UHF 825 TV Part Generator	97.50
CM8052 UHF/VHF Pal Colour Bar Generator	215.00
7056 TELETEXT ADAPTOR (Converts any set to remote)	208.00
AMPLIFIED CARAVAN AERIAL (All Channels)	18.50

## FUSES

	Pack of 10
$\frac{1}{2}''$ QUICK BLOW	
100ma	73
250ma-500ma-750ma-1A	54
1.5A-2A-2.5A-3A-5A	45
$\frac{1}{2}''$ ANTISURGE	
250ma, 500ma 600ma, 630ma, 750ma, 850ma, 1A, 1.25A	1.80
1.5A, 2A	2.48
2.5A, 3A, 5A	
20m ANTISURGE	
80ma	3.43
100ma	2.30
180ma, 200ma	2.09
315ma, 500ma, 630ma, 800ma, 1A, 1.25A, 1.6A, 2A	1.18
2.5A, 3.15A	1.59
20mm QUICK BLOW	
100ma, 250ma, 500ma, 630ma, 800ma, 1A, 1.25A, 1.6A, 2A, 2.5A, 3.15A, 5A	81
1" MAINS	
2A, 3A, 5A, 10A, 13A	91

## MAINS DROPPERS

DECCA 20	2.20
DECCA 2R5	50
DECCA 27R/47R	75
DECCA 56R/68R	75
R.B.M. A823	88
R.B.M. 161	82
GEC 2000/2018	70
GEC27840	84
PYE 713/15 3R5/15/45R	1.70
PYE 725/31 3R0/56R/27R	1.19
PYE 725 56R/27R	1.04
PHILIPS 210/5050 30R/125R/2x85	1.75
PHILIPS 210/5051 -/118R/148R	93
PHILIPS G8/5081 47R Section	50
PHILIPS G8/5083 2R2/88R	85
THORN 1400	1.15
THORN 1500	1.32
THORN 1600	1.80
THORN 3500	84
THORN 8000	98
THORN 8500	88

## SUNDRIES

ANTIFERRENCE Super Set Top	6.80
ANTIFERRENCE Car antenna	7.80
ANTIFERRENCE Xtra Boost UHF Amp.	15.40
ANTIFERRENCE Triangular Splitter	1.20
Surface Mounting Splitter	1.70
Delay Lines DL60	2.20
Delay Lines DL700	2.20
58 Knobs small/large	50
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
IHT Cable 30kV	25p per metr.
Coax Plugs	pack of 10 1.80
Focus control GEC/THORN	1.83
PVC Tape	26
IM Plugs	35
PL259 Plugs	40
DECCA 30 Series width control	50
DECCA 3.9R Modulohm	30
DECCA Height Control 2M2	26
THORN 1500 Frame Hold 390K	32
THORN 1500 Line Hold 470K	32
THORN 1500 Contrast 1K5	32
Line Connectors	36
6 3V CRT boost trans.	4.35
ANTIFERRENCE XGB High Gain Aerial (State Channel)	17.00
Reducers for PL259	16
13A Plug Tops	box of 12 4.00
TV Filter 50db rejection 27MHZ	2.10
Quick Set Adhesive	78
Attenuators 6db, 12db, 18db	each 1.00
Moulded Plastic Hex 6mm Trim Tools	10
Trim Tools Moulded Double Ended 4mm/6mm	20
Thorn 1591 Loudspeakers 4 $\frac{1}{2}$ x 2 $\frac{1}{2}$	3.45
Thorn 1591 Loudspeakers 5 $\frac{1}{2}$ x 2 $\frac{1}{2}$	3.95
Focus Rhd	1.25
Holder	2.00
Cassette Drive Belts 46mm per pack of 5	1.85
58mm	1.88
66mm	1.71
77mm	1.80
89mm	1.90

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
(Pair) Tips for Gun	36
WELLER Cordless Iron	24.78
ANTEX Soldering Iron 25W	4.89
Solder Remover Sucker	6.50
Solda Mop	70
500G Reel Solder	7.00
DIY Type Solder	4.3
250G Solder	3.50

## SERVICE AIDS

SERVISOL Freeze-It	92 plus VAT
SUPER SERVISOL	84
SERVISOL Foam Cleanser	82
SERVISOL Plastic Seal	85
SERVISOL Silicone Grease	98
SERVISOL Tubes Silicone Grease	1.58
SERVISOL Aero Klene	90
SERVISOL Aero Duster	92
SERVISOL Excel Polish	74
Penetrating Fluid	70
Fire Extinguisher 640G	2.80
Heat Sink Compound 25G	1.05
Silicone Rubber Tube 110G	2.98
Solda Mop standard reel	72

## ELECTROLUBE PRODUCTS

Electro-Mech lubricant	1.38
Elect. cleaning solvent	1.50
Freezer	1.39
Foam cleanser	1.00
Heat transfer compound	1.07
Silicone compound	1.81
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.

Goods are despatched on the day we receive your orders. If for any reason beyond our control, we are out of stock, we will inform you.

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

For Aerosols please add 30p per can (These are very heavy!)

ALL ENQUIRIES SAE PLEASE

VAT invoice on request.

We no regret any postal increases but we try our best to give a speedy, and efficient service, at a fair price.

Same day dispatch

# POST-A-PART-ELECTRONICS

<p><b>SEMICONDUCTORS</b></p> <p>AC128 24p BC107 25p BC108 25p BC109 25p BC153 12p BC154 12p BC171 7p BC172 7p BC208 7p BC237 10p BC238 7p BC251A 7p BC307 10p BC308 7p BC347 7p BC455 7p BC456 7p BC546 7p BC549 7p BC556 7p BC559 7p BC595 7p BCX34 10p BD131 25p BD183 1.00 BF137 20p BF197 20p BF240 8p BF255 10p BF256C 50p BF256LC 50p BF257 30p BF259 40p BF274 10p BF337 20p BF394 8p BF459 80p BFR87 30p BU105 60p BU108 1.00 BU207 1.00 BU208 1.00 BU126 1.00 ME0404 7p ME0412 7p ME6002 7p NKT241 (ACY21) 7p NKT276 (AC128) 24p PN107 (BC107) 7p R2010B 1.00 R2443 20p R2540 1.00 R2781 1.30 RCA16446 30p TIC126 7p TIS91 20p 2N2193 7p 2N3703 20p 2SA473 7p 2SC734 (BC107) 7p 2SC388 7p</p>	<p>SN15846N 40p SN74123N 40p SN74154N 1.40 SN7610N 40p SN6622N 40p TA7109AP 1.00 TA7117P 1.40 TAA570 1.00 TBA480 1.00 TBA1440C 1.00 TDA2680 40p TDA2690A 40p</p> <p><b>E.H.T. TRAYS</b></p> <p>PYE 731 4.00 THORN 3000 5.00 THORN 8500 5.00 THORN 9000 5.00 THORN 4000 5.00</p> <p><b>EHT STICK FOR THORN</b> 950/1400/1500 TRIPLERS E.C.T. TYPE 80/150 5p</p> <p><b>TRANSFORMERS/LOPT</b></p> <p>MAINS TX 3000/3500 10.00 MAINS TX 8000/8500 10.00 S.O.P.T. 8000/8500 3.50 3000/3500 SCAN TX 6.00 3000/3500 EHT TX 6.00 8000 LOPT 9.35 8500 LOPT 10.65 9000 LOPT 10.15</p> <p><b>DROPPERS</b></p> <p>PYE-78+161 40p PYE 147+260 40p THORN 6+1+100 3K 50p THORN 56+1K+47+12 1.00 THORN 350+20+128+1K 1.00 5+317 1.00 THORN 50+40+1K5 50p RBM 250+14+58TV161 50p 185+185 28W 40p 190+190 28W 40p 140+140 28W 40p</p> <p><b>UHF AERIAL SOCKET &amp; LEAD</b> 25p PYE, ITT, THORN</p> <p><b>UHF AERIAL SOCKET &amp; LEAD GEC</b> 25p</p> <p><b>UHF AERIAL SOCKET &amp; LONG LEAD GEC</b> 35p</p> <p><b>MAINS ON/OFF SWITCH ROTARY</b> 20p</p> <p><b>MAINS ON/OFF SWITCH PUSH</b> 20p</p> <p><b>A1 SWITCH THORN 3000/3500</b> 50p</p> <p><b>A1 POT 5M 3000/3500</b> 70p</p> <p><b>100K 40 TURN POTS FOR V/CAP TUNERS</b> 25p</p> <p><b>UHF TV AERIAL FOR PORTABLE</b> 50p</p> <p><b>MAINS NEON ON TAG STRIP WITH SERIES RESISTORS + LEADS THORN</b> 25p</p> <p><b>DOUBLE FUSE HOLDER ON SMALL PAX. BOARD</b> 10p</p> <p><b>ITT BRIDGE REC FXS 244/2A</b> 15p</p>	<p><b>MIXED PACKS</b></p> <p>300 MIXED RESISTORS 1.50 300 MIXED CAPACITORS 1.50 150 MIXED ELECTROLYTICS 2.00 100 W/W RESISTORS 1.00 20 MIXED CONV POTS 1.00 40 MIXED POTENTIOMETERS 1.50 20 MIXED SLIDERS 1.00 40 MIXED PRESETS 60p 20 MIXED VDR &amp; THERMISTOR 1.00 20 MIXED FERRITE CORES 50p 20 MIXED VALVE BASES 1.00 10 SPARK GAPS 1.00 10-16 PIN QUIL. IC SOCKET 90p 20 ASSORTED TV KNOBS 1.00 10-16 PIN QUIL. TO DIL IC SOCKET 90p 100 MIXED DIODES 1.00</p> <p><b>FUSES 20mm</b></p> <p>50ma 10 for 70p 315ma 10 for 50p 500ma 10 for 40p 1.25ma 10 for 40p 2.5ma 10 for 40p 3.15ma 10 for 40p</p> <p>Thorn 3000 metal 2A cut out 1.25 Thorn 8500 plastic 2.5A cut out 1.25</p> <p><b>SLIDERS</b></p> <p>470R 1KR 2K5 any 6 2.80 4K7 10K 47K</p> <p>3000, 8500, 9000, Thorn focus pots 1.25</p> <p><b>IC INSERTERS</b> 50p Large IC Extractor 50p Crystals +433619 MHZ 50p Degause Thermistor PT37P ITT/GEC 25p + Fits some PYE/Bush etc. Degause VDR Type E299D/H P230. 3000/8000 25p</p> <p><b>EX-EQUIPMENT UNTESTED 3000/3500 PANELS ANY SPECIFIED PANEL 3.75</b> PRICE INCLUDES P&amp;P</p> <p><b>8500 IF/DECODER PANEL EX-EQUIPMENT UNTESTED 4.75</b> P&amp;P INCLUDED</p> <p><b>LEATHER BOUND VIDEO CASSETTE CASE'S AVAILABLE IN FOUR COLOURS RED, BLUE, BROWN, GREEN</b> 10 for 25.00</p> <p><b>COAX PLUGS</b> 12p R2265 1.35</p>	<p>2500+2500/63V Thorn 1.20 200+100+100+50/350V 40p 32+32+16/350V 40p 200+100+50/300V 40p 100+150+50/350V 50p 32+32/350V 30p 400+400+/350V 1.30 175+100+100/350 Thorn 3K 2.00 150+150+100/Thorn 1500 1.90</p> <p><b>CAN TYPES</b></p> <p>2MF 250V 50p 22MF 375V 50p 50MF 350V 50p 400MF 350V Thorn 8K 90p 800MF 2V PRINT TYPE 80p 800MF 250V 70p 1250MF 50V 50p 1500MF 70V Thorn 3K 1.00 2000MF 30V 50p 2500MF 35V 50p 2500MF 40V 50p 3000MF 40V 50p</p> <p><b>ELECTROLYTICS</b></p> <p>1MF 63V 20 for 1.00 4MF 350V 10 for 1.00 10MF 160V 10 for 1.20 15MF 16V 20 for 1.00 15MF 63V 20 for 1.00 22MF 40V 20 for 1.00 22MF 63V 20 for 1.00 22MF 160V 10 for 1.00 22MF 400V 10 for 1.00 33MF 40V 20 for 1.00 33MF 50V 20 for 1.00 47MF 250V 10 for 1.00 50MF 25V 20 for 1.00 100MF 150V 10 for 1.00 100MF 160V 10 for 1.00 100MF 350V 10 for 1.00 125MF 16V 10 for 1.00 150MF 25V 20 for 1.00 160MF 25V 20 for 1.00 160MF 40V 10 for 1.00 220MF 10V 10 for 1.00 330MF 35V 10 for 1.00 330MF 63V 10 for 1.00 470MF 10V 10 for 1.00 470MF 25V 10 for 1.00 680MF 16V 20 for 1.00 680MF 40V 10 for 1.00 1000MF 10V 10 for 1.00 1000MF 70V (Thorn) 80p 1500MF 16V 10 for 1.00 2200MF 25V 6 for 1.00 2200MF 40V 6 for 1.00</p> <p><b>THORN 8000 EHT DOUBLER</b> 3.12</p> <p><b>10R 20W SPECIAL RESISTOR FOR 3500 CONVERGENCE BOARD (R751)</b> 50p</p> <p><b>PANEL MOUNTING FUSE HOLDER 20MM</b> 25p</p> <p><b>MOST VALUES OF PRESETS AVAILABLE HORIZONTAL OR VERTICAL MINIATURE OR STANDARD 10 OF ANY VALUE 1.00</b></p> <p><b>3500 6 PUSH BUTTON UNIT PLUS KNOBS, THORN V/CAP 1.00</b></p> <p><b>625 AERIALS +FITTINGS AVAILABLE. 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<p><b>DIODES</b></p> <p>AA112 8p AA119 8p AA143 8p BA115 8p BA131 8p BA154 8p BA157 8p BB103 8p BY127 12p BY133 10p BZU15C12R 14p BY204 8p BYX22/400 8p BZY79C 20V 8p DA002 8p SCR957 30p IM102255 8p IN60 8p IN5349 8p IN2070 8p IN5254B 8p IN4742A 8p IS025 8p IS451 8p IS1554 8p IS1658 8p ITT638 CV9 8p ZX6.2 8p ZX150 8p</p> <p><b>INTEGRATED CIRCUITS</b></p> <p>BAV40 50p BRC/M/200 1.00 BRC/M/300 1.00 DM74123N 50p</p>	<p><b>UHF AERIAL SOCKET &amp; LEAD GEC</b> 25p</p> <p><b>UHF AERIAL SOCKET &amp; LONG LEAD GEC</b> 35p</p> <p><b>MAINS ON/OFF SWITCH ROTARY</b> 20p</p> <p><b>MAINS ON/OFF SWITCH PUSH</b> 20p</p> <p><b>A1 SWITCH THORN 3000/3500</b> 50p</p> <p><b>A1 POT 5M 3000/3500</b> 70p</p> <p><b>100K 40 TURN POTS FOR V/CAP TUNERS</b> 25p</p> <p><b>UHF TV AERIAL FOR PORTABLE</b> 50p</p> <p><b>MAINS NEON ON TAG STRIP WITH SERIES RESISTORS + LEADS THORN</b> 25p</p> <p><b>DOUBLE FUSE HOLDER ON SMALL PAX. BOARD</b> 10p</p> <p><b>ITT BRIDGE REC FXS 244/2A</b> 15p</p> <p><b>BELLING &amp; LEE SWITCHED FLUSH FITTING AERIAL OUTLET (WHITE) 1.20 each</b></p>	<p><b>MULTI SECTION CAPACITORS</b></p> <p>200+32+300+100/350V 50p 200+200+100/350V 70p</p>	<p><b>THORN 8000 EHT DOUBLER</b> 3.12</p> <p><b>10R 20W SPECIAL RESISTOR FOR 3500 CONVERGENCE BOARD (R751)</b> 50p</p> <p><b>PANEL MOUNTING FUSE HOLDER 20MM</b> 25p</p> <p><b>MOST VALUES OF PRESETS AVAILABLE HORIZONTAL OR VERTICAL MINIATURE OR STANDARD 10 OF ANY VALUE 1.00</b></p> <p><b>3500 6 PUSH BUTTON UNIT PLUS KNOBS, THORN V/CAP 1.00</b></p> <p><b>625 AERIALS +FITTINGS AVAILABLE. PRICE LIST ON REQUEST</b></p> <p><b>EHT LEAD FOR SPLIT DIODES LOPT 1.00</b></p> <p><b>LITESOLD 20 WATT 240V SOLDERING IRON ELEMENT 65p each or 4 for 2.00</b></p> <p><b>RECLAIMED 8000/8500 FOUR PUSH BUTTON MECH/ TUNERS 3.75 each</b> Plus P&amp;P 1.00</p>	<p><b>RESISTORS</b></p> <p>16R 1W 22R 1W 62R 1W 56R 1W 68R 1W 68R 1W 82R 1W 100R 1W 120R 1W any 10 for 25p 150R 1W 220R 1W 270R 1W 301R 1W 330R 1W 330R 2W 390R 1W 470R 1W 560R 1W 680R 1W 820R 2W 1K 1W 1K5 1W 2K7 1W 4K7 1W 11K 1W 18K 2W 33K 1W any 10 for 25p 47K 1W 68K 1W 100K 1W 110K 1W 500K 1W 1M 1W 2M2 1W 2M7 1W 10M 1W</p> <p><b>EHT FINAL ANODE CAP</b> 47p <b>6MHZ CERAMIC FILTER</b> 30p <b>1MF 250V MAINS FILTER CAPACITOR ITT ETC.</b> 25p <b>SP8385</b> 25p</p>

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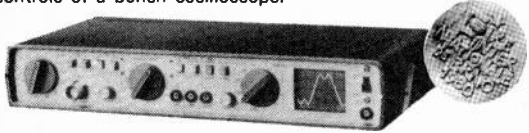
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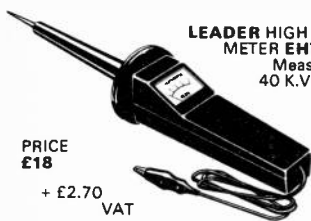
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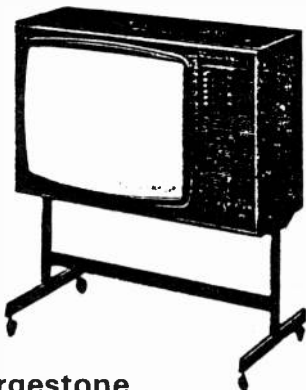
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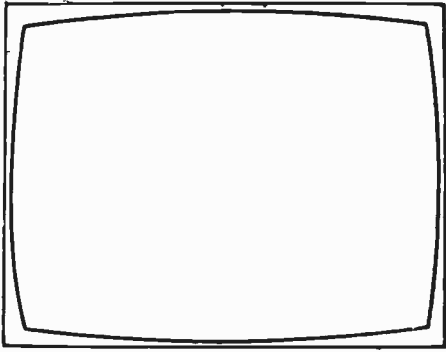
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AC117	0.38	AU107	2.78	BC204*	0.39	BC394	0.39	BD236	0.63	BF224 & J	0.22	BR101	0.53	MP5U08	0.76
AC126	0.36	AU110	2.40	BC205*	0.39	BC440	0.52	BD238	0.63	BF240	0.32	BR103	0.64	MP5U56	1.26
AC127	0.54	AU113	2.60	BC207*	0.39	BC461	0.78	BD239	0.68	BF241	0.31	BR303	1.06	MP5U58	1.32
AC128	0.46	BC107*	1.16	BC208*	0.37	BC478	0.30	BD243	0.58	BF245*	0.43	BR444	1.76	MP5U60	0.82
AC128K	0.55	BC108*	0.15	BC209*	0.39	BC479	0.65	BD244	1.05	BF254	0.48	BRY39	0.60	MP5U60	0.82
AC141	0.65	BC109*	0.16	BC211*	0.36	BC479	0.65	BD245	1.05	BF255	0.48	BRV56	0.44	OC26	1.90
AC141K	0.70	BC113	0.22	BC212*	0.17	BC547*	0.13	BD246	0.70	BF256*	0.44	BSS27	0.82	OC28	1.49
AC142	0.60	BC114	0.22	BC212*	0.17	BC548*	0.13	BD247	0.70	BF256*	0.44	BT106	1.50	OC29	1.80
AC142K	0.65	BC115	0.24	BC212*	0.17	BC548*	0.13	BD248	0.74	BF258	0.52	BT109	1.99	OC35	1.25
AC151	0.31	BC116*	0.25	BC213*	0.16	BC549*	0.15	BD249	0.74	BF258	0.52	BU119	1.45	OC36	1.25
AC152	0.36	BC117	0.30	BC213*	0.16	BC550	0.24	BD249	0.74	BF258	0.52	BU122	3.38	OC42	0.90
AC153	0.42	BC118	0.24	BC214*	0.18	BC555	0.23	BD250	0.88	BF262	0.73	BU105	1.90	OC45	0.83
AC153K	0.82	BC119	0.34	BC214*	0.18	BC557*	0.16	BD250	0.88	BF263	0.88	BU105/02	1.95	OC70	0.65
AC154	0.41	BC125*	0.30	BC225	0.42	BC558*	0.16	BD251	0.88	BF270	0.47	BU108	2.98	OC71	0.73
AC176	0.45	BC126*	0.30	BC227*	0.16	BC559*	0.17	BD252	1.23	BF271	0.42	BU126	2.91	OC72	0.73
AC178	0.35	BC132	0.20	BC238*	0.15	BCY10	0.30	BD253	0.88	BF272A	0.80	BU204	2.50	OC81	0.83
AC179	0.55	BC134	0.22	BC239*	0.22	BCY30A	1.06	BD254	1.55	BF273	0.33	BU205	2.58	OC81D	0.95
AC187	0.56	BC135	0.21	BC251*	0.25	BCY32A	1.19	BD255	0.63	BF274	0.34	BU206	2.89	OC139	1.30
AC187K	0.65	BC136	0.22	BC252*	0.26	BCY34A	1.02	BD256	0.63	BF274	0.34	BU208	2.75	OC140	1.36
AC188	0.52	BC137	0.30	BC253*	0.38	BCY72	0.27	BD257	1.65	BF337	0.65	BU407	1.38	OC170	0.80
AC188K	0.61	BC138	0.38	BC261A*	0.28	BD115	1.35	BD258	2.29	BF338	0.68	BU407	1.38	OC200	0.82
AC193K	0.70	BC140	0.36	BC262A*	0.28	BD123	1.50	BD259	1.38	BF355	0.72	BU407	1.38	OC201	0.82
AC194K	0.74	BC141	0.44	BC263*	0.28	BD124	1.85	BD260	1.85	BF362	0.49	BU407	1.38	OC202	0.82
AC194K	1.20	BC142	0.35	BC267*	0.20	BD130Y	1.85	BD261	1.85	BF363	0.49	BU407	1.38	OC203	0.82
AC194K	1.20	BC143	0.38	BC268*	0.28	BD131	0.58	BD262	0.88	BF367	0.29	BU407	1.38	OC204	0.82
AC194K	1.20	BC144	0.12	BC269*	0.12	BD132	0.68	BD263	0.88	BF451	0.43	BU407	1.38	OC205	0.82
AC194K	1.20	BC145	0.12	BC270*	0.49	BD133	0.70	BD264	0.88	BF457	0.46	BU407	1.38	OC206	0.82
AC194K	1.20	BC146	0.12	BC271*	0.27	BD135	0.37	BD265	0.88	BF458	0.49	BU407	1.38	OC207	0.82
AC194K	1.20	BC147	0.12	BC272*	0.27	BD136	0.38	BD266	0.88	BF459	0.49	BU407	1.38	OC208	0.82
AC194K	1.20	BC148	0.12	BC273*	0.27	BD137	0.40	BD267	0.88	BF459	0.49	BU407	1.38	OC209	0.82
AC194K	1.20	BC149	0.12	BC274*	0.27	BD138	0.40	BD268	0.88	BF459	0.49	BU407	1.38	OC210	0.82
AC194K	1.20	BC150	0.12	BC275*	0.27	BD139	0.46	BD269	0.88	BF459	0.49	BU407	1.38	OC211	0.82
AC194K	1.20	BC151	0.12	BC276*	0.27	BD140	0.50	BD270	0.88	BF459	0.49	BU407	1.38	OC212	0.82
AC194K	1.20	BC152	0.12	BC277*	0.27	BD141	2.24	BD271	0.88	BF459	0.49	BU407	1.38	OC213	0.82
AC194K	1.20	BC153	0.12	BC278*	0.27	BD142	0.75	BD272	0.88	BF459	0.49	BU407	1.38	OC214	0.82
AC194K	1.20	BC154	0.12	BC279*	0.27	BD143	0.85	BD273	0.88	BF459	0.49	BU407	1.38	OC215	0.82
AC194K	1.20	BC155	0.12	BC280*	0.27	BD144	0.90	BD274	0.88	BF459	0.49	BU407	1.38	OC216	0.82
AC194K	1.20	BC156	0.12	BC281*	0.27	BD145	0.95	BD275	0.88	BF459	0.49	BU407	1.38	OC217	0.82
AC194K	1.20	BC157	0.12	BC282*	0.27	BD146	0.95	BD276	0.88	BF459	0.49	BU407	1.38	OC218	0.82
AC194K	1.20	BC158	0.12	BC283*	0.27	BD147	0.95	BD277	0.88	BF459	0.49	BU407	1.38	OC219	0.82
AC194K	1.20	BC159	0.12	BC284*	0.27	BD148	2.30	BD278	0.88	BF459	0.49	BU407	1.38	OC220	0.82
AC194K	1.20	BC160	0.12	BC285*	0.27	BD149	2.30	BD279	0.88	BF459	0.49	BU407	1.38	OC221	0.82
AC194K	1.20	BC161	0.12	BC286*	0.27	BD150	2.30	BD280	0.88	BF459	0.49	BU407	1.38	OC222	0.82
AC194K	1.20	BC162	0.12	BC287*	0.27	BD151	2.30	BD281	0.88	BF459	0.49	BU407	1.38	OC223	0.82
AC194K	1.20	BC163	0.12	BC288*	0.27	BD152	2.30	BD282	0.88	BF459	0.49	BU407	1.38	OC224	0.82
AC194K	1.20	BC164	0.12	BC289*	0.27	BD153	2.30	BD283	0.88	BF459	0.49	BU407	1.38	OC225	0.82
AC194K	1.20	BC165	0.12	BC290*	0.27	BD154	2.30	BD284	0.88	BF459	0.49	BU407	1.38	OC226	0.82
AC194K	1.20	BC166	0.12	BC291*	0.27	BD155	2.30	BD285	0.88	BF459	0.49	BU407	1.38	OC227	0.82
AC194K	1.20	BC167	0.12	BC292*	0.27	BD156	2.30	BD286	0.88	BF459	0.49	BU407	1.38	OC228	0.82
AC194K	1.20	BC168	0.12	BC293*	0.27	BD157	2.30	BD287	0.88	BF459	0.49	BU407	1.38	OC229	0.82
AC194K	1.20	BC169	0.12	BC294*	0.27	BD158	2.30	BD288	0.88	BF459	0.49	BU407	1.38	OC230	0.82
AC194K	1.20	BC170	0.12	BC295*	0.27	BD159	2.30	BD289	0.88	BF459	0.49	BU407	1.38	OC231	0.82
AC194K	1.20	BC171	0.12	BC296*	0.27	BD160	2.69	BD290	0.88	BF459	0.49	BU407	1.38	OC232	0.82
AC194K	1.20	BC172	0.12	BC297*	0.27	BD161	2.69	BD291	0.88	BF459	0.49	BU407	1.38	OC233	0.82
AC194K	1.20	BC173	0.12	BC298*	0.27	BD162	2.69	BD292	0.88	BF459	0.49	BU407	1.38	OC234	0.82
AC194K	1.20	BC174	0.12	BC299*	0.27	BD163	2.69	BD293	0.88	BF459	0.49	BU407	1.38	OC235	0.82
AC194K	1.20	BC175	0.12	BC300*	0.27	BD164	2.69	BD294	0.88	BF459	0.49	BU407	1.38	OC236	0.82
AC194K	1.20	BC176	0.12	BC301*	0.27	BD165	2.69	BD295	0.88	BF459	0.49	BU407	1.38	OC237	0.82
AC194K	1.20	BC177	0.12	BC302*	0.27	BD166	2.69	BD296	0.88	BF459	0.49	BU407	1.38	OC238	0.82
AC194K	1.20	BC178	0.12	BC303*	0.27	BD167	2.69	BD297	0.88	BF459	0.49	BU407	1.38	OC239	0.82
AC194K	1.20	BC179	0.12	BC304*	0.27	BD168	2.69	BD298	0.88	BF459	0.49	BU407	1.38	OC240	0.82
AC194K	1.20	BC180	0.12	BC305*	0.27	BD169	2.69	BD299	0.88	BF459	0.49	BU407	1.38	OC241	0.82
AC194K	1.20	BC181	0.12	BC306*	0.27	BD170	2.69	BD300	0.88	BF459	0.49	BU407	1.38	OC242	0.82
AC194K	1.20	BC182	0.12	BC307*	0.27	BD171	2.69	BD301	0.88	BF459	0.49	BU407	1.38	OC243	0.82
AC194K	1.20	BC183	0.12	BC308*	0.27	BD172	2.69	BD302	0.88	BF459	0.49	BU407	1.38	OC244	0.82
AC194K	1.20	BC184	0.12	BC309*	0.27	BD173	2.69	BD303	0.88	BF459	0.49	BU407	1.38	OC245	0.82
AC194K	1.20	BC185	0.12	BC310*	0.27	BD174	2.69	BD304	0.88	BF459	0.49	BU407	1.38	OC246	0.82
AC194K	1.20	BC186	0.12	BC311*	0.27	BD175	2.69	BD305	0.88	BF459	0.49	BU407	1.38	OC247	0.82
AC194K	1.20	BC187	0.12	BC312*	0.27	BD176	2.69	BD306	0.88	BF459	0.49	BU407	1.38	OC248	0.82
AC194K	1.20	BC188	0.12	BC313*	0.27	BD177	2.69	BD307	0.88	BF459	0.49	BU407	1.38	OC249	0.82
AC194K	1.20	BC189	0.12	BC314*	0.27	BD178	2.69	BD308	0.88	BF459	0.49	BU407	1.38	OC250	0.82
AC194K	1.20	BC190	0.12	BC315*	0.27	BD179	2.69	BD							



# TELEVISION

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### HELD OVER

Several items we'd planned to include in the present issue have had to be held over due to shortage of space.

### COVER PHOTO

Our cover photo this month shows RCA Selectavision video discs being quality checked prior to packing. Our thanks to RCA who provided the photograph.

Many years ago the performance of TV receivers left something to be desired in several respects. This was certainly true of some monochrome designs of the sixties, especially those made during periods of heavy demand and intense competition between setmakers. There were even "cost improved" designs, in which a dozen or so of the components in the original design had been deleted! Then the first dual-standard colour sets didn't perform too well, though they were certainly great achievements at the time. The e.h.t. regulation of one or two chassis we can recall was truly shocking, and there were some with which good line or field linearity or convergence or whatever just couldn't be achieved – not by us, anyway! One tended to avoid leaving such sets displaying a test card – far better to select Bugs Bunny or Play School, with which the shortcomings were less obvious.

Apart from such of those old sets that still survive, things are quite different today. Self-converging tubes, picture breathing compensation and cleverly designed chips have given the 1981-2 TV set a performance several orders better than in days of yore. Given a finer grain picture tube than the normal consumer type, we suspect that some modern designs would produce results almost indistinguishable on most signals from a professional monitor – and all for no more than the price of a hot-and-heavy dual-standard beastie some fifteen years ago! All too often, the only things available in the service department to set up these paragons of virtue are off-air programme material or the specialised patterns provided by a colour-bar generator. Some caring service departments have gone to the trouble of rigging up optical or electronic pattern generators, with varying degrees of sophistication and success – an optical generator depends very much on the resources and ingenuity of the man who makes it, and anyway such things are today rather old fashioned. We've often known a technician record a broadcast test pattern on tape and use it for checking and setting up receivers – just adequate for some purposes perhaps, but inadequate and misleading for most. Ugh!

There have been at least two published designs to our knowledge for amateur construction, providing an electronically generated test pattern that incorporates most of what's wanted. No doubt more are in the pipeline. These can be tricky to construct however and difficult to debug – due to the fast digital techniques necessarily used. Their performance can also fall short of a broadcast test pattern in several respects, notably the sync pulses. The answer will come when some enterprising chip manufacturer brings out a single chip or other simple test pattern generator – he'll certainly do a roaring trade, amongst dealers and enthusiasts alike.

In the meantime, we have to rely on the broadcast test cards/patterns – during the odd intervals when they're available. At present, this means one of three, Test Card F, the Philips pattern, or the new IBA ETP1. Test Card F is well loved by those in the trade, containing as it does the insert picture for colour evaluation, corner stripes and true background squares. We'll be sorry to loose it if it disappears, as we fear it must one day. The Philips pattern is a good one, containing a large circle for scan linearity checks, square squares and many other good features. The strange colours in the side blocks correspond to certain fixed chroma phase angles, and with a practised eye these can be used for decoder performance appraisal in almost the same way as the colour picture in Test Card F – they are better for this purpose than a row of saturated colours, which can be reproduced by a decoder way out of alignment.

Which brings us to the IBA pattern. It's bright and cheerful, but does it really fulfil modern needs? We suggest that it doesn't. The wide borders are a bit misleading – set up the scan amplitudes with this pattern, then revert to one of the BBC patterns and see the difference. The pattern doesn't help at all with linearity checks – no circles, and rectangles rather than squares in the background. A receiver's linearity can be surprisingly far out and yet look quite acceptable when displaying this pattern. The black rectangle on a white ground at the top is not above criticism either. This gives a test for streaking due to poor l.f. response, but the streaking is not easy to see. If the black rectangle had been made shallower than the white background, as it was in the old test cards, any streaking effects would have had a white reference above and below, making them easier to detect and evaluate.

The original test cards were evolved through careful liaison between the broadcasting authorities, BREMA and the retail trade. ETP1 seems to have been hastily conceived and designed. Perhaps the opportunity could be taken to update the pattern and match it to the potential of modern sets? We'd like to see a centre circle, perhaps two concentric ones. Diagonal corner stripes are very good for linearity adjustment – corner circles, as featured in some older test card designs, are even better. Scan linearity can be set up with great accuracy when corner circles are present. How about a single diagonal line from corner to corner to show up compression or expansion in the centre of the raster – it happens! Couldn't room be found for a special decoder setting up pattern, coded in anti-PAL (as it's been dubbed)?

TV4 test transmissions have now started in many areas, with a test pattern during the day. In spite of our criticisms of ETP1, it's very welcome during working hours!

# How to be Tetchy

Les Lawry-Johns

I AM one of the most pleasant of people – easy to get along with, understanding and tolerant, helpful and constructive, with never a nasty thought in my head except on rare occasions. It's worrying therefore to find these occasions becoming less rare and my tolerance increasingly strained. I'm aware that I'm not as young as I once was, and that to the above list could perhaps be added dodderiness. But I don't somehow think that age has too much to do with this subtle change of character, which has me contemplating bashing people over the head with a blunt instrument and then dancing at their funerals.

You see what I mean. It is rather worrying – especially since I don't seem to worry about it all that much. Our dog Ben and I seem to share one trait in common: we snap at people even though they appear to be kindly souls, just in case they're not I suppose. Take the other day for example.

## Plug Ploy

A chap brought his set in for repair just as we were closing. I had a quick look, but as it was a case of intermittent field collapse and it wouldn't collapse for me I suggested that he leave it and take one of our loan sets home with him so that his wife wouldn't miss Crossroads and he the football.

When he came back the following day to collect his own set he brought ours back and dumped it down. He surveyed it for a moment and then came out with "did it have a plug on it when I took it?" This annoyed me and I snapped "yes it did and you're not having that one." He'd had his set repaired at a very reasonable price, he'd been lent a set for nothing, and here he was scared stiff or loosing a plug, even though a moment's thought would have confirmed that it did have a plug when he took it away the night before. Only a little thing, but it did get me going for a moment.

## Enter Mr. Doubleday

We hadn't seen Mr. Doubleday for quite some time. He showed up the other day and needed a bit of help in getting the big Ultra colour set out of the back of his estate car. "This is a 26in. set" he panted quite unnecessarily. "It belongs to my neighbour, my neighbour." To cut the story short and avoid all the repetition to which Mr. Doubleday is prone, it seems that the neighbours were watching the set when it suddenly went off. And now here it was waiting for the little thing that would start it up again.

Quite unsuspectingly, I took the back off the Thorn 3500 and immediately started to check the usual things in the power supply before applying the juice – the rectifier diodes, the cut-out, etc. These were all intact, so we plugged the set in. The degaussing buzz occurred and the tube heaters lit. There was a hefty h.t. present at the body of the chopper transistor (see Fig. 1) and the 30V supply was present. There was no 60V h.t. supply at the centre fuse (F603) however, i.e. no output from the chopper. When the meter was applied to the end, right-side tag of the dropper resistor to see whether the 12V supply to the chopper driver transistor was present, we found only about 3V.

This was obviously a starting point. We lifted up the power unit to start checking – and found the timebase plug

hanging free. Incredibly, I didn't immediately notice that all the other plugs and leads from the field and line timebase panels were also hanging free – I suppose because I was concentrating on the power supply panel. Taking this out (having plugged the timebase plug in and got no results) we followed up the low voltage. Was the chopper driver transistor short-circuit or permanently on? Check the drive from the monostable circuit. Whilst we were attending to this our eyes were attracted to R620 in the monostable circuit. The resistor looked a bit sick, and measured only a couple of hundred ohms instead of 2.7k $\Omega$ . So we replaced it and on putting the power supply panel back we found we had the correct 12V at the end of the dropper and 60V at the centre fuse. So the power supply and the line oscillator were working (the trigger pulses for the monostable come from the line oscillator). There was no sign of line output stage operation however, and no voltage across R907 in the beam limiter circuit (this resistor is between the line output stage earth line and the rest of the chassis).

It was then that I turned to the line output stage and found all the leads off and the tripler disconnected. "Someone's been at this" I growled at Mr. Doubleday. "Oh no, it just went off, went off" he protested. By this time I'd removed the line timebase panel and looked at it a little more closely. The R2008 line output transistor was completely disconnected, leads were off the two transformers and, looking just a bit more closely, the line driver transistor was seen to be missing along with several capacitors and diodes.

"Look at this" I bawled, making the cat beat a hasty retreat.

"I don't understand these things, these things" said Mr. Doubleday.

"Perhaps you don't, but see all these leads hanging free and these empty spaces. It means someone's been here before us, and a bloody fine mess they've made of it too. Your neighbours are having you on. Sorry Mr. Doubleday, but I don't want the job putting this lot right."

"They wouldn't mind spending a tenner on it, a tenner on it" bumbled Mr. D. "I shouldn't think it would cost much more than that."

I finally lost my cool at this and slapped the bits together and the back on. Before he could say another word, I'd the set outside and in the back of his car. "Cheerio Mr. Doubleday, it's been nice knowing you, knowing you."

When I got back into the shop Honey Bunch was giving me that look. "I don't know what's got into you lately. Mr. Doubleday was quite upset when he left. You won't have any customers left if you carry on like this, carry on like this."

"\*\*\*\*\*" I said nastily.

## They'll Never Believe Me

Hardly had we had time to drink a cup of coffee than a young fellow struggled in with another 3500 – a 22in. Ferguson set this time. "What's wrong?" I asked carefully.

"We were watching it and it suddenly went off."

I took the back off and carefully checked all the plugs and sockets. They were all connected and hadn't been disturbed, so we started the routine. 30V line o.k. 240V at

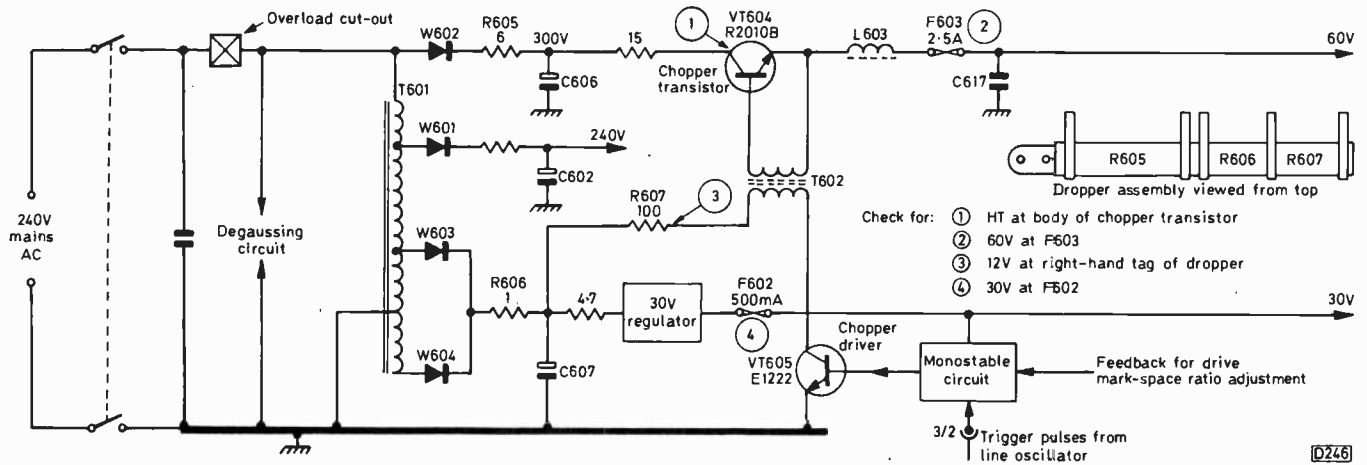


Fig. 1: Quick checks on the Thorn 3000/3500 chassis power supply module (simplified circuit). H.T. at the body of the chopper transistor but no 60V supply at F603 means that either the fuse or the transistor is open-circuit or the transistor is without drive. If the fuse and chopper transistor are o.k., check the 12V supply to the driver transistor, the 30V supply to the monostable circuit etc., and for the presence of trigger pulses at connector 3/2 and drive to VT605.

the body of the chopper transistor, nothing at the 60V fuse. Also nothing at the extreme right-hand tag of the dropper resistor though there was 45V at the next tag. Like a fool I started to try to find out what was pulling the voltage down and had got to the point of taking out the power pack when a voice inside my head said "why isn't the dropper section hot if you think it's overloaded?" I suppose I was still thinking of the previous disaster. So I checked the continuity of the 100Ω section with the ohmmeter and of course it was open-circuit.

Back went the power unit and in went a new dropper section. On went the set and up came a pink picture (no green). A quick check revealed that there was no supply to the tube's green first anode, due as usual to leakage in the beam switch. This was soon dealt with and everything seemed fine except for an intermittent flash of bright blue. Moving the thick-film video load unit proved that it was at fault since the picture remained bright blue now that the intermittent open-circuit had become a permanent one. A new thick-film unit was put in and everything was now fine.

"Lucky you had those parts" said the young man.

"Luck had very little to do with it" I said. "I have to order them and about ten million other parts at a cost of billions of pounds so that you and those like you don't have to be kept waiting."

"Thanks" said the young man. "Would you mind if I took the set and paid you at the weekend, because I'm a bit short at the moment?"

### Furious Frank

Frank is (or was) a regular customer of ours. For more years than I care to remember. He'd bought a colour set from us several years ago, and it had proved to be very reliable. He often pops in with various bits and pieces however and waits whilst I fix them for him. During this process he talks incessantly about things which are of interest to himself only, smokes incessantly, and incessantly flicks the ash on the shop floor despite the fact that I put an ash tray under his nose. This time he brought in his sister's old ITT monochrome set (VC200 chassis).

"It's the aerial socket Les" he told me. "The picture goes off and when you pull out the aerial plug and push it back in the picture comes on again." So we switched the set on and in due course quite a good picture appeared and didn't vary however much I messed about with the aerial plug. "Seems all right to me" I said.

"Oh yes, it is for about five minutes or so" said Frank. So we waited a bit while he filled in all the details of what had been happening to him workwise and homewise and I tried to serve customers with their odd bits and pieces, attempting to listen to them as they explained what they wanted.

"There you are" Frank suddenly shouted, scaring me out of my wits. The picture had gone off, leaving a very dull raster which looked ominously familiar to me. I turned the brightness control and the dull raster didn't vary one iota whether it was turned up or down. "You just push the aerial plug" said Frank.

Without much hope I pulled the plug out and pushed it back in again. No change.

"Not like that. Like this" said Frank, grabbing the aerial plug and wrenching it out and in so that the whole set vibrated. The picture appeared with a flash and went off again.

"You can get the same effect by tapping the cabinet" I said wearily.

"No you can't" said Frank, gently touching the cabinet.

I started to lose my cool again and whipped the back off. "This is where you tap if you really want to see what's wrong" I said, tapping the neck of the tube with a screwdriver handle. The picture flashed on and off as I tapped.

"You can't mean it's the tube" said Frank. "You put a new one in only a little while ago." I looked at the label on the tube. It said 1975. "Over six years ago to be exact."

"Well it shouldn't go so soon" he moaned. "What's my sister going to say? She'll have to go without her gin for a week, and she won't like that."

So I put the set to one side as Frank slid off to consult his sister. He phoned later to say that they were still thinking. The next day he came back and purchased a 24in. Philips monochrome set we'd taken in part exchange – the cost was less than installing a new tube in the ITT set.

### In the Meantime

Meanwhile two sets fitted with the Thorn 8500 chassis had come in. One had a blown fuse, and before that had exhibited colour bars, i.e. no colour lock. The other was working but again with no colour lock. The blown fuse was no more than a short-circuit mains filter capacitor, but the unlocked colour was a rather more stubborn problem that couldn't be resolved until the 4.43MHz reference oscillator

crystal had been replaced. We checked the decoder presets on the second set without result, and again had to replace the crystal in order to get the colour to lock. Funny how this decoder seems to need crystal replacement so often – the crystals seldom seem to fail in other chassis.

### A Bouncer

Last month I mentioned the lady whose Waltham W125 had given her trouble – she'd wanted it fixed in a hurry. So we'd snipped off the line output transformer's e.h.t. overwinding and fitted a tripler to get the e.h.t. back quick. I had another call from her the other day. The other windings on the transformer now had shorted turns. No problem this

time, as we'd now got a couple of spare transformers in stock. Once again she wasn't without her set for long: there's a moral here somewhere, if only I could think of it.

### Philips Cube

Finally this month those Philips black box "entertainment centres", with TV, radio, cassette recorder plus clock, all in a compact square (Model 9TC2100). We've had a couple in with field collapse. If you trace the leads from the field scan coils down to the right-hand side, you'll find that they terminate in a plug and socket. Nearby are the two field output transistors. In both cases the BC338 (TS560) had gone short-circuit.

# Simple Variac

Victor Rizzo

IN these days of semiconductor devices that go dead at the drop of a hat, a variac is one of the most desirable items of equipment either for servicing or for experimental purposes. Many are deterred from buying one however because of the cost. The present article describes a very good one which, given a little patience, can be constructed at a fraction of the cost of a commercial variac. The one I made may not be a beauty, but is safe and serves its purpose admirably. It uses tapings to enable all the decades except three in the range 10V to 240V to be obtained. Voltage selection is done by plugging two flying leads into a robust octal valve base socket.

The first step is to find a serviceable double-wound mains transformer, i.e. not an auto-transformer, from an old TV set. Many an old set is rated at 200W, with all the power

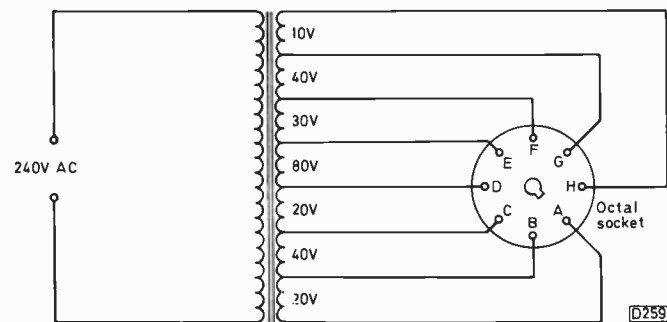


Fig. 1: Circuit diagram showing voltage taps.

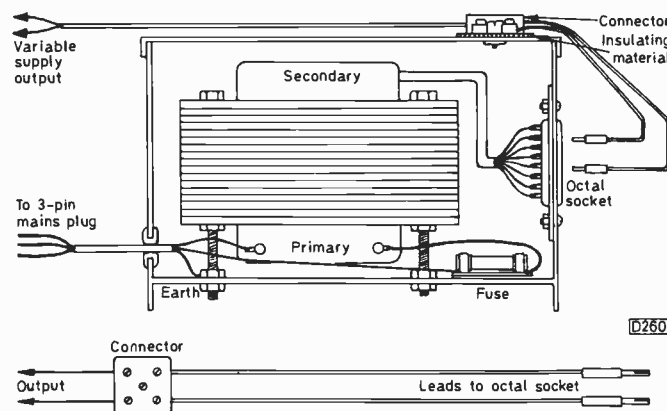


Fig. 2: Cross-sectional view of the prototype.

used provided by the mains transformer. This should be more than adequate for our purposes.

Next try the transformer and check the turns/volt ratio. This is very important, and can be done by noting the heater voltage provided by one of the windings and seeing the number of turns this winding consists of, then dividing the number of turns by the voltage. In the transformer I used the ratio was two.

Remove the laminations and the secondary windings from the transformer. Don't disturb the primary winding, and don't remove the insulation which separates it from the secondaries. Sand the laminations very lightly, wipe them clean and smear lightly with grease to facilitate reinsertion.

Now make up a new secondary, using wire of the same gauge as the primary winding – the wire must be new. In the arrangement I used (see Fig. 1) this winding consists of seven sections (A-B, B-C etc.) with eight terminals. The number of turns in each section depends on the turns/volt ratio: multiply the voltage required by the ratio and you get the number of turns required for each section. The tapings should be well sleeved and left long enough to be soldered directly to the voltage selection socket. Letter the tapings to avoid confusion later on.

When the new secondary winding has been finished, replace the laminations and tighten them up. The whole transformer can be impregnated with wax.

How you arrange the rest of the device depends on what you have available for the purpose – Fig. 2 is included as a general guide. If the transformer chosen has its own fuse and mains tapings, these can be retained. I housed the transformer in a biscuit tin that happened to be around. A hole was cut in one side for the voltage selection socket, the connector for the flying leads being fixed to the lid. Glue a table showing the voltages available in a convenient place. Include a mains on-off switch if you want, but do make sure that the whole thing is well earthed.

On completion of the device, try it out to check on the voltages available. It's these readings that should be written down on the voltage table of course. Due to mains voltage variations, the voltages will never be spot on. There are so many possibilities to choose from however that this will present no problems in practice.

Table 1: Voltages available.

10V G-H	80V A-D, D-E or E-H	170V B-F or C-G
20V A-B or C-D	100V C-E	180V C-H
30V E-F	110V D-F	190V A-F
40V B-C or F-G	130V C-F	210V B-G
50V F-H	140V B-E	220V B-H
60V A-C or B-D	150V D-G	230V A-G
70V E-G	160V A-E or D-H	240V A-H

The voltages not available are 90V, 120V and 200V.

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# VCR Clinic

*Reports from Steve Beaching, T.Eng. (C.E.I.)  
and Mike Phelan*

FIRST this month some JVC HR7700 problems.

## Interrupting the Micro

The first machine came from another dealer after his engineers had come to a dead end. They said that the fault was intermittent, but fortunately for me the fault was present all the time when I tried the machine. The symptom was this. When play was selected, the machine threaded up and playback commenced. Then the pinch roller dropped out and the tape transport stopped. No further function could be selected, and the only way to persuade the machine to unthread was to switch it off and then on again. This would initiate "power on" reset, and unthreading would start but would not be completed. It was necessary to try a second time to complete the unthreading and enter eject.

Now when one of these machines comes to a halt like this there'll be a reason though it might be the wrong one – the microprocessor may be responsible, or more often it may be getting incorrect information, thus bringing things to a halt. The microprocessor in the systems control department has an "interrupt" input which when activated stops the tape transport system dead. A check revealed that the interrupt input had indeed been activated when the fault condition was present.

The interrupt input monitors the tape transport – the supply and take-up spools, drum rotation and lamp failure. My first guess was that the drum rotation input was missing. I inhibited the interrupt input by connecting pin 9 of IC17 to chassis. The machine then played happily, enabling me to check the flip-flop signal from the servo. This was absent, so the system control had been under the impression that the head drum had stopped. As it was whizzing around normally however there was obviously a failure somewhere in the signal path – something like a plug and socket connection on the servo PCBs. This turned out to be the cause of the problem.

## Slow Start

We had a similar problem on another of these machines – to make it operate, the customer had to keep his finger on the fast-forward on rewind buttons for a short while. During this time the machine's solenoids played a tune, banging away. Investigation revealed that in the fast-forward mode the take-up spool was taking too long to gather speed. The previously mentioned interrupt input was again being activated, because the spools were taking too long to rotate. Keeping one's finger on the fast-forward button allowed the system control to re-enter fast-forward however, and after a couple of stop/goes the speed was sufficient for fast-forward to continue without interruption.

It seemed that either the interrupt inhibit timing was too short, or the spool drive motor was taking too long to reach speed. We monitored the rise time of the spool motor voltage and compared this with a correctly working machine. This proved that the motor was indeed taking too long to get up speed. Further investigation revealed that C26 in the reel motor drive circuit was defective – its value

was much more than the 100 $\mu$ F written on it. Replacing C26 restored normal operation.

## Intermittent Mode Change

This last one will bring a great sigh of relief to many of our readers who are responsible for the upkeep and satisfactory operation of these machines once they've been sold. Vince said that his machine had a personality of its own. Hands up now those of you who's customers are driving you mad with complaints that HR7700s are ejecting cassettes without provocation once every blue moon, changing mode from play to still frame, slow motion, twice times speed, shuttle search or audio dub or, worst of all, record, intermittently. Your saviour is at hand! I could just say change transistor X1 in the remote control receiver preamplifier. Before you do though, check the signal path where the remote control data enters the system control panel with your trusty scope. Do you see lots of noise? Then proceed as stated, or replace the transistor with a 2N3819 mounted 180° reversed (the pins are different). The noise will then go away, and so will all the funny operation changes. A word of warning however: if there's no noise present and the operation is erratic, I suggest you go over the solder joints and the double-sided PCB feed through holes and check the PCB connections.

## Transformer Trouble

Another funny thing happened last week. A Toshiba V8600 stopped working, with a blown 800mA mains fuse. Having eliminated other possibilities, we removed the mains transformer and connected it to a mains power supply. After about two minutes there was a crackling noise and a smell of hot epoxy resin. Back to the suppliers it goes. Did you hear the one about the Toshiba V8600 clock that lost about six minutes in half an hour? So did Andy, but the mains transformer burnt out before we could check it – anyway they didn't have any modules in stock . . .

## Sideways Wobble

The November batch of Grundig 2x4 Supers suffered from problems – as you'll know if you're in the trade. The thing I don't believe – though I'm open to reasonable persuasion – is the cure to the fault I had on one of them. Every time play was selected, the picture would wobble from side to side for the first 15-20 seconds – this was discovered when testing a new machine out of the box. Others may say "Yes madam, they all do that" – but my quality control is more stringent.

The cause was not the drum servo panel – easy substitution eliminated that possibility. So it was down to either the motor or the motor drive. Fifteen to twenty seconds is the time it takes for the motor drive transistors to warm up – they are not on heatsinks. Being of sound mind and body at the time, I decided to give the power transistors a squirt with the freezer. That made the picture wobble until they warmed up again. I was working late on this occasion,

so I rang my friend Peter. A discussion took place which resulted in Peter suggesting that I interchange motor drive panels, which could give me two good machines. So I put a good motor drive panel in the faulty machine, curing the problem and eliminating the drum motor at least. Next I removed the four motor drive transistors from the faulty panel – two drivers and two output transistors. Check them for leakage but find nothing. Fit replacements and find that the previously faulty panel is fine. Next try the suspect transistors in the good panel and refit it in the good machine. The replay remained stable even when the transistors were frozen! So I ended up with two perfectly good recorders. There must be a reason, such as gain/temperature tolerances. Maybe big G have some ideas?!

S.B.

## Common Faults

A couple of fairly common faults on Ferguson/JVC machines. As an example of the first, we had in a Ferguson 3V23 with all the symptoms of one defective video head – there was a picture of sorts when a prerecorded tape was being played back, but it was covered with white noise dots as if there was no output from one of the heads. A screwdriver placed on the two live connections to the rotary transformer that links the heads to the pre-rec board produced equal picture disturbances – so it was reasonable to assume that the preamplifiers in both channels were working and that a head was indeed faulty. After fitting a new drum however we found we were wrong. On closer scrutiny and another screwdriver test we discovered that touching three of the four connections to the rotary transformer produced picture disturbances, so clearly one of the connections was not being earthed – the fault in fact was a dry-joint on pin 11 of the rotary transformer's edge connector. We've had several machines with this fault – it's necessary to remove the screening can to see the print side.

The other common fault we've had with Ferguson/JVC machines of late is the complaint that nothing happens when the play key is depressed. The Ferguson models concerned are the 3V00, 3V16 and 3V22. The loading mechanism in these machines is operated by a large nylon gear (see Fig. 1) that carries an eccentric roller to move the mechanism. During loading and unloading it turns through 180°: it's driven via two other gears on a moveable arm from a pinion on the capstan flywheel. When play or stop is selected, the arm carrying the two gears moves so that the smaller gear engages with the flywheel and the loading gear rotates. On the faulty machines the large gear was found to

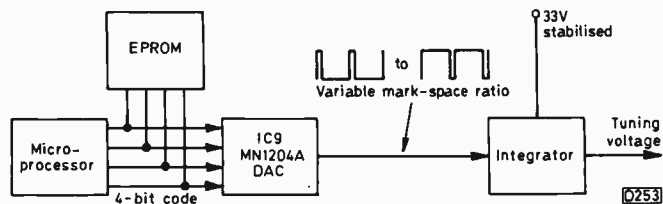


Fig. 2: Tuning system used in the Ferguson Model 3V23.



Fig. 3: Drum servo waveforms. (a) Unstable. (b) With bursts of oscillation in fault condition.

be binding on the pivot point. We cleaned it up, gave it a smear of grease (yes I know you don't need to lubricate nylon!), reassembled it and all was well.

## Tuning Failure

A Ferguson 3V23 (JVC HR7700) came in with the complaint that it wouldn't tune in. To carry out this procedure, the required channel number is selected with the + or - buttons, then the channel set button is depressed, followed by sweep and store (when the required channel is reached). When we pressed sweep, the indicator on the fluorescent display moved along, proving that the microprocessor on the tuner/timer board was producing the correct code. All we had however was a noisy raster – it looked as if the local oscillator in the tuner had packed up, or that there was no tuning voltage. It turned out that the problem was due to the latter condition. We'd 33V at the stabiliser i.c., so we next looked at the output from the digital-to-analogue converter IC9 (see Fig. 2). The input to this consists of a four-bit code which varies continuously while the band is being swept: the DAC converts this coded input into a variable mark-space ratio output which goes from about 10:90 to 90:10. This output is then integrated to get the tuning voltage for the tuner. A scope showed that the input codes to IC9 were varying, but its output remained at the minimum mark-space ratio. A new MN1204A i.c. restored normal operation.

## Squeak Squeak

The last one is always the best they say, and this one was quite a good fault as they go. We put a Baird 8902 (JVC HR3330) on the bench, inserted a tape, and ran it in the playback mode. After a few minutes the fault appeared. Squeak, squeak the machine went. Ah! we thought, the metal pulley on the take-up clutch is slipping against the rubber tyre on the reel disc, the usual cause of squeaks on playback. It wasn't of course – the noise came from the drum motor, and disappeared when the drum was stalled by hand. In with a new drum motor, test, and find the squeak still there. The only other rotating component here is the lower drum assembly itself, so we changed this – no mean task. As you'll probably have guessed, the squeak was still present!

Sit back, light pipe, watch picture. O.K. for a few minutes then, when the squeak starts, noise bars on the picture coinciding with the squeaks. Now if something was wrong with the drum speed, we'd not get noise bars – just horizontal displacement or line slip, due to trying to cram more or less than 312.5 lines into each field. If the tape speed is wrong or varying on the other hand, we'll get noise

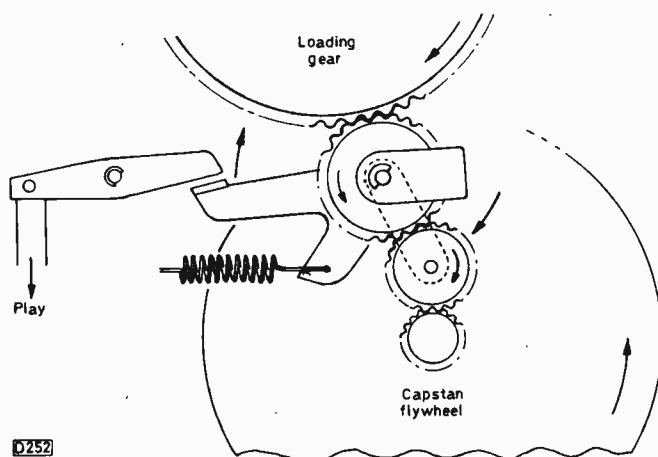
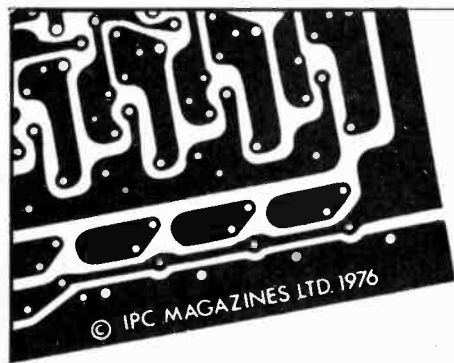


Fig. 1: Threading drive on JVC/Ferguson machines.

bars but the effect on the sound will be apparent before this. The sound was perfect on this machine, so we tried adjusting R52 to set the gain of the drum servo loop. The quick way to do this is to connect a 100Ω resistor across the drum motor (TP13 to TP16), select play and pause, scope the waveform at the collector of transistor X9, turn R52 clockwise until the servo goes unstable – see Fig. 3(a) – and then turn it back until the spikes disappear (only just). The servo loop is then adjusted for maximum gain and optimum lock-up time.

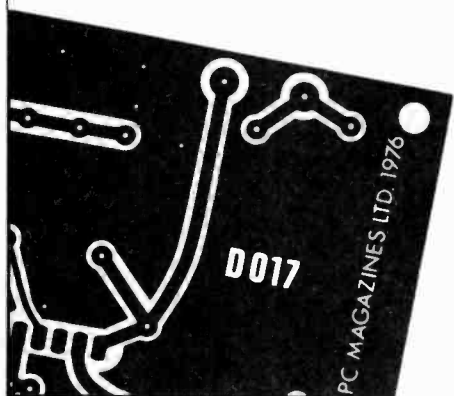
The waveform we got was more like that shown in Fig. 3(b) however – there were bursts of oscillation at about 800Hz. These were being fed to the drum motor, making it

squeak. In addition the vibration superimposed on the head drum's rotation produced mistracking without altering the speed – hence the noise bars. Capacitor trouble we thought. We tried replacing the electrolytics C6 (1μF) and C45 (10μF) in the motor circuit, but the culprit turned out to be C44 (0.022μF) which decouples pin 3 of the servo i.c. (IC5) – it was open-circuit. There's a sequel to this little story. The following day, one of our other branches rang through. "I've got a 3V00 that's making squeaking noises Mike. I've replaced the drum motor and it still squeaks – help!" "Replace C44 Tony, it's open-circuit." A great pity we don't have videophones! We haven't heard of the fault since. M.P.



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# Teletopics

## UK TV PRODUCTION ON THE INCREASE

Recent changes in the industry mean that the UK is becoming an increasingly important centre for TV receiver production. The Decca-Tatung plant at Bridgnorth is now producing sets at the rate of 125,000 a year, twice the rate of production a year ago. Over 27% of production is exported, and Tatung hope to increase this proportion. Sanyo have now announced details of their production set up at Lowestoft. The plant will be run by a new company, Sanyo Industries (UK), which will be owned 10% by Sanyo Marubeni (UK) – the present sales and marketing organisation in the UK – 10% by the Marubeni Corporation, and 40% each by the Japanese parent companies Sanyo Electric and Sanyo Electric Trading. Production will start this August, with a target of 60,000 for the first year rising to 120,000 by the third year. The tubes and cabinets will be UK manufactured, but most of the rest of the electronics will initially be supplied from Japan. Sanyo Industries (UK) will be Sanyo's 33rd overseas plant, and is clearly intended to contribute to increased sales of Sanyo sets in W. Europe. Production of VCRs is expected to follow once the TV lines have come into full operation.

## THORN-MITSUBISHI LINK

An agreement has been signed between Thorn Consumer Electronics and the Mitsubishi Electric Corporation for the sharing of technical information on television technology. Subjects covered include systems and chassis development, production technology and quality control. Commercial arrangements will remain unaffected, but the two parties will have access to each other's research and development work. Thorn are understood to be particularly interested in satellite TV equipment, while Mitsubishi are interested in TV data services. Thorn EMI and Mitsubishi already have links in the lighting industry, and both are shareholders in the Australian electronics company AWA-Thorn Consumer Products Pty Ltd.

## INCREASED PICTURE SHARPNESS

The latest issue of the Philips publication *Electronic Components and Applications* contains a report on the use of scan-velocity modulation (using signal information to modulate the line scan) to achieve increased picture sharpness. As Philips point out, the idea is not new. Until recently however, developments in c.r.t. gun and deflection yoke design have been of greater importance. With the 30AX system, the performance of the c.r.t./yoke combination has reached standards of performance that make it worth while turning attention again to the use of scan-velocity modulation as the best way of achieving some further improvement. Philips have introduced two new deflection coil assemblies, types AT1261 and AT1271, that incorporate an extra coil to enable scan-velocity modulation to be applied.

Fig. 1 shows that basic idea of scan-velocity modulation. A luminance signal sample is tapped from a point along the luminance delay line, differentiated, amplified and fed to the scan modulating coil. The reason for tapping the signal from a point along the delay line is because of the different

transit times of signals from the delay line to the c.r.t. cathodes and from the line to the modulating coil – the beam and scan modulation must obviously coincide for correct operation.

The module developed by Philips for processing the signal and driving the modulating coil is compact and uses only nine transistors – a further emitter-follower is required adjacent to the luminance delay line. Complementary-symmetry driver and output stages are used, operating from a 33V rail and with capacitance coupling to the modulating coil. To avoid the accentuation of noise with weak signal operation, also to prevent overloading by high-amplitude pulses, a diode clipper circuit follows the differentiator. In addition, to prevent excessive accentuation of the h.f. signal components the amplifier has a roll-off at about 3.5MHz. Since there is no need for scan-velocity modulation with a teletext display, the amplifier is then blanked.

The modulating coil is of the printed circuit type, with four turns to each section, and is recessed in the inner surface of the deflection coil former.

Something to watch out for in future up-market models!

## TRANSMITTER NEWS

As many readers will be aware, the IBA have been carrying out test transmissions from various TV4 transmitters around the country – mainly the high-power transmitters, but also some relays in Wales. When an installation is completed, there is usually a series of engineering test transmissions – these may be at various power levels, and should not be used for adjusting receiving aeriels. There follows a period of regular engineering transmissions (Mondays to Saturdays 9 a.m. to 5 p.m.) consisting of various test patterns and cards. These usually last for a month or so, after which the transmitters are switched off until the start of regular trade test transmissions this summer.

The IBA point out that the high-power TV4 transmissions can in some cases affect existing reception – those receiving a non-local channel for example may experience co-channel interference. There have also been reports of patterning and interference due to overloading of a receiver with an insufficient linear dynamic range: this is most likely to occur where a high-gain preamplifier is in use. Cross-modulation and the generation of intermodulation products can occur when an additional carrier is present even though the carrier is no stronger than the others, due to the cumulative effect of the signals. Such interference can usually be avoided by slightly attenuating the input to the receiver or preamplifier (depending on where the overloading is occurring). 3dB of attenuation is normally adequate.

Following the new ITV contract period which started on January 1st, a number of IBA transmitters are being reallocated between regions. The stations involved are Marlborough, Kendal, Windermere, Sedberg, Hawkshead,

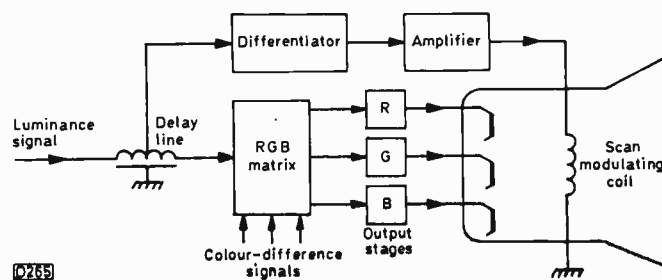


Fig. 1: The Philips scan-velocity modulation system.

Coniston, Grasmere, Bluebell Hill, Chatham Town, Tunbridge Wells, Buxton, Cornholme, Todmorden, Walsden and Walsden South.

The following relay stations are now in operation:

**Bossiney** (Cornwall) Television South West ch. 61. This is the experimental solar and wind powered transmitting station described in our December issue. Due to action by the Association of Broadcasting and Allied Staff, it has not been possible to start BBC-1 and BBC-2 transmissions.

**Woolacombe** (Devon) BBC-1 ch. 39, Television South West ch. 42, BBC-2 ch. 45, TV4 (future) ch. 49.

The above transmissions are vertically polarised.

### SATELLITE TV STANDARDS

The IBA have expressed reservations about the early introduction of direct broadcast satellite systems, pointing out that it would be preferable to start out with a new TV standard rather than perpetuate the present use of different standards. IBA engineers have proposed a system called MAC (multiplexed analogue components) as a means of overcoming the problem, while at the same time providing potentially improved picture quality with a 625-line system that has to cope with the different noise-distribution problems with f.m. video. The proposed system uses time compression to enable the luminance and colour information to be time-multiplexed: it would require the use in the decoder of a CCD memory that could store a complete line, but would not involve changes in the design of the satellite transposer. Further investigation of the system is being carried out.

### JOINT VENTURE AGREEMENT SIGNED

The European joint venture agreement between Thorn EMI, Telefunken and JVC has now been formally signed. A new holding company will now be formed for the production of consumer video electronic products in Europe. The company will be incorporated in Holland, the three partners having equal shareholdings. Manufacturing subsidiary companies will be formed in the UK and W. Germany – products will include VHS VCRs, video cameras and VHD disc players. Production of VCRs at the former Telefunken works in W. Berlin is expected to start later this year. It was originally intended that Thomson-Brandt would be a fourth partner, but the French government has vetoed this for the present because the proposals do not include plans for VCR production in France.

### SERVICE BRIEF – ITT

Occasional cases of failure to start up have been reported in sets fitted with the Mini series chassis (CVC800 and CVC801). The cause is the electronic fuse operating at switch on. To overcome the problem, remove R774 (100kΩ) in transistor T771's base circuit. In later production this resistor has been deleted.

### SELECTAVISION PRODUCTION

RCA expect to have sold some 60,000 Selectavision video disc players during 1981. Production reached 135,000 machines, and the original target was for sales of around 200,000 during the first year. Purchasers have bought more discs per player than originally anticipated however, so disc sales have reached 90% of the target figure of three million. The initial disc catalogue included 160 titles, and owners on average bought 18 discs each. RCA attribute the sluggish

sales of players to lack of public awareness, and believe that once a threshold level has been reached sales growth will be rapid. Though the price advantage of a disc player compared to a VCR is not great, the price advantage of the discs themselves will rise substantially once production levels increase.

### THE ULTIMATE PSU?

Another interesting article in the latest issue of *Electronic Components and Applications* describes the series-resonant power supply. It's more efficient (over 90%) than a switch-mode power supply and causes less mains and radiated interference. Other advantages include: continued operation with the output short-circuit; stable output off load; can be made self-starting. Its use has been limited in the past due to the lack of a suitable high-voltage switching device. The recently introduced BTW58 series of gate-controlled switches now fulfills this requirement.

The basic elements of the series-resonant power supply are shown in Fig. 2(a). C1 is the mains rectifier's reservoir capacitor, and the feed to the resonant circuit C2/L2/C3 is via L1. The value of L1 must be at least ten times that of L2, and the value of C3 at least twice that of C2. If there was no switch, C3 would simply charge via L1 and C2 via L1 and L2. The switching device (gate-controlled switch GCS) is used to discharge C2 (and C3 via L2) periodically, thus initiating oscillation in the resonant circuit. D1 clamps the junction of C2/L2 at 0V. The amplitude of the oscillatory waveform produced depends on the on time of the GCS, thus providing regulation: the longer the GCS is on, the higher the peak currents produced.

For TV receiver use a series-resonant power supply would probably take the form shown in Fig. 2(b). Here L1 and L2 have been integrated into a transformer that provides mains isolation – L1 is the primary winding and L2 the transformer's leakage inductance. If the value of C3 is multiplied by the square of the transformer's turns ratio, it can be connected across the secondary winding. The latter feeds a simple rectifier circuit (D2/C4) to provide the regulated h.t. output.

With the growing interest in reduced power consumption, we may well encounter this type of power supply in the not too distant future.

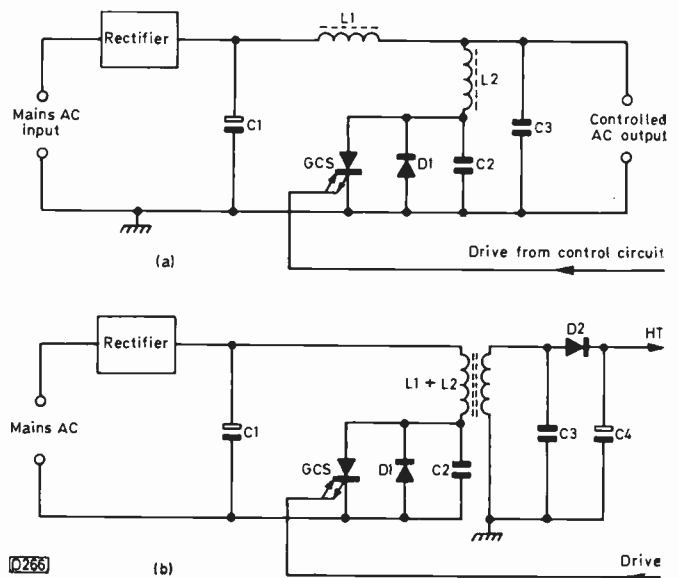


Fig. 2: The series-resonant regulated power supply. (a) Basic elements used in the circuit. (b) Type of circuit that would probably be used in a TV receiver.

# New DX Receiver System

Roger Bunney

IN the past, UK DX-TV enthusiasts have tended to use dual-standard (405/625-line) receivers. Personally, I've been using sets of this type (the Bush TV125 series) for the past ten years. The great advantage is the ability to switch easily between narrow (405-line) and wide (625-line) i.f. bandwidths – once you've modified the 405-line detector circuit to give a negative-going output. With a very weak signal, reducing the i.f. bandwidth pays dividends in terms of increased gain and reduced noise, while during Sporadic E openings the greater degree of selectivity obtained by reducing the bandwidth is useful when trying to resolve signals on adjacent channels, for example channels E2 (48.25MHz vision) and R1 (49.75MHz vision).

My Bush TV125 sets proved to be excellent for the purpose, once the problem of line drift had been overcome by means of some modifications. The days of dual-standard sets with their fully valved or hybrid chassis are fast coming to an end however. Their design is now dated, there are problems with spares, and in particular the cost of replacement valves is becoming prohibitive. There's also the unnecessarily high mains consumption – some 160W in the case of the TV125.

## Set Selection

When it came to considering what to use as replacement, I made the decision to buy British. The Thorn 1690/1691 monochrome portable chassis was selected since its four discrete transistor i.f. stages provide high gain with good selectivity, its sync circuits are stable and efficient, and it's competitively priced. Sets using this chassis still seem to be widely available, though the later 1696/1697 chassis (with a SAWF/i.c. i.f. strip) has now gone into production. The lack of a line hold control in the 1690 series chassis was at first thought to be a possible disadvantage, but the locking efficiency of the chassis with both tropospheric and SpE signals has been found to be excellent. I've bought four of these sets – one will eventually be modified for system L (French) reception and another for system M (N. America).

## Front-end Unit

The problem is that these – and any other new sets you may decide to purchase – are single-standard receivers with

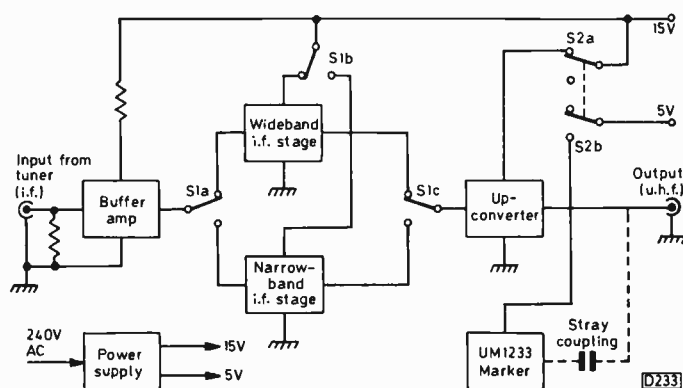


Fig. 1: Block diagram of the front-end unit.

a single i.f. bandwidth (for the UK system I). How then to get narrow-band operation, with the advantages for DX use outlined above? The course I adopted was to use a switchable wide/narrow bandwidth i.f. preamplifier arrangement – see Fig. 1. The input, at i.f., comes from the varicap tuning system. It's fed via a buffer amplifier to single-transistor wide- or narrow-band i.f. stages, the output being applied to an upconverter to give a u.h.f. output suitable for feeding to the aerial input socket of a standard 625-line receiver. A marker oscillator gives a "blip" at u.h.f. to ensure that the receiver itself remains on-channel and thus the tuner's calibrations remain constant. The result is a unit which can be used with any system I receiver and, since it's an external item, calls for no modification to the set itself.

## Circuit

I've made three units using the circuit shown in Fig. 2 – all in separate diecast boxes. The input, at i.f. with 36MHz centre frequency, is fed to a medium-gain preamplifier/buffer stage using a BFY90 transistor. This stage is included to act as a buffer between the tuner's i.f. output and the upconverter, and to make good losses introduced by the switching etc. The amplified signal is then switched to either of two parallel i.f. amplifier stages using BF196 transistors. One stage is heavily damped, providing a system I wideband i.f. response; the other stage uses higher-value damping resistors (4.7k $\Omega$ ) and an additional bandwidth limiting transformer (T5) to achieve a bandpass response of approximately 3MHz. Both stages are identical with respect to biasing etc.

S1c selects the required output for feeding to the upconverter. I was fortunate in having several Teleng upconverter units available: these were cut down to provide the basic board (less the power supply). The Teleng unit has reasonably good gain and a relatively low noise performance. Filtering adjacent to the unit's input socket was removed to ensure that the i.f. input wasn't simply filtered out! The oscillator on the upconverter board was adjusted to provide an output at the oscillator frequency minus the i.f. at around channel 28-30 – experience with the first board tackled showed that an output at the oscillator frequency plus the i.f. gave reduced output with some unusual patterning. This happened with all three of the upconverters. The blip previously mentioned is provided by the Aztec UM1233 u.h.f. modulator.

The rest of the circuitry is shown in Fig. 3.

## Construction and Alignment

The buffer amplifier is mounted on a small piece of copper laminate immediately adjacent to the input socket. The output from this is taken to the wideband/narrow band selector switch via screened feeder. The two i.f. circuits are built on a larger piece of laminate. Construction is simple, though care should be taken to minimise the overall dimensions. The output from the i.f. section is fed to the upconverter board and then to the output socket.

The readily available Aztec u.h.f. modulator unit

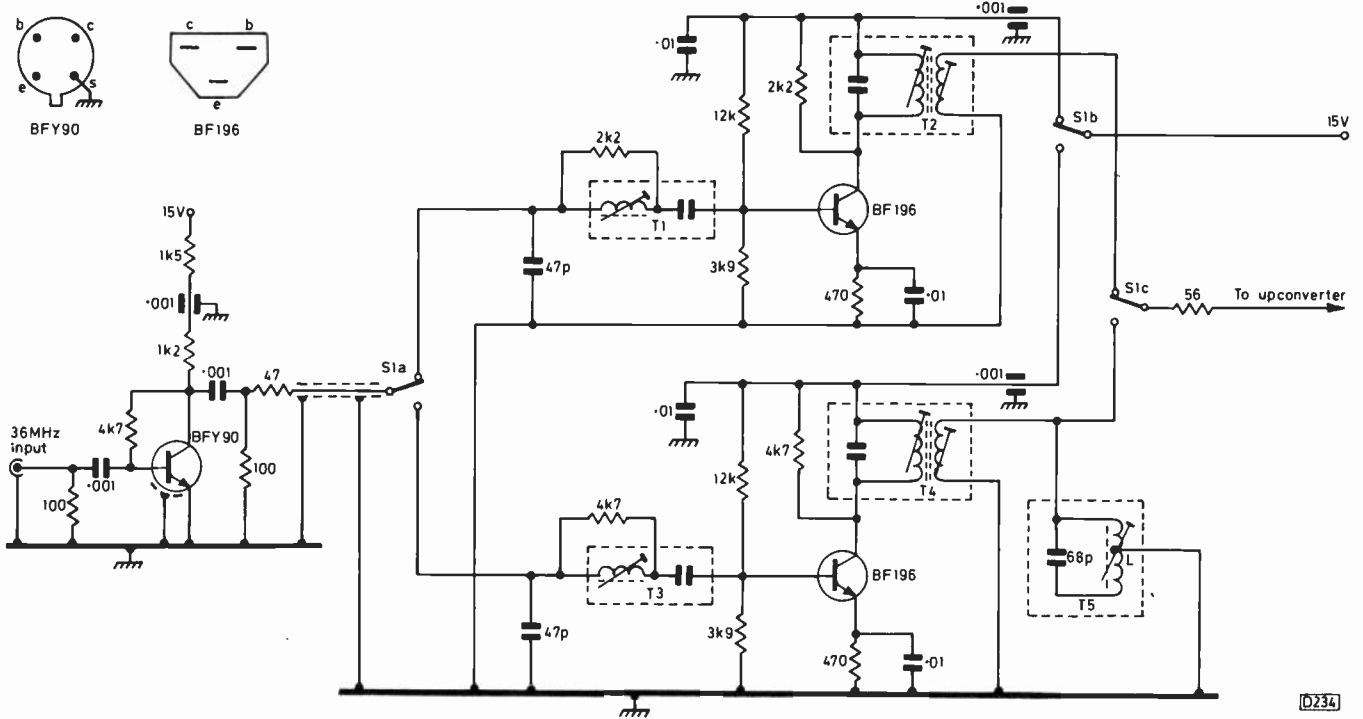


Fig. 2: Circuit of the buffer and i.f. stages. Switch S1 (4-pole 2-way) RS type 316-995. T1/3 i.f. input bandpass transformers, Thorn part no. 06D0-218-001. T2/4 i.f. output bandpass transformers, Thorn part no. 06D0-219-001. T5 i.f. bandpass peaking, Bush TV125 sound rejector (2L1) – seven turns on  $\frac{3}{8}$ in. coil former spaced over 1 in. and tapped at two turns.

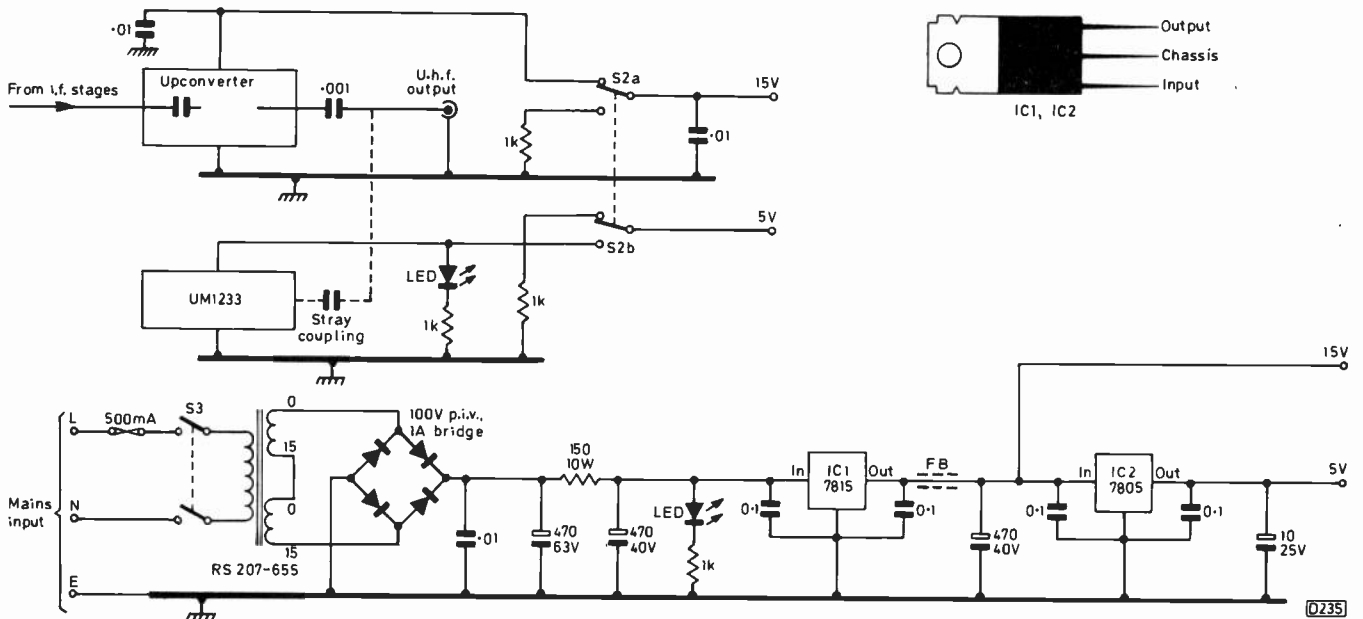


Fig. 3: Power supplies and marker/upconverter arrangement. The Aztec UM1233 modulator unit is available from Ambit.

provides a simple marker. The device is usually supplied adjustable over channels 36/7, but can easily be modified for a lower frequency. Remove the underside cover, revealing the soldered chassis board, and solder a miniature trimmer capacitor (2-10pF, RS type number 125-648) across the connections to the single turn wire coil (these can be determined by examining the upper side of the chassis). The modulator should then be mounted adjacent to the upconverter/output socket – there should be sufficient stray coupling to provide a reasonable signal level at the output socket.

The power supply arrangements are quite conventional, but care should be taken to ensure good decoupling to chassis from the input/output pins of the stabilizer i.c.s.

Alignment is quite simple. Inject a 36MHz sinewave or

squarewave signal at the i.f. input socket. If all is well there should be an upconverted signal in the channel 26-30 region. If there isn't, remove the signal input and tune the main TV receiver over the lower half of the coverage – say from channel 21 to 40. At some point the noise will increase, this noise being contributed by the i.f. strip. Adjust the oscillator control in the upconverter (different units use different arrangements – there may simply be twisted wires) to move the noise to the channel 28-30 region.

Reconnect the 36MHz input signal, at a higher level. Modulation should now be seen. Switch the signal to the narrow-band i.f. stage and peak all four cores, lowering the output from the signal generator to compensate for the rising gain as the stage comes into alignment. Once the narrow-band stage has been aligned, switch to the wideband

stage and adjust the three cores similarly – the peaking will be less definite this time. Switch the calibrator on – in my version this switches the upconverter off – and adjust the trimmer in the u.h.f. modulator to centre the blip at the receiver setting.

Alignment is now complete. If two noise displays are noted initially, it's important that the lower one is selected. With the unit switched to the wideband position the full 6MHz system I channel bandwidth should be resolved: in the narrow-band position a 3MHz bandwidth should, assuming careful alignment, be achieved – this can be confirmed on test card F, when the 2.5MHz frequency response gratings should be displayed but the 3.5MHz gratings should not be resolved.

### General Notes

Instability can arise if a very short feeder connection is used: I found that some 6ft of feeder was advisable between the unit and the main receiver to damp down any possibility

of u.h.f. instability.

The high gain means that attenuation may be necessary at the input – there's no a.g.c. I found a Wolsey 0-20dB VA20 potentiometer attenuator useful, since an accurate setting that prevents overloading can be established. A value of between 18-21dB was required with the three units I've constructed. A pin-diode attenuator system to improve the performance is planned – this will remove the need for the VA20s.

The i.f. transformers used are of Thorn origin and should be available through Thorn dealers. Ambit also have a selection of miniature i.f. transformers and, more important, the trimming tool for miniature hexagonal dust cores!

The use of these units has proved that superior DX performance can be achieved with a completely unmodified domestic TV set. The cost is low and the parts required are readily available. The performance I've achieved with these units is as good as with the old TV125s, while operation is much more efficient. A further article will describe the new varicap tuning system I'm now using. ■

# The Miller-transitron Circuit

Keith Cummins

The ingenious Miller-transitron timebase circuit has been mentioned in several Vintage TV articles in recent months. Its operation is not always clearly understood, so it seems an idea to look at it in a little more detail.

The basic circuit is shown in Fig. 1. The Miller bit consists of capacitor C1 which is connected between the anode and the control grid of the pentode valve V1. The valve's control grid is returned to the h.t. line via R1 and RV1, whose combined value is far greater than that of the load resistor R2. Let us start by assuming that C1 is fully charged, i.e. its right-hand plate is at the h.t. potential and its left-hand plate carries a negative charge. At this point, i.e. at the beginning of the linear scan portion of the output waveform, C2 is also charged – this means that the screen grid voltage is high, while the suppressor grid is at 0V, being connected to chassis via R4.

Since the left-hand plate of C1 is connected to the h.t. line, it will begin to discharge via R1 and RV1. The valve turns on, and its anode voltage falls. The stage now operates as an integrator – the basic configuration is shown in Fig. 2. R1/RV1 and C1 form an integrating network, with the amplifying device increasing the effective capacitance of C1. The valve's control grid is maintained at a slightly negative potential, and a linear negative-going voltage waveform is produced at the anode.

If nothing more were done, the anode voltage would sink to a permanently low level with the valve saturated. This is where the transitron bit comes in: it provides a means of recharging C1 and thus repeating the cycle.

As the pentode's anode voltage falls, more current is diverted via the screen grid. Thus the screen grid voltage also falls. Finally, saturation occurs: the anode voltage falls to a critical point where it can drop no further since no further anode current can flow.

Now comes the clever bit. As the anode voltage is no longer falling, there's no feedback to the control grid which becomes slightly positive. The resultant increased cathode current flows via R3, producing a sudden drop in the screen grid voltage. This change is conveyed via C2 to the suppressor grid. As a result, a negative-going pulse is

applied to the suppressor grid, cutting off the anode current. The valve's anode voltage then rises sharply, and C1 recharges – via R2 and valve grid current.

Meanwhile C2 discharges via R4, and as the suppressor grid voltage moves positively a point is finally reached when anode current again begins to flow. There is a cumulative effect here, since the screen grid current falls and its voltage rises, driving the suppressor grid positively to restore the initial conditions. We are now back where we started, and the cycle repeats.

The Miller-transitron circuit was very popular in the early post-war years. It provides a large voltage swing which can be used to drive an electrostatically deflected tube directly. Those of us who built TV sets using the good old VCR97 tube (green picture the size of a postcard) or the VCR517 (blueish picture, more acceptable) almost invariably employed Miller-transitron circuits with the SP61 valve – it cost about two shillings, ex-government.

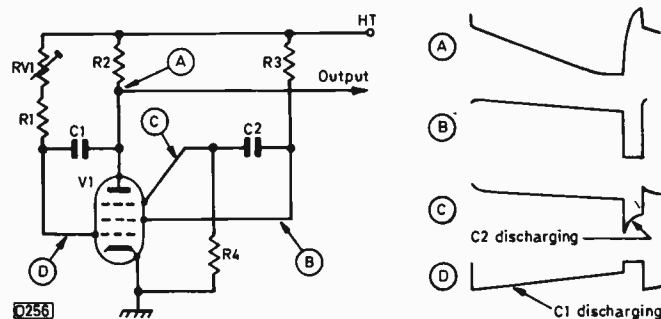


Fig. 1: The Miller-transitron – circuit and waveforms.

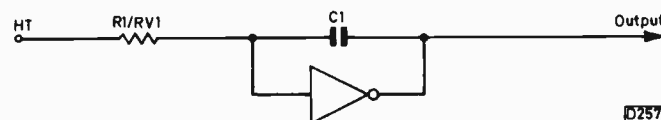


Fig. 2: Integrator action of the circuit. Since C1 provides negative feedback, a linear output is obtained.



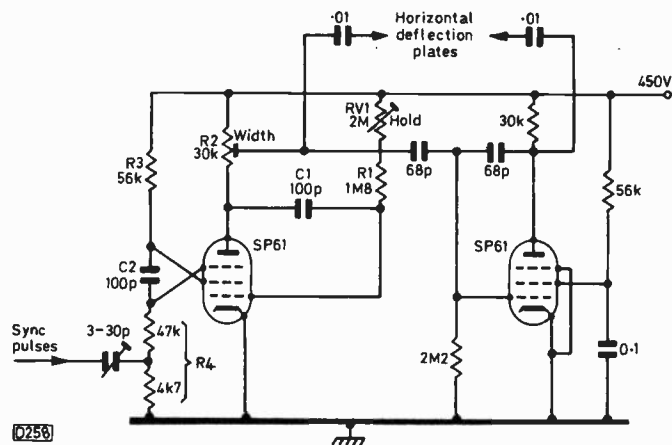


Fig. 3: Practical Miller-transitron line timebase circuit for use with an electrostatically deflected c.r.t.

To avoid trapezium distortion, two valves were generally used, one as the Miller-transitron stage itself and the other as an inverter (see Fig. 3). This gave push-pull deflection drive. Sync pulses, negative-going of course, were usually applied to the suppressor grid of the Miller-transitron valve to initiate the flyback. The time-constant of the forward scan is determined by RV1 (the hold control), R1 and C1. The flyback time is determined mainly by the values of C2 and R4 – it's also a function of R2, C1.

The sawtooth output obtained at the anode of the Miller-transitron valve is not perfect: a small step occurs at the beginning of the ramp, due to the valve moving out of grid-current operation into the linear Miller mode of operation. This didn't worry TV users since it fell in the back porch area of the line scan or during blank lines of the field. It is more troublesome if the circuit is being used as an oscilloscope timebase (many people made their own scopes in those early days).

There's sometimes a very slight cramping at the end of the scan, as the valve moves into saturation immediately before the flyback. If the sync pulse triggers the timebase before this point is reached however the scan will not be cramped. The waveforms shown in Fig. 1 illustrate the basic action, unsynchronised.

Fig. 3 shows a practical line timebase circuit suitable for driving an electrostatic tube: I'm somewhat shattered to realize that I used it thirty years ago!

Why did the popularity of the Miller-transitron wane? For one thing, its output consists of a negative-going sawtooth. This is in the wrong sense to drive an output stage, though the circuit can be fiddled to get a positive-going output from the cathode. Also a linear sweep generator circuit is of less importance with magnetic deflection, since the line output valve acts as a switch, while correction is required anyway in the field output stage to compensate for the distortion introduced by the output transformer.

The Miller-transitron (or perhaps more correctly the Transitron-Miller Integrator) is nevertheless an aesthetically pleasing design. It's economical in the use of components, and provides a substantial voltage swing. SP61 valves would run quite happily from a 450V h.t. supply, and a pair would provide a swing of nearly 800V.

I have a certain nostalgia for the SP61. My first home-built TV set used thirty of them! They were cheap and would do nearly everything. Those were adventurous days: I was young, enthusiastic and mostly broke. Aerials fell down and things blew up. I learnt a lot, but that's another story!

next month in

# TELEVISION

## ● TV SOUND ADAPTOR

TV sets generally provide rather poor sound reproduction, since the constraints of the cabinet don't allow the use of a good quality speaker/enclosure system. The broadcasters on the other hand take great care to transmit the highest quality sound. One approach to the problem is to use a separate unit which is fed with a standard aerial signal and delivers an audio output suitable for feeding to the "auxiliary" input of a hi-fi system. The results that can be obtained are truly impressive, especially with musical programmes, though even the speech in an ordinary programme is given a new realism. Our TV sound adaptor project is simple and inexpensive to construct, the alignment being kept to an absolute minimum. The unit consists of a tuner and an i.f. strip, plus a mains power supply to make it completely independent of the TV set itself. Push-button tuning is used for ease of operation.

## ● FAULT REPORT

Mick Dutton contributes the next edition of this popular feature.

## ● VINTAGE TV

Our vintage spot next month describes the Cossor 930 series, dating from the early 50s.

## ● VIDEO CAMERAS

A look at what video cameras can do, the usual features provided, ease of operation (or otherwise) and their compatibility with various types of VCR.

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# VCR Servicing

## Part 6

Mike Phelan

THIS month we'll deal with playback of the chrominance signal – as previously mentioned, this uses most of the same circuitry as with the machine in the record mode, but with a few extra bits. Following this reassuring comment, take a look at Fig. 31. When you've recovered from noting the two burst gates, two crystal oscillators and other items, read on.

You'll recall that we need to generate a 5.06MHz carrier to mix with the off tape 626.9kHz chroma signal in order to convert it back to 4.43MHz. Once this has been done it can be added to the processed luminance signal and the composite signal can then be sent to the u.h.f. modulator and the video output socket. The 5.06MHz carrier must this time be locked to the off-tape line sync pulses.

Although the signal input to, and the output from, the mixer in IC202 now come from and go to different parts of the circuitry, no switching is necessary – as the input and output frequencies are reversed (compared to the record mode), filters can be used to carry out the required signal routing. The 4.43MHz output is passed by BPF202 to emitter-follower X204. From here it goes to burst gate X205 and to the circuit consisting of X206/7, DL202 and the associated components. If this latter part of the circuit looks familiar, you are quite right – it's just like the delay line circuit used in a PAL decoder, complete with phase and amplitude controls (L205 and R238). In this case however the delay line provides a delay of approximately 128µsec

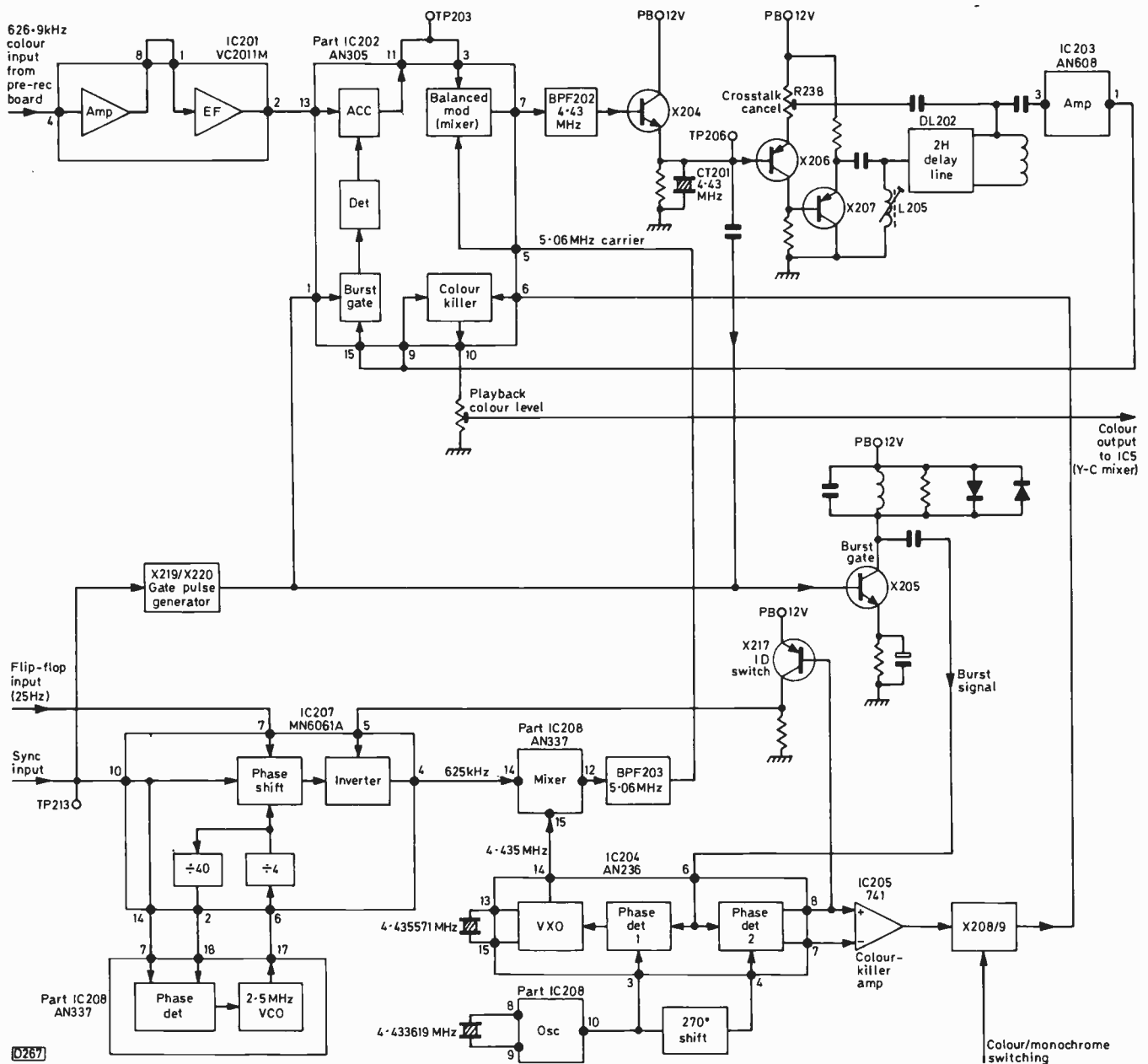


Fig. 31: Block diagram of the chroma playback system. Note: the type number of IC207 was shown incorrectly in Fig. 29 last month.

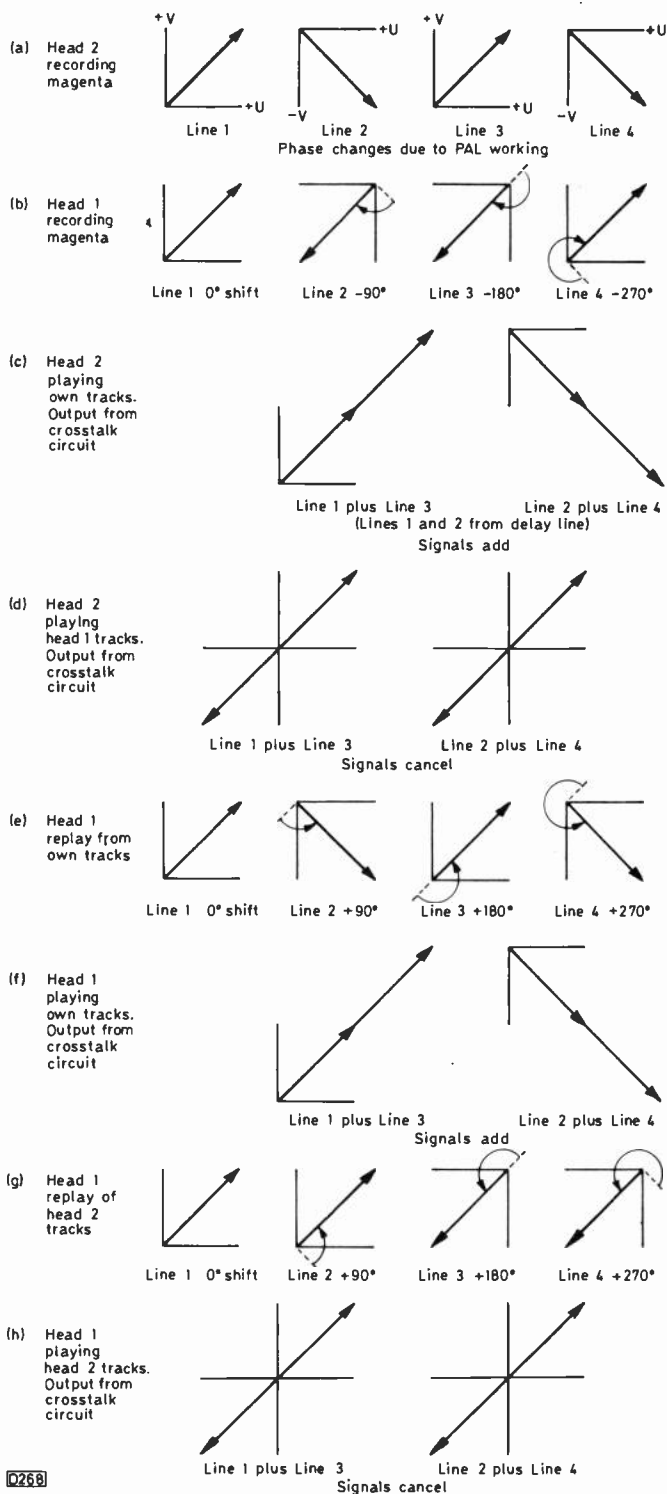


Fig. 32: Chroma crosstalk cancellation.

(2H). We mentioned last month that it's necessary to have an arrangement to eliminate chroma crosstalk between adjacent tracks (recorded by heads 1 and 2). To this end, the chroma signal fed to head 1 when recording is phase shifted by  $-90^\circ$  line by line (see Fig. 30). On playback a  $+90^\circ$  phase shift takes place. The effect of this is shown in Fig. 32: this is a case of one picture speaking volumes – by studying the vectors carefully you'll see that the delay line circuit cancels out all crosstalk.

From the delay line circuit the chroma signal passes via IC203 to pins 9 and 15 of IC202. The burst gate behind pin 15 is opened by delayed line sync pulses and feeds a detector which provides an output for automatic chrominance control – the chroma signal must be kept at a

constant level. The other input goes to the colour killer. We'll see later where the killer operating potential comes from. The processed chroma signal comes out at pin 10, and is passed via a level adjustment to the Y-C mixer stage in IC205.

This leaves us with the business of sorting out the generation of the 5.06MHz carrier. As on record, most of this process takes place in IC207 and IC208. The carrier is locked to the off-tape line sync pulses, taking care of tape stretch, speed variations etc. This is an a.f.c. loop, using the phase detector and voltage controlled oscillator in IC208 to produce a 625kHz output at pin 4 of IC207 (with the required head 1 phase shift). On playback however we need more accurate control of the carrier's phase in order to be able to compensate for short-term variations in speed etc. To achieve this, we phase control the 4.435571MHz crystal oscillator which was free running on record.

The reference used is a free-running 4.433619MHz crystal oscillator in IC208. The output from this, at pin 10, feeds one of the inputs of phase detector 1 in IC204 (at pin 3). We need a comparison signal at this frequency therefore, so X205 gates out the burst from the up-converted off-tape chroma signal and feeds this to IC204 at pin 6. The output from phase detector 1 in IC204 controls the 4.435571MHz variable crystal oscillator (VXO).

Phase detector 2 in IC204 does two things. The inputs are the same as those to phase detector 1 except that the one from the 4.433619MHz oscillator is phase shifted by  $270^\circ$ . This means that when everything is working correctly its output will be high (instead of zero). This voltage, via IC205 and X208/9, opens the colour killer in IC202. This operation can also be manually controlled by means of a switch at the back of the machine.

Due to the type of phase detector used (it compares a pulse with a triangular waveform), if the phase error is greater than  $180^\circ$  it's possible for the circuit to lock to this error. If this happens, the output from phase detector 2 in IC204 falls to zero. This switches transistor X217 on, the voltage at pin 5 of IC207 rising. As a result, an inverter in IC207 shifts the 625kHz signal by  $180^\circ$ , correcting the error and turning X217 off again. The output from pin 8 of IC204 that produces this action is known as the ID pulse.

The way in which tape speed variations are prevented

## NEW VIDEO EQUIPMENT

Sanyo have introduced a new VCR, Model VTC5300P, intended for the lower middle price range of the market. It's similar to the well established VTC9300P but includes a seven-day timer and logic control. An infra-red remote control system has been introduced as an optional extra for the Toshiba four-head Model V8600B. The infra-red receiver unit plugs into the recorder's remote control socket: the transmitter unit has comprehensive control facilities, the still frame button also providing pause when recording.

Hitachi have introduced a new colour video camera, Model VKC600, with an attractive specification for the expected selling price of around £525. The 6:1 lens has manual and power zoom control, with a macro facility that enables shots to be made as close as 1cm. The automatic exposure control operates over a light intensity range of 75-100,000 lux. In addition, a wide colour temperature control band gives colour matching under different lighting conditions. The weight is 1.9kg and the camera incorporates an electronic viewfinder.

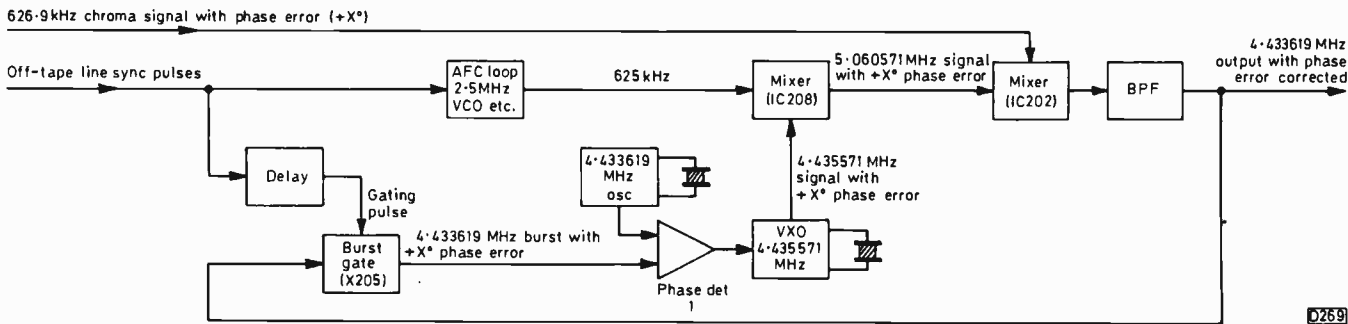


Fig. 33: How the a.p.c. loop cancels chroma phase shifts.

from affecting the phase of the chroma signal is shown in Fig. 33. Let's assume that the off-tape chroma signal has a phase error of  $+X^\circ$  due to a change in the tape speed. This error will be present at the output from the burst gate transistor X205, and will thus be applied to phase detector 1. This will apply a corresponding correction voltage to the 4.435571MHz variable crystal oscillator, whose output will also contain this error – and so on up to the 5.060571MHz input to the mixer in IC202. We thus have at this mixer two

inputs with the same phase error, and by subtractive action the error is cancelled. This may seem rather contradictory, since its output (and hence the input to the burst gate) is shown as being error corrected. The point is however that the error correction is continuous and rapid following an initial phase change, so that the output is to all intents and purposes of constant phase.

Next month we'll be looking at some typical simple VCR faults (sighs of relief!).

# The Summer of '39

Chas E. Miller

LET'S take a trip back to the summer of 1939, just a few weeks before the outbreak of World War II. Imagine that you're a service engineer of the day. Your workshop wouldn't be so very different from many today, though the pinups would certainly be less explicit! The equipment you'd have would probably include an Avometer, a signal generator, an RC bridge and possibly a wobulator and an oscilloscope, all of which had been available for several years. Since you're a go-ahead technician, anxious to keep abreast of the latest developments, you've taken out a subscription to *The Service Man's Manual*, described as "a quarterly publication for Service Men, containing Technical and Practical Data required for the repair of widely used Commercial Radio Receivers." It was published by the proprietors of *Radio and Electrical Marketing*, a leading trade journal. Pricy perhaps at 5/- a year post paid, but the Manual strikes you as being money well spent.

## The New Sets

The new high-definition television service from Alexandra Palace has been in operation for nearly three years, so one of the first things you look for in the July issue of the Manual is details of new TV receivers. And you're not disappointed: there are three, from Ekco, Marconiphone and Pye. Mind you to find them you have to search through some thirty pages of new radio receivers, but most of these are also of technical interest and worth looking at. All but three of the eleven radio sets described have push-buttons for example, usually for station selection but in one instance (the Pilot T63) for tone control and waveband selection. In the Ultra set they perform the latter function only. The Pilot receiver costs a lot more than the Ultra (12½ guineas against 8½), but it has twice as many push-buttons and they are of the imposing "organ-key" type. If you've a customer who needs a really cheap set, there's the Pilot "Little Maestro", an a.c./d.c. model costing 5 guineas. This is little more than

the cost of the valves used if bought separately. How on earth do they do it?

At the other extreme is the RGD Model 722, a magnificent table model covering the long, medium and short wavebands with full motor tuning and an r.f. amplifier. Both the r.f. and i.f. bandwidths can be adjusted to give a broad frequency response if required. The price of this beauty is all of 22 guineas, which coincidentally is also the price of the Ekco TA201 add-on vision unit. This has eighteen valves and provides a 6¼ × 5in. picture. The audio signal is available, at two levels, for feeding to the pickup sockets of an ordinary radio receiver, thus saving the cost of an audio output stage and loudspeaker. You'd like to study the circuit of this inexpensive televisor, but Ekco alone restrict such information to the chosen few. Even the lordly HMV company allows the Manual to print its circuits, but not Ekco.

Which brings you to the other half of the EMI set up, Marconiphone. Here is their version of the HMV combined television and radio receiver, Model 707, with 16 valves, a 7in. tube and a price tag of £36-15-0d. It costs half as much again as the Ekco add-on vision unit, but has all the quality of construction and cabinet work associated with EMI. And it has a superhet vision and sound section, which is more than most of the receivers of the time. Maybe this is why its performance matches that of the Ekco set, despite the two extra valves in the latter. A certain amount of comparison between the two sets is possible, since in the absence of a circuit diagram a particularly detailed description of the Ekco set is given.

## Ekco Model TA201

One plus point for the Ekco set is its use of the latest Mazda valves, many of them with the new Mazda Octal base (different from the International Octal base adopted by EMI, GEC and others for their valves). The vision channel

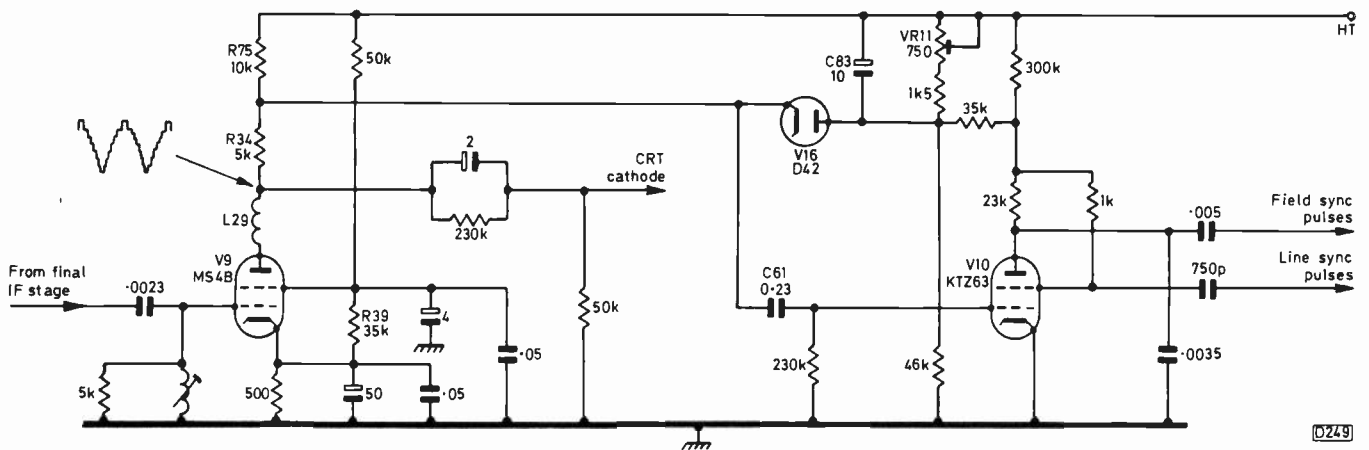


Fig. 1: The video and sync circuitry used in the Marconiphone Model 707. V9 is an anode bend detector, R39 providing a stable bias.

consists of three SP41 r.f. pentodes followed by one of those amazingly small (not much larger than a good sized dial bulb) D1 diodes as the detector. The completely independent sound section consists of two r.f. amplifier stages, the first using a VP41 variable-mu pentode (for the application of a.v.c.). This is followed by an HL41DD with two diodes and a triode – one diode for detection/a.v.c. and the second not used, with the triode used as an a.f. amplifier if required. The idea is that the sound can be taken from either the detector diode or from the anode of the triode, giving two levels suitable for use with radio receivers having either low or high sensitivity pickup sockets.

A fair amount of thought appears to have been given to the sync circuitry, which uses two more D1 diodes and an SP42 amplifier. T41 thyatrons (gas-filled triodes) are used in the line and field oscillator stages. The Pen45 field output valve is RC coupled to the scan coils while the AC6Pen line output valve is transformer coupled. The text reminds you that high voltages are present at the anode of the line output valve when it's working, so that voltage measurements should not be made unless the line oscillator valve is first removed. One is also cautioned about the e.h.t., which has the high value of 3.5kV. It's recommended that the rectifier is removed and the c.r.t.'s anode lead isolated when service work is being carried out and it's not necessary to observe the picture at the same time. In addition, you are asked to be careful of even the ordinary h.t. when the chassis is out of the cabinet. There are three subchassis, arranged around a rectangular frame which can be turned to give easy access

to the unit under investigation. But since the power pack uses wet electrolytics, it mustn't be switched on unless in its normal upright position.

### Marconiphone 707

This problem doesn't arise with the Marconi 707, since all the works are on a single horizontal chassis which can be withdrawn from the cabinet after removing only four screws. It's a beautifully designed set, as you would expect from EMI who after all developed the 405-line system. When you look at the circuit, you see that the first three valves (r.f. amplifier, frequency changer and i.f. amplifier) are common to the television and radio sections of the receiver. The Marconi valves are old-fashioned ones (MSP4/X41C/KTZ41 respectively) with British 7-pin bases, but they must have been extraordinarily well designed since they are now having to work on the ultra short wave television frequencies in addition to the broadcast bands for which they were originally intended.

The set in fact is an interesting amalgam of radio and television techniques. When used for radio reception, the sound from the first i.f. amplifier is taken to the MHD4 double-diode-triode valve (audio detection, amplification and a.v.c.). When used for television, the 4.5MHz sound signal passes through two i.f. amplifier stages before being passed to the MHD4. The vision signal passes through a third stage of i.f. amplification and is then fed to a straight r.f. tetrode – another oldie, the venerable MS4B – which is used as an anode-bend detector, providing sufficient output to drive the cathode of the c.r.t. (see Fig. 1).

The circuitry shown here – video and sync – is certainly rather different from anything seen in the post-war period. First, the anode-bend detector. If a valve is operated close to the cut-off point along its grid voltage/anode current characteristic it will, as shown in Fig. 2, rectify the input. The anode-bend detector is not very efficient, but has the advantage of providing amplification. So one valve does two jobs. The following bit of circuit, the sync separator, also does things in a way not seen since. Diode V16 is conductive during the video part of the waveform, since the negative-going video keeps its cathode negative with respect to its anode (where the sync preset VR11 is to be found). Under these conditions, C83 decouples the 10kΩ section (R75) of the video stage's anode load, and there's no input to V10. When the positive-going sync pulse arrives, V16 cuts off. R75 now becomes part of V9's anode load, and the pulse developed at the junction of R34/R75 is coupled by C61 to the control grid of V10, which provides a pulse clipper action to give constant-amplitude output pulses. The

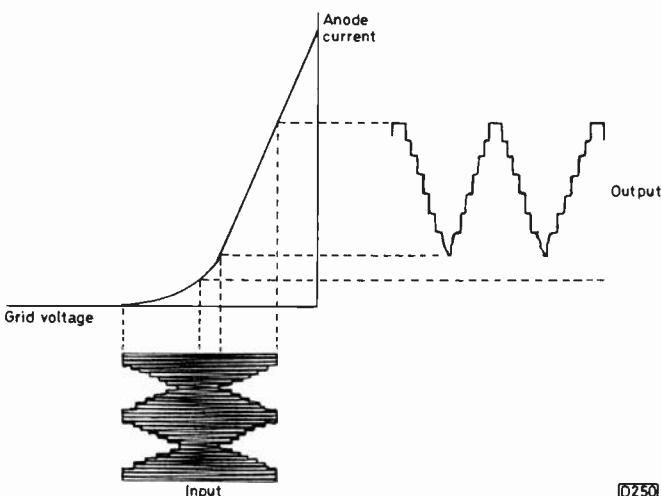


Fig. 2: Operation of an anode-bend detector. The advantage is the signal amplification obtained.

line sync pulses are taken from the screen grid while the field sync pulses are taken from the anode.

This time we have blocking oscillators in the line and field generator stages. The field output tetrode is *RC* coupled to the high-impedance scan coils; the line output valve being transformer coupled. A KT63 is used in both output stages, but in the field output stage it's operated as a triode (anode and screen grid strapped together) to reduce the internal impedance and thus give closer matching.

There are two mains transformers, one for the e.h.t. supply and the other for the h.t. and heater supplies. The e.h.t. transformer has a 1,800V a.c. winding to get the 2.75kV required for the Emiscope 3/2 tube. The h.t. supply is interesting since there's a single line for both radio and television operation. To prevent the voltage from rising unduly when the set is used for radio reception, the value of the reservoir capacitance is reduced from 16 $\mu$ F to 1 $\mu$ F. The 16 $\mu$ F capacitor is kept polarised on radio operation by feeding a little h.t. to it via a 15k $\Omega$  resistor.

This example of careful design is matched by the provision made for obtaining optimum focus from tubes with slightly different characteristics. The focus coil is not connected in series with the h.t. supply, as is normally the case, but across it to chassis. In addition to the variable series resistor (focus control) there's a network of three fixed resistors which can be brought into circuit by a device similar to the mains-voltage tapping panel on the mains transformer which, by the way, is protected by a heat-operated overload cut-out.

All in all then the Marconiphone 707 promises to be a popular and reliable set. Since there are not all that many hours of TV a week, it will serve as a sort of home entertainment centre. What about the Pye set? You skip through the next few pages of the Manual to investigate, noticing en route that Bush have introduced a push-button model for radio listeners who have no mains supplies. It uses two (2V and 144V) batteries and costs 9½ guineas (complete with batteries). The reasonably large (8in.) speaker means that the sound will be almost up to "mains" standards. The pity of it is that battery-operated TV doesn't seem to be a possibility in the foreseeable future (or d.c. operation for that matter).

### Pye 815

The Pye televisior uses 18 valves, gives a 7½ × 6in. picture, is housed in a compact table cabinet and costs just 30gns – roughly half way in price between the Ekco and the Marconiphone sets. A look at the valve line up reveals some surprises straight away. There are no fewer than ten Mullard EF6 r.f. pentodes, seven of which are used in the vision and sound r.f. amplifier strips (this is a t.r.f. set, like the Ekco one), two for sync separation (one for line sync and the other for field sync), and the remaining one as the line blocking oscillator. There's a brand new triode-hexode

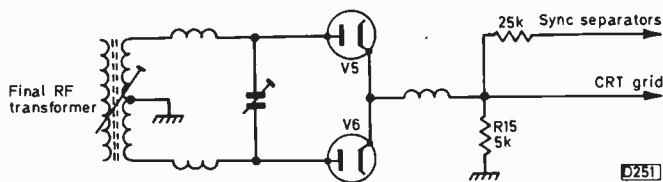


Fig. 3: The full-wave video detector circuit used in the Pye Model 815. Full-wave rectification simplifies the output filter and enables a higher value load resistor (R15) to be used. These factors increase the detection efficiency, though the design of the input circuit is more difficult. Even harmonics of the input are balanced out.

(Mullard 6153/T) doing duty as the field oscillator and output valve. The EF6s have the continental side-contact ("P") base, and since they would be rather difficult to remove in the cramped spaces of the vision and sound units the holders are provided with central holes through which a rod can be passed to ease out the valve.

The vision unit employs four stages of t.r.f. amplification, the first stage being common to the sound and vision signals. The gain is controlled by taking the suppressor grids of the first three valves to a potentiometer connected across a negative supply (a similar arrangement is used in the sound unit). The final stage in the vision unit consists of a full-wave demodulator (see Fig. 3) which uses two T6D single diode valves (another tiny all-glass type, equivalent to the Mazda D1 but with a 6.3V heater). The output from the demodulator drives the c.r.t. grid (no video-frequency amplification).

The two sync separators have independent cathode bias controls to adjust their operating points, the separated pulses being used to control blocking oscillator circuits in both timebases. The line output stage uses a transformer-coupled Mazda AC6Pen valve, the drive to the coils being fed via a special screened cable to reduce radiation at line frequency. The 6153/T used in the field timebase appears to be a modified version of the ECH3 frequency changer valve. The hexode section is connected as a tetrode to act as the output stage, and is transformer coupled to the coils.

The c.r.t. differs from those used in the Ekco and Marconiphone sets, being a Mullard type (MW22-1) with a "special hexode gun assembly". This is operated with 150V on the first anode. Advantages claimed for this type of gun assembly include that of a more uniform spot size during deflection, making the overall focusing better. The final anode is operated at 5kV, which is obtained from an overwinding on the mains transformer. Although the e.h.t. reservoir capacitor (0.25 $\mu$ F) is provided with a bleeder resistor which will discharge it once the set has been switched off, the high value (50M $\Omega$ ) of this resistor means that it's a lengthy process. The recommendation therefore is always to discharge the capacitor, using an insulated screwdriver, before any servicing work is carried out.

### Maybe a Trade-in?

So much then for the new models. It's clear that different designers have their own ideas about how to get a picture. How long will it be before you can afford a televisior of your own? It's galling to be able to view only during working hours, but maybe when some of the old '36 models start coming back in part exchange...

### Footnote on Prices

Direct conversion of prices to their metric equivalents is of little use when comparing the prices of 1939 and 1982. The main thing to bear in mind is wage rates. A first-class service engineer could expect to earn around £4 a week in 1939, while a full-blown service manager might earn £6. You get a more realistic picture if you relate the prices to the time taken to earn the money. Thus the Pilot "Little Maestro" sounds cheap at say £5.25, but would have cost you perhaps ten days' take-home pay. The cheapest television set, the 22 guinea Ekco model, cost over £4 more than the deposit on a three-bedroom semi – this may seem almost unbelievable to modern eyes, but I have before me as I write an advertisement for a housing estate in Welling, Kent, where the cheapest houses cost £435 freehold, or £20 down and 11/6d (58p) a week!

# Test Report: LOPT Testing

*Eugene Trundle*

IN the fifteen or more years I've been in the TV servicing trade, sets have changed out of all recognition. Circuits have become more sophisticated, valves have long since disappeared from new chassis, and in most cases nowadays the e.h.t. rectifier has disappeared into the line output transformer. One bugbear that's always been with us remains however – the difficulty of diagnosing a faulty line output transformer. If it smokes, catches alight or goes open circuit, no problem (with diagnosis, that is). But such cases are rare. Far more often internal shorts develop due to the high voltages and general stress to which the component is subjected. The result is short-circuit turns which, as with any transformer, place a heavy load on the primary. The damping effect thus introduced "loads down" the line output stage, causing excessive current consumption and usually little or no scan or e.h.t.

## Line Timebase Failure

This would not present us with too great a problem in reaching a diagnosis were it not for the fact that quite a number of other components can be responsible for the same symptoms: any faulty or leaky component in the line output stage can produce similar results. Incorrect line drive, i.e. wrong frequency or a low-amplitude or misshaped drive waveform, can do likewise. Hence the difficulty in being sure whether the line output transformer itself is the culprit when trouble of this type is encountered. When a transformer develops short-circuit turns one might reasonably expect it to overheat, thus betraying its malady. In practice the heat often develops elsewhere, maybe in the line output valve or transistor. With most modern sets there's a highly-strung power supply trip arrangement which pumps or ticks away, further obscuring the path towards a successful diagnosis.

## Conventional Checks

So much for the problems. How can we deal with the situation? The time-honoured method has been to remove or unload from the transformer suspect components one by one, checking each time to see whether the overload remains. Thus the tripler, scan coils, auxiliary rectifiers and so on are disconnected, and if the overload remains when all have been disconnected the line output transformer is condemned – rightly or wrongly! An alternative method that's been suggested in some places involves "ringing" the line output transformer with a pulse, examining the resultant waveform produced by the transformer with an oscilloscope. This is time consuming and can be misleading however. The subject of this test report is a little unit designed as an alternative solution to the problem.

## The Jabco Tester

The Jabco tester is a mains-powered device housed in a case measuring 10 × 7.5 × 4cm. It has no controls, merely a couple of LED indicators and twin flying leads fitted with crocodile clips. Inside there's a PCB containing a mains power pack, two chips and some peripheral components –

the device operates at 9V. The idea is that when a good LOPT is connected to the circuit oscillation begins, the resultant waveform being detected and fed to a bistable whose output illuminates a green LED. Anything other than the presence of a good LOPT winding will light up a red LED which doubles as a power-on indicator. Short-circuit turns will damp the primary winding on a faulty transformer so that oscillation at sufficient amplitude to light the green LED is prevented, thus giving a dud LOPT indication. The unit comes with a useful booklet giving data on testing most common transformers. I recommend fitting a low-rated fuse in the mains plug since there's no internal fuse – I used a 1A fuse with the tester I had for review.

## On the Bench

I started by testing all the good LOPTs in our stores. All gave a green indication and I was gratified to see the green change to red when I wound a single turn of plastic-covered wire around one limb of a transformer and shorted the ends together. Generally I found that using the primary winding gave the correct indication, though with certain low-impedance transformers such as those used in the Thorn 9000 chassis and some small-screen portables I had to connect two of the windings in series. Next I dug from the dustbin a LOPT from a Decca 100 series colour set. It had been condemned because of burning at the 8.5kV pulse output tag, but the tester gave me a green indication!

On I went to in-situ tests. Diverse types of hybrid sets, both monochrome and colour, checked out o.k. – usually with no more component disturbance than removing a valve e.h.t. rectifier if used so that its heater didn't provide damping. What about diode-split line output transformers? These have foil windings of very low impedance. I found a working Philips G11 and consulted the book. Complying with its instructions, I removed the tube heater fuse and plug 3E – and got a red indication! It was found necessary to disconnect one end of the primary winding (pin 13) to get a green indication.

There were two sets in the workshop with known faulty LOPTs during my testing session. The first was an ITT set fitted with the CVC20 chassis, and the tester confirmed the diagnosis by giving a red indication. The second candidate, a Philips G8, let me down. The tester gave a green indication even though the transformer was faulty, with slight discolouration of the overwinding – the diagnosis was subsequently proved when a new LOPT brought the set back to life.

The unit didn't lie to me on any other test, and many were made. I sometimes found it necessary to disconnect odd bits of circuitry, including the tube base where the c.r.t.'s heaters are powered from the LOPT: in most cases the instruction booklet gave the correct guidance.

## Conclusion

Rather as with an in-situ transistor tester, the unit is not infallible. This much will be obvious from the above account of the tests carried out. Curiously enough though, on the odd occasions when I got a false green indication the faulty

transformer was revealed anyway by careful examination, either when operating or cold. As with much test equipment then, it's important to appreciate the limitations of the gear one's using. If a careful examination of a suspect transformer is made first, few will slip through the net. Certainly the unit is worth its price tag of only £16.50,

which after all represents a fortnight's supply of cigarettes for some! It doesn't give a cast-iron, guaranteed correct indication, but is nevertheless a useful addition to the armoury. Available from J. Barker and Co., 1 Old Shoreham Road, Southwick, Sussex - phone Brighton 593315. ■

# Long-distance Television

*Roger Bunney*

RECEPTION conditions during November varied from excellent to depressing. The enhanced F2 layer propagation during October continued into November, giving morning-long signals from various TSS (Russian) transmitters, and then during the afternoon signals from Ghana, Zimbabwe and on several occasions N. America (ch. A2). F2 activity died down from about the 17th, and since then very few F2 signals have, at the time of writing this (November 30th), been received above 48MHz.

Improved tropospheric conditions during the 3rd-6th November provided many enthusiasts with an extensive variety of signals. On the 3rd, reception came from West and East Germany, Denmark etc. and along the south coast from central France. The signals on the 6th came from a mainly southerly direction, with French u.h.f. signals received as far north as Wigan, Lancs. There were several small SpE openings, which coupled with periods of F2 backscatter during good F2 conditions produced reception of "nearer" stations. The Leonids meteor shower duly arrived, as usual producing very strong signal "pings" - though no reports of TV signals above Band I have been received to date.

The more interesting reception during the month was as follows:

- 30/10/81 TSS ch. R1; Dubai E2. Both F2.  
31/10/81 An interesting day. The "usual" TSS F2 signals on ch. R1, with the MUF rising eventually to ch. R2 vision (59.25MHz). At 0920 two ch. E2 vision signals which by 0935 became very strong were noted. A suggestion is that one was Aramco TV (Dhahran), but a siting in Holland suggests that the announcer seen at 1000 GMT was Malaysian. At this time two other E2 signals were present. At 1024-1032, ch. A2 (525 lines, 55.25MHz) was received in Holland via F2 from the east - AFRTS Seoul? ZTV/GBC (Zimbabwe/Ghana) were also widely received during the 1300-1700 period, on ch. E2.  
1-4/11/81 TSS ch. R1 received daily during the morning, with Dubai daily from 1200 onwards. Hugh Cocks received N. American vision (ch. A2), with a second weaker signal, from 1200-1430, on programme.  
5-17/11/81 TSS R1 daily. Dubai E2 plus at times a second Arabic signal floating with it seen on the 7th, 8th, 12th, 13th, 14th and 15th. Ch.

A2 reported by Hugh Cocks on the 7th and 14th (seen here at 1520, at noise level).

18-30/11/81 TSS R1 on the 20th and 25th; GBC E2 on the 18th and 19th. Hugh Cocks reports an A2 signal at 1615 on the 18th - an auroral type signal, i.e. very rumbly.

There were also improved tropospheric conditions on the 21st-22nd. On the 10th, Hugh logged an interesting signal when the F2 conditions were good - a standard 0249 (Russian) test card, but with 525 lines (0930-0940). This could have been due to a switching error at the Ostankino TV centre, Moscow. TSS relay programme material to Cuba (which uses the 525-line system M), while Cuba uplink system M material to the Ghorizont craft (modified Tele Rebelde network) for relaying via its downlink to Sandinista TV (Managua, Nicaragua). One assumes then that the TSS output to Cuba via the Ghorizont craft is on the system M standard. UPITN (United Press/ITN) send major European news items via the Ghorizont craft at 1400 GMT - to whom, one wonders?

Meanwhile F2 reception has been lacking in Australia, with fewer openings this month, and the start to their SpE season has been slow. Anthony Mann (Perth) received ch. B1 sound and vision on November 10th, also a ch. E2 (with +10kHz offset) test pattern - not the PM5544.

As I type this the MUF is reaching 45-46MHz, with no sign of any low Band I vision signals. At 1600 however I logged North American amateurs (SSB) at 50MHz, which could suggest that there will be an improvement shortly. An interesting check was made on November 6th when I measured the signal strength of the F2 ch. R1 signals coming directly from the two-element aerial at 35ft - the average signal strength was 0.4-0.6mV!

My thanks to the following for adding to my own reception log here at Romsey, Hants, during November 1981: Anthony Mann (Perth, Australia); Hugh Cocks (E. Sussex); Cyril Willis (Ely); Arthur Milliken (Wigan); George North (Walton); Ryn Muntjewerff (Holland); Brian Renforth (Chippenham); John Tellick (Surbiton); and Petri Pöppönen (Finland).

## *Reception from Equatorial Guinea*

Michel Dubernat (Biganos, south of France) has been doing a bit of detective work. On March 1st, 1980 he received (as usual) ZTV Gwelo ch. E2 until close down at 2100 GMT, via TE (transequatorial skip). At this time a much weaker signal was evident, with Spanish sound, closing with an unknown anthem. On several subsequent occasions following the ZTV close down the unknown signal was present. Michel receives RTVE (Spain) ch. E4 as a regular signal, and subsequently heard the same anthem whilst watching the news. The news item covered a visit to Malabo, the capital of Equatorial Guinea, by King Juan-Carlos - the Spanish and Equatorial Guinean anthems were played on his arrival. The French paper *Le Monde* dated August 26th, 1980 carried a report of Spanish technicians restoring the Guinean radio/TV service following a change of government in August 1979. The power of the ch. E2 transmitter at Malabo is unknown, and it's unlisted, though



there's an entry in an old issue of the *World Radio and TV Handbook*. So if RTVE programming is received via TE/F2 on ch. E2 it's likely to be Malabo! Incidentally Michel received NTV (Nigeria) chs. E3/4 and also JOS v.h.f./f.m. radio on 88.6MHz via TE on October 16th at 2035-2300 GMT.

### News Items

**UK:** Various TV4 transmitters are now being run in and acceptance tested at main transmitter sites. For local information contact the IBA Engineering Information Service at Crawley Court, Winchester.

**Finland:** As reported last month, the Tampere ch. E2 transmitter has now closed down. Taivalkoski ch. E2 will cease operating on October 1st 1982. On the credit side, Ruka ch. E4 will come into operation during 1983.

**Arabian Gulf:** Bud Lloyd-Bennett (Dhahran) reports that discussions being held under the "Gulf Vision Project" are likely to result in all the Gulf transmitters moving to u.h.f. channels in order to overcome the co-channel interference problems being experienced due to the prevalent "ducting" conditions in the region. The expectation is that all stations will be operating at u.h.f. by 1983.

**Bahrain:** A bilingual (Arabic and English) TV service is at present in operation. A new transmitter (ch. E55) is due to come into operation later this year, carrying English language programmes. Ch. E4 will then be solely Arabic.

**AFRTS:** We've heard from the American Forces Radio/TV Service headquarters in Los Angeles that there is no system M AFRTS ch. A2 transmitter in operation in either Europe or the Middle East - this follows reception of a ch. A2 transmitter with AFRTS programmes (thought to be from Iraklion, Crete) last August.

**Denmark:** The police and postal authorities are seeking the source of "Channel 3", a 3W pirate transmitter operating in the town of Randers. Local residents are not being exactly helpful - apparently they enjoy the illicit fare as a variation from the single government-controlled channel.

**Zimbabwe:** ZTV hope to be broadcasting in colour (PAL) by the end of the year.

**Israel:** The pirate ship Odelia is still on-air off the coast, operating on ch. E58 on a daily basis with Hebrew commercials and mainly English programmes. The operator has approached the Israeli government suggesting that the station be legalised and half the profits paid to the state.

### New EBU Listings

**France:** Chambéry 100kW e.r.p. ch. E29, Champagnole 80kW e.r.p. ch. E58, Aurillac 500kW e.r.p. ch. E59. All carrying the TDF-1 service with horizontal polarisation.

**Italy:** Monte Faito 1,250kW e.r.p. ch. E39, Roma 300kW ch. E43 - for the optimist! Both carry the RAI-3 service, with horizontal polarisation.

**Romania:** Turnu Severin TVR-1 15kW e.r.p. ch. R2 horizontal; Dobrogea TVR-1 15kW e.r.p. ch. R3 vertical.

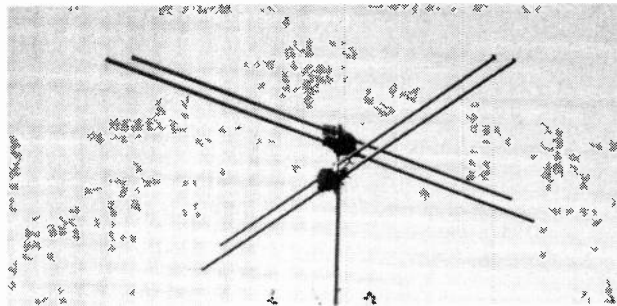
### Satellite TV

In view of the increased interest in direct TV broadcasting from satellites in recent months it seems appropriate to give details of the reception obtained by several South African enthusiasts from the Russian Stat-T craft in orbit at 99°E. Perhaps some other overseas readers will be persuaded to "have a go"! The transmitter operates on ch. 51 (714MHz centre frequency) with an e.r.p. of some 63kW. Negative-going f.m. video is used, with a deviation

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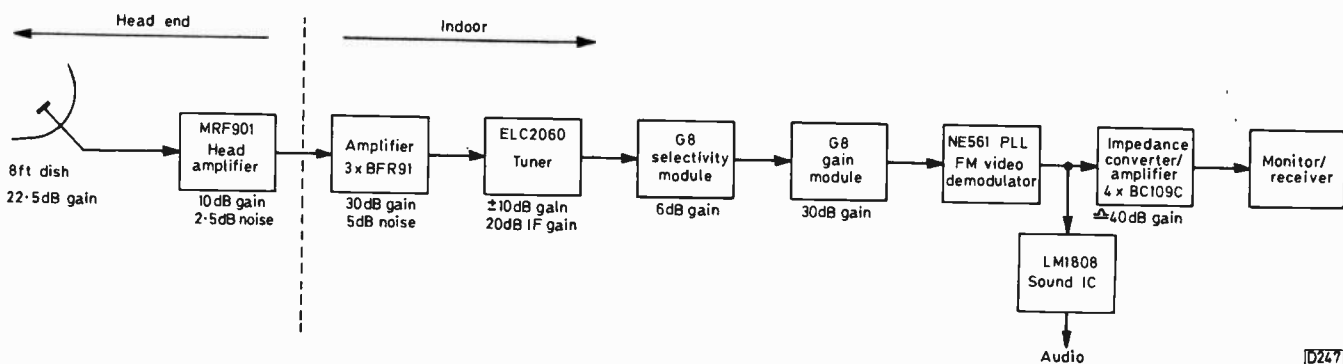


Fig. 1: The Stat-T receiver set up used by Ian Roberts in S. Africa. The r.f. gain is 72.5dB and the i.f. gain 96dB, giving an overall system gain of about 168dB. The i.f. gain (G8 selectivity module) is run at minimum.

of 18MHz. The signal strength is such that an enthusiast with line-of-site reception can display a reasonable picture. Unfortunately for us in Europe, the 0° elevation point runs through Poland and Greece into Libya. The UK is thus well outside the area of possible reception, but DXers in Turkey, Africa, the Gulf and India are all attempting to get reception with basic equipment – and getting results!

The three who've been receiving good signals in South Africa are Ian Roberts (Glenstantia), J. Abbott and Jim Maden (both in Vereeniging). J. Abbott feeds the output from his 5ft dish with three-element integral aerial and 38dB head amplifier (1.8dB noise figure) into a Philips monochrome receiver with a modified i.f. strip (additional i.f. amplification and an NE561 phase-locked loop i.c. for f.m. video demodulation).

The receiver set up used by Ian Roberts is shown in Fig. 1. For sound incidentally the Stat-T uses a conventional 6.5MHz system D carrier. Ian is now progressing well with 4GHz reception, using an 8ft diameter glassfibre dish – he constructed the mould for this, achieving a surface accuracy (without stress) of approximately 1mm!

T.S. Nanda Kumar (Madras), another regular Stat-T viewer, reports that the winter schedule is 1230-1245 test pattern, 1245-1700 programmes, 1700-1715 test pattern, 1745-2000/2100 programmes – Madras time.

### Correspondence

Due to pressure of space this month the letters section is being held over until next month.

## Letters

### RANK T20 CHASSIS FAULT

I was most interested to read the Rank T20 chassis fault on page 98 of the December *Service Bureau* – to recap, the line driver transistor's feed resistor going open-circuit intermittently, followed by the set eventually giving the no results symptom permanently. The advice given, to concentrate on the line driver transistor and its associated components, and just possibly the line driver transformer, was quite correct. This is a fault we've had on many occasions however, so perhaps I could add a word?

When the fusible feed resistor keeps going open-circuit intermittently and resoldering it restores normal results, you'll find that the driver transistor will eventually fail. After replacing it, check the voltage at its collector. If this is varying, check the earth connection between the scan drive panel and the line output panel – it can develop a high-resistance joint. If the trouble persists, check the TBA950 sync/line oscillator chip by replacement – this should clear all the problems.

John Coombes,  
Dawlish, Devon.

### THE SPARES PROBLEM

For service engineers like myself, *Television* is an invaluable guide to developments and faults in TV receivers and allied equipment. This letter concerns a day-to-day problem that seems to be getting worse – the difficulties experienced in dealing with manufacturers' service/spares departments, and even general component suppliers. The following recent

examples concern audio equipment, but the problem is a general one.

An order to a large service organization for a cassette recorder motor plus five rear cover screws eventually produced one switch, five cabinets and a bill for over £50. The same firm charges £1.50 for a popular cassette recorder replacement belt – justified by the company because of the need to keep large stocks of small parts, and the high distribution costs. Another major component supplier offers similar belts in various sizes at an average price of 35p each however.

A reputable Norwegian tape recorder UK agency was asked for a pressure-pad assembly and plate for a specific open-reel machine. We didn't have the part numbers, but the machine was fully described – and there's only one pad in the whole machine! Back comes a pad assembly for a totally different model, and no plate. Wrong pad/bracket returned together with original worn parts for identification – back comes correct pad and plate, minus bracket. An expensive phone call eventually produces the correct bracket, the only problem being excessive friction with customer . . .

And even the Japanese . . . The UK agency for a well-known Japanese manufacturer takes at least three weeks to open an envelope, and is then sometimes too exhausted to read the order correctly.

Computers are being used increasingly by suppliers. They are efficient processors, but the problem is that someone has to feed the order in. An error of one digit can mean chaos for the customer. One large supplier has no means of checking the assembled order against the customer's original list, and not surprisingly mistakes are frequent.

There are still some excellent service/spares organizations of course. RS Components are prompt and efficient for example, and in the unlikely event of an error correction is quick and courteous. On a smaller scale,

Sendz Components provide a good and very economical limited spares service. But these are relatively thin shafts of light amidst the overall gloom.

Those who fall down with their service always have ready and pat answers, but surely a major cause of the problem lies in the attitudes of those involved? The alarming aspect of experiences such as those quoted above is the almost complete indifference and lack of courtesy shown by those concerned.

Operating an honest, one-man radio/TV etc., servicing business is hard and challenging work (even Les L-J's comments are an understatement!). It's very rewarding however, though not always so financially. It seems to me that good service, conscientiousness, fair dealing and hard work are considered by all too many nowadays as a curse rather than a redemption. Am I alone? Are there any kindred spirits out there...?

Chris Avis,  
Heavitree, Exeter.

### A STRANGE FOCUS FAULT

I always read with interest the fault reports from other readers and contributors. The following fault report may be of help to others – the problem very nearly made me more insane than the average TV engineer already is! The story starts with a perfectly ordinary Thorn set (8500 chassis) with a soft tube. A new tube was fitted and all was o.k. until the blue raster went out of focus – the red and green rasters were o.k. The drives were swapped over to see whether the fault was in the video department, but the fault remained in blue. So (with a certain amount of cussing) the tube was removed and another fitted. Purity o.k., red and green focus o.k., blue out of focus! Ring up tube manufacturer and get him to exchange the two tubes.

Fit third tube. Everything o.k. except, you guessed it, blue out of focus. Change tube base, same fault. I then found that when the purity magnets were rotated so that the blue gun produced a green or red raster the focus was o.k. At this point the height folded over. Forget about that and concentrate on the focus problem. Change the convergence

board, fault remains the same: change the scan coils, everything now o.k. including the field scan. Refit old scan coils to confirm: blue out of focus, height o.k. for two-three minutes then foldover.

Can anyone suggest why the scan coils should be responsible for only one gun going out of focus?

L. Ingle,  
New Mill Radio,  
Huddersfield.

### SOLDERING THEN AND NOW

The letter from A. S. Foster (November issue) on soldering flux certainly revived memories. Old time plumbers, like my father, had no commercial fluxes available. For lead work a mixture of tallow, copper and powdered resin was used: for ferrous metal a solution of zinc chloride was made from zinc clippings dropped into hydrochloric acid – this process was done outside because of the violent chemical reaction.

My own career led me into radio receiver manufacture, where in some factories fluxite paste was strictly taboo – its use invited instant dismissal. A more favoured product was crimson in colour and called Coraline. In those days an assembly line was an infernal region, the heat from the gas irons and the flux fumes making conditions most unpleasant. The original soldering iron was heated over a covered gas burner: later types were pipe fed with a compressed gas-air mixture.

Early electric irons were heavy and fed by stout rubber-covered cable, so they were very tiring to use – today's "Curie effect" heat-controlled irons were years away. The Burgoyne soldering gun appeared after the war, priced at £4.50. It didn't catch on, and the innards became available on sale at 62½p. I invested in one which is still going strong, though it's less speedy than the modern type.

In conclusion, the ubiquitous "Baker's fluid" is still with us for difficult jobs, but for those requiring a paste flux for electrical work the product sold as "Yorkshire flux" (for copper pipe fittings) can be recommended.

William E. Harrison,  
Windsor.

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# Pye 731 Series Power Supply

John Law, T.Eng. (C.E.I.)

THE Pye 731 chassis and the related 735, 737, 741 and 725 chassis were used in various Pye, Ekco and Dynatron solid-state 22in. and 26in. models before the introduction of the Pye/Philips G11 chassis in mid-1977. The subject of the present article is the power supply used in these chassis, with notes on some common faults experienced during the past few years.

The power supply panel measures 7 × 6in. and is mounted, along with the field timebase and convergence panels, in a frame to the right of the c.r.t. The frame is mounted vertically between runners at the top and bottom, enabling it to be withdrawn to the rear (after lifting the plastic latch at the bottom rear corner) and then turned through 90°. This gives excellent access to the panel. The "dropper" resistor is mounted separately, at the bottom of the cabinet beneath the c.r.t. neck.

Fig. 1 shows the circuit of the power supply (there was a different over-voltage circuit in early versions, see Fig. 2, and minor component changes in very late production –

also the surge limiter section R978 of the dropper was not present in very early versions). The key component is the controlled rectifier (thyristor) D888, which produces stabilised 170V and 185V h.t. lines, the former for the line output stage and the latter for the RGB output stages and a few other purposes. The mains a.c. is applied to the anode of D888, which conducts only when a trigger pulse is applied to its gate via C889. This trigger pulse is timed to occur during the falling edge of the positive-going excursion of the mains input waveform. The thyristor then conducts until its anode voltage falls below the voltage at its cathode, i.e. across the reservoir capacitor C880. When this occurs the thyristor switches off until the next trigger pulse arrives: stabilisation of the output voltage is achieved by varying the timing of the trigger pulse.

The trigger pulse occurs when the diac D892 conducts. This device will switch on when the voltage across it reaches a certain critical point. For this purpose, the charging/phase shift network R898/8 and C900 is used –

C900 charges via the resistors, and when the voltage across it rises to approximately 32V the diac fires, discharging C900. R924 and D925 establish the correct d.c. conditions for the firing of D892. D901 shorts C900 to chassis during the negative-going excursions of the mains waveform. The conduction of the control transistor VT902 adjusts the charging rate of C900, thus controlling the timing of the trigger pulse applied to the thyristor and the stabilised h.t. obtained – the coarse and fine h.t. preset controls are connected in VT902's base circuit.

To provide the control action, the base of VT902 is connected to the a.c. input via R911 while feedback is applied to its base from the h.t. line via R897. Let's consider the feedback action first. If the h.t. falls due to increased load conditions, the d.c. voltage applied to the base of VT902 will also fall. This reduction in the bias applied to its base reduces the current through R898/9 and thus the voltage developed across these two resistors. C900 charges more rapidly therefore, D892 fires earlier in the cycle, and D888 switches on when the voltage at its anode is at a higher point. As a result the charge on C880 increases and the h.t. is stabilised. The same basic action occurs when the mains input varies. Say the input voltage falls: the a.c. voltage applied to the base of VT902 is reduced, the a.c. conduction of VT902 falls, C900 charges more rapidly during the positive mains half cycle and the thyristor is switched on earlier to compensate for the reduced input. From all this it follows that D888 must conduct during the falling flank only of the input at its anode. Diode D904 is included primarily to compensate for the temperature coefficient of VT902's base-emitter junction.

Transistor VT896 with the electrolytic capacitor C894 and associated components form a slow-start circuit to avoid heavy surges when the set is switched on. Since C894 is then discharged, VT896's collector and base will be at the same voltage. VT896 is therefore saturated, short-circuiting D904. This in turn increases the conduction of VT902, so that the charging of C900 and the build up of h.t. is delayed. As C894 charges via VT896's base current so VT896 switches off and normal operation commences. C894 is discharged rapidly via D895 at switch off, so that the slow-start action occurs when the set is switched off and on again quickly.

VT881, D884 and the associated components provide over-voltage protection. A different circuit, using a thyristor and diac, was used in early versions (see Fig. 2). In very early versions the thyristor was connected via R883 across the h.t. line. Should the h.t. rise to an excessive value, the voltage at the junction of R878/RV879 will rise sufficiently for diac D881 to conduct. D884 would then fire, blowing the mains fuse through crowbar action. Subsequently D884/R883 were connected across D904, reducing the h.t. when D881 fires in the same way that the slow-start circuit operates. In the later circuit (Fig. 1), the emitter of the over-voltage transistor VT881 is held at a constant 7.5V by zener diode D884. Its base is returned to the h.t. line via R883. Should the voltage at its base rise above some 8V, due to excessive h.t., VT881 will conduct. This shorts out C900, so that D888 cannot be triggered. The h.t. falls, VT881 switches off, and the h.t. then builds up again. If the h.t. is still excessive, the cycle repeats, i.e. a tripping action occurs, producing a pronounced picture flutter.

The later circuit has the advantage over the later version of the thyristor circuit in that the latter provides no protection should VT902 go open-circuit or lose its supplies due to D904, R903 or R911 going open-circuit. Excessive voltage on the panel endangered neighbouring components and produced a dangerous increase in the e.h.t.

voltage. Another fault cleared by the later transistor over-voltage circuit was an undesirable picture flutter caused by multiple breakovers in the diac interrupting the regular triggering of the rectifier/regulator thyristor.

## No HT

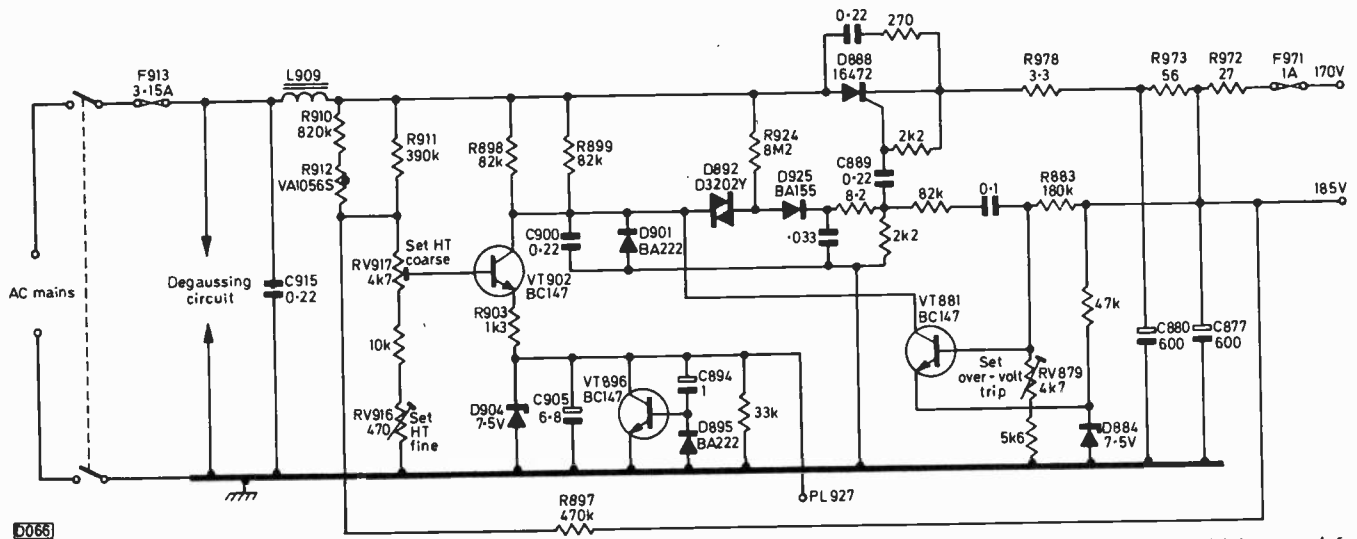
When confronted with the "no h.t." symptom, first ensure that the mains a.c. is reaching the anode of D888 (BT106 – other types were used). The BT106 passes a heavy peak current, over 12A, albeit momentarily. The on-off switch is thus designed accordingly, and being a BEAB approved device must be replaced with the correct type should it fail. Disconnect the mains supply before checking the switch. Probably before doing this you'll have inspected the mains fuse (F913, on the panel – the fuse near the dropper resistor is the h.t. fuse F971). If the mains fuse is open-circuit but the glass is clear, it probably died of old age. If so a replacement will clear the fault. Should a replacement blow, suspect leakage or a short in D888 or the mains filter capacitor C915. In this event however the fuse will probably be blackened. A meter test will not always provide a reliable check of C915, which may break down on load. Replacement is the only true test therefore. In passing, it's worth inspecting the connections to the filter choke L909 for overheating or dry-joints, which can give intermittent results or even a dead set. If the choke is at all suspect, it's best to replace it. Excessive heat here can damage D884 and VT881 in the later versions of the panel.

Assuming that there's mains a.c. at the anode of the thyristor, the next thing to do is to check for h.t. at its cathode. A very low voltage at this point means that R978 is open-circuit. A low voltage of some 100V can be due to a dead spot on the track of RV917. No voltage means either that D888 is open-circuit or that there are no trigger pulses, due to D892 being open-circuit or some other reason (we'll come back to this). The diac can be checked only by substitution. D888 can be tested in circuit, but a more certain check can be made with it removed from the panel. Only three joints have to be unsoldered to remove it complete with its heatsink.

The thyristor can be checked with an Avo 8 switched to read ohms  $\times 100$ . With the meter's leads connected to the device's anode and cathode and no connection to the gate, a thyristor in good condition should produce a reading of about 200M $\Omega$  either way. With the leads connected between the cathode and the gate the reading should be somewhere between 200-2k $\Omega$  in one direction (forward bias) and between 20k-600k $\Omega$  in the other direction (reverse bias). Given these readings, connect the black lead to the anode and the red lead to the cathode. Switch the meter to the lowest resistance range. No reading should show on the scale. Shorting the gate to the anode with a screwdriver should give a reading of about 20 with a good thyristor. Readings outside these figures mean that the device is suspect and a replacement should be fitted.

Given a.c. at the anode of the thyristor and d.c. at its cathode, but no d.c. on sections R973/R972 of the dropper resistor, then the latter is suspect – inspection will often reveal a black burn spot on the green surface, indicating where the break has occurred, usually in the 56 $\Omega$  section. As previously mentioned, when the 3.3 $\Omega$  section goes open-circuit there's no or very little voltage readable at the cathode of D888, because C880 does not receive a charge.

If there's no h.t. at the cathode of D888 and the thyristor, diac D892 and R978 are in order we have to seek the reason for the absence of trigger pulses. Check the voltage at the collector of VT902. No voltage here (should be about



D065

Fig. 1: Regulated h.t. supply circuit used in the Pye 731 etc. chassis. Type BZX79-C7V5 zener diodes should be used for replacement purposes. In late production R898/9 were changed to 56kΩ, 1W, R910/2 were deleted, R903 was changed to 680Ω, R897 was changed to 330kΩ and an 82kΩ, 1W resistor was added between the cathode of D888 and the cathode of D904.

12V) could mean that D901, VT881 or D884 is short-circuit. If the voltage is very low, check VT902, VT896, D904 and C905. Another possibility is R924 going open-circuit.

On Dynatron models the fault could be on the control panel, which is linked to PL927. Disconnect PL927 to check.

### Other Faults

Instead of no h.t., the fault could be excessive h.t. (tripping with the transistor over-voltage circuit). Faults that can cause this condition are D904 open-circuit, R898/9 or R897 low in value, or D888 leaky (unusual). The diac D892 is also suspect, especially if of the D3202Y (black plastic) type – replace with a BR100.

A change in the value of R924 can produce a high frequency flutter that doesn't respond to normal setting up of RV917. Replacing R924 and if necessary the diac will usually clear this one.

Low h.t. can be due to R911 changing value or C905 being leaky. In cases of hum, check for dry-joints on C880 and C877. If the start-up time seems to be long, check C894 by substitution.

### Setting up

Pye recommend that whenever the thyristor or associated components have been replaced the h.t. setting up procedure should be carried out.

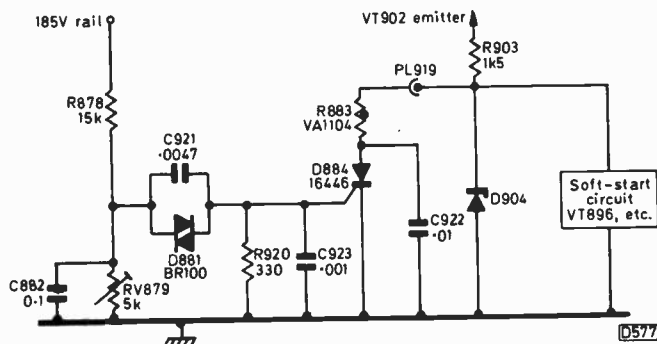


Fig. 2: The earlier thyristor over-voltage protection circuit. In very early versions PL919 was taken to the cathode of D888, shorting this point and blowing the mains fuse in the event of excessive h.t.

With the transistor over-voltage protection circuit the procedure is as follows. Set RV916 and RV917 to their mid-track positions and RV879 fully anticlockwise (looking at the component side of the panel). Switch on and adjust the brightness and contrast for a normal picture. Connect an Avo 8 between chassis and the centre tap of R972/3. Adjust RV917 for 195V. Turn RV879 slowly clockwise until the picture begins to pulsate. Next turn RV917 fully clockwise and check that the h.t. does not rise above 200V. The over-voltage protection circuit is now preset to operate at 195V. Set the brightness and contrast to minimum and readjust RV917 for 185V. If necessary, use RV916 to obtain this voltage. The power supply is now set for 185V at minimum beam current, with the over-voltage circuit operating when the h.t. rises above 195V. Readjust the brightness and contrast controls.

With the thyristor over-voltage protection circuit, proceed as follows. Set RV917 fully anticlockwise. Connect an Avo 8 between the junction of R972/3 and chassis. Disconnect PL919 and adjust RV917 for 200V. Connect the Avo across RV879 and adjust this preset for the maximum reading. Reconnect plug PL919 and connect the Avo between the junction of R972/3 and chassis again. Set RV916 to mid-track and RV917 fully anticlockwise. Advance RV917 to obtain a reading of 185V, followed by RV916 as necessary.

### Faults Elsewhere

If the h.t. fuse F971 has blown, attention will have to be directed to the line output stage. Suspects here are the c.r.t. first anode supply reservoir capacitor C563 (a favourite), the line output transistor, the tripler and the focus potentiometer which can blow up with smoke and flames (later ones are more robust). Unfortunately C563 can destroy the tripler and also possibly the line output transistor and transformer when it goes short-circuit.

Finally remember that no sound or raster can be due to non-operation of the line timebase. If there's no drive to the line output transistor, check the line oscillator timing capacitor C514 (by substitution) and the line driver transistor – C514 is present in chassis using a TBA920 sync separator/line oscillator i.c. (early 731 chassis used an SN76544N07 sync plus line and field oscillator i.c.). Both i.c.s receive a start-up feed from the 185V line via R520 (8.2kΩ). ■

# A TV Man's Guide to Video

## Part 2

Harold Peters

FOR the viewer who must have everything, VCR manufacturers produce "de-luxe" versions of their basic model. Control of the various operations in one of these machines is generally assigned to a microprocessor chip. You can usually identify them by the absence of mechanical knobs and position indicators, by the presence of more than one digital display, by the use of calculator type keyboards, and by their ability to store a programme of many timed requirements over many days. Not every microprocessor-controlled VCR has full facilities however, and not every full-performance VCR uses a microprocessor.

### Microprocessor Control

The only problem with microprocessor control is that you have to give the thing its head – let it do things its own way. And generally speaking it will do only one thing at a time. Ask it to tune up and store BBC-2 while it's looking for position 0125 on the tape and it will probably go sick on you, locking up and requiring an engineer, or alternatively a day without the mains supply, to clear the trouble.

Tuning is often accomplished by means of an electronic hunt up the band, stopping at every station on the way. When it homes in on a station you can store this using any one of 24 numbers, or move on and try another station. The stored stations are remembered by the electronics in the same way as a calculator does things, which means that some method of preventing the memory being lost when the machine switches off has to be incorporated. It takes the shape of a small, rechargeable battery soldered on the memory board. This battery is float charged as you run the machine, and can keep your station selection stored for up to three months with the VCR disconnected from the mains supply. It can also keep the real-time clock going and the tuner programmes stored for up to an hour in the event of a power cut.

Beware of two points. The battery in a new VCR just unboxed may not be fully charged when you first program the machine. So keep it plugged in until just prior to delivering it to the customer. And if you have to handle the panel which contains the battery, remember that it not only contains MOS devices but that these will be operational – so mind where you put it.

In addition to selecting and storing the channels, the microprocessor is able to store a complex program of four or more timer requirements. Say "Match of the Day" on BBC-1 today, "The World About Us" on BBC-2 tomorrow, and "Coronation Street" on ITV on Monday to keep some families happy on Tuesday when returning from a weekend away. In fact it's usually way ahead of the user, who often fails to put sufficient tape in to cover the program of recordings the machine has been asked to make. Tape location and cueing are also organised by the microprocessor.

Of the VCRs at present on the market, all the Philips/Grundig V2000 type machines, even the basic models, use microprocessor control. In the VHS sector, the Ferguson 3V23 and its brand counterparts also use one.

There's no real way of avoiding a careful reading of the

instruction book with one of these machines. As we have already said, they do things their own way. Also the "positive thinking" used by the manufacturers means that these books tell you only what the machine does, not what it can't do! In case the reader detects a note of irritation here, he's quite right. The writer is still smarting from his inability to set the clock on a 3V23 from basic principles, and from the struggle he had when trying to interrupt a VR2020 half way through its second timer selection because the broadcaster had changed the programme.

The microprocessor is not directly responsible for all the features in a de-luxe machine. Such extras as stop motion and search depend on the mechanics as much as the electronics. Designers go to great lengths to perfect the performance of these extra features, as a look at a typical tape transport system will show.

### Mechanical Features

Unlike the compact audio cassette, the tape in a video cassette has to be pulled out of the cassette and wrapped around the video head drum ("threading up") before recording or playback can commence. A motor-driven capstan then pulls the tape past the video head drum and the stationary erase/audio/control heads (no control head with the V2000 system, which uses the dynamic track following technique – see later). Another motor rotates the video head drum in which the two video heads, approximately 180° apart, each scan a whole picture field at a time whilst in contact with the tape. The tape moves in the same direction that the video heads revolve.

It follows that for the fastest fast-forward or rewind action, also to enable the cassette to be ejected, the tape has to be unwrapped from the head drum and wound tightly back into the cassette.

### Basic Controls

From this outline of a VCR's operation we can consider the knobs/levers at the front of the machine. Without exception, there are the same essential seven that are present on an audio cassette recorder – fast forward, rewind, stop, play, record, pause, eject – though various interlocks make the action slightly different from model to model.

When the stop control has been operated, it is normally necessary to wait for the tape to unthread before another control can be activated. In the fast-forward mode, the tape is normally unthreaded – the exception is with some Beta models. On some machines the fast-forward or rewind controls can be held down to get fast winding in the threaded mode without previously operating the stop button – this facility should not be confused with the search refinement.

At the end of the tape the machine will stop automatically, and on machines that will let you ask them to will then rewind to the beginning and/or eject. If you've set the counter memory to "on" however, fast wind will stop at 0000 on the counter – a useful facility when you've begun a

recording half way through a tape following something else you want to keep. Advanced machines better this: you can dial up a tape setting where the winding has to stop – for example with Philips V2000 series machines you press “go to” and then say 2824 or whatever position you want. You have to make a note of where your programmes begin and end on the tape of course.

As with an audio recorder, it’s customary to press both the play and record buttons simultaneously to start a recording. The threading up time has to be allowed for and, as some machines take a few seconds for the tracking to settle down, allowing a lead-in time of ten-fifteen seconds will pay dividends every time.

If nothing moves, check that you’ve not set the timer to come on about now, and that the various “TV/video”, “camera”, “timer” or “standby” switches are not in the wrong position. You may even have forgotten to put the tape in! Tape presence is usually sensed by means of a low-voltage lamp and a photodiode, and if the beam is not interrupted nothing moves (an insurance against pile ups if the tape breaks). If the lamp goes open-circuit, fail-safe circuits lock the machine – and produce a very common cause for a service call.

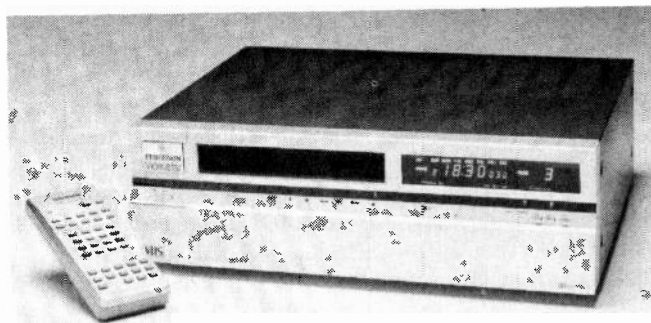
The pause control merely lifts the pressure roller off the capstan and mutes the sound. The video heads still rotate, and when the pause control is released there may be a second or so of tracking error as the tape regains its speed. Using the pause control will not normally give you “stop motion” still-frame pictures – the control should be used for as short a period as possible to avoid scoring a groove in the tape’s oxide coating. Some advanced machines will “backspace” a few inches when the pause control is operated, and will not switch back to “record” until the backspaced portion has been read in again and locked to – this enables a clean edit to be made without a tracking error. It’s a useful facility when you have a camera, as we’ll see later.

The eject control will get you the tape back only when the tape is unthreaded. A power cut, a broken or jammed tape or an open-circuit bulb (see above), or even asking the microprocessor to do something impossible, will lock the cassette in.

Now to the less familiar knobs and sockets. Unlike the items so far mentioned, not all machines have the same features and, as much as we’d like to make this article as comprehensive as possible, you’ll have to read the instruction book for the machine you’re using to find out exactly how it has to be controlled.

## Tracking

Tracking is as important on a VCR as convergence is on a colour set. As the name implies, it’s the recorder’s ability to keep the video heads in alignment with the tracks recorded on the tape. We’re talking for the moment about VHS and Beta machines – the Philips/Grundig V2000 system uses a different approach that we’ll come to in a moment. Pulses are recorded on the control track at the edge of the tape and if, with respect to these pulses, the speed and phase of the video drum drive is the same on playback as on record there will be good reproduction of the picture. If on playback the control pulses arrive in advance of the correct timing, the drive to the drum will be slowed down – and vice versa (alternatively in a few machines the capstan drive is adjusted instead). The tracking control gives the user a means of influencing this process. It’s normally set to a “click” position, which may be at the centre or one end of the potentiometer.



*Top of the Ferguson range, the full-specification micro-processor controlled Model 3V23. Most of the front controls are concealed behind the flap across the bottom. The infra-red remote control system duplicates the record, playback, set-up and information controls required for normal use. The timer enables up to eight recordings of different lengths and on different channels to be made over a period of 14 days – the recordings can be made repeatedly at the same time each day or on the same day each week.*

When playing back a recording made on another machine (or a prerecorded tape) the phase relationship between the control pulses and the video signals may be different from that when your machine replays its own recordings. A tracking error thus occurs – it looks like a twinkling band of interference moving up or down the screen, or alternatively the colour may move out of register with the luminance signal, either forwards or backwards (the sound will be o.k.). Adjust the tracking control to minimize this effect. It must be returned to its nominal or “click” position before you record on the machine again.

Good tracking is a measure of the recorder’s mechanical stability, and is bound to deteriorate with use and age as the machine wears. Various automatic devices are used to improve the tracking or speed up the time the machine takes to settle down.

## Dynamic Track Following

The V2000 system uses a different approach – dynamic track following. Each video head is mounted on a piezoelectric bar which bends up or down in accordance with the applied voltage, thus moving the heads away from their “centre” positions. Low-frequency signals are recorded along with the video signals, and differ from track to track, following a four-track sequence. These signals are filtered out on playback and used to operate the servo system, which acts on the piezoelectric head mountings. Since the signals on adjacent tracks differ, the heads are kept aligned with the correct track. With this system there’s no need for a tracking control.

## Stop Motion

In theory, if a tape is stopped but the video drum continues to rotate the same field will be scanned (remember that each video track on the tape represents a complete field of 312.5 lines) and the result will be a still picture – “stop motion”. In practice it doesn’t work out that easily, and the elaborate arrangements some manufacturers adopt to get good still pictures add a great deal to the cost of the machine.

The problem is that during the recording both the head and the tape move (in the same direction). During stop motion however only the head moves. If it starts at the correct point on the wanted field, it will then start to cross into “no-man’s land” and end up on the field in front. As it

crosses the "no-man's land", a band of mistracking twinkle (often referred to as the noise bar) will appear across the screen.

The simplest course is to let it be and accept the bar. The next simplest course is to arrange for the machine's tracking electronics to move the bar into the field blanking area, i.e. up and over the top or bottom of the screen. Machines using dynamic track following are reputed to be able to cope with little trouble (but few of the early ones had this feature). The latest solution, from Toshiba, is to mount a couple of extra wide heads at 90° from the other two video heads: being extra wide, they totally overlap more than one field (adjacent fields will be very similar most of the time of course). Scanning the same field continuously would mess up the PAL switching, but the electronics take care of that. The sound is automatically muted.

### **Search**

The same problems apply in the search mode, but here the tape is being speeded past the heads by the fast-wind electronics to enable you to find the bit you want. Similarly slow motion can be produced by reducing the capstan speed or by inching the tape through a field at a time. The controls for this are usually labelled "slow" and "frame advance". The restrictions about tracking and PAL switching still apply – Sony go to monochrome during search to simplify matters.

### **Dub**

The dub control is used in conjunction with the microphone socket, which may be at the front or back. When the dub button is pressed, the existing sound track is erased and a spoken commentary can be substituted. The writer knows of no machine with superimpose facilities, but on some VCRs with a microphone jack at the front and an audio socket at the rear mixing of music and a microphone input is possible.

### **Timer Lock**

A switch is sometimes provided to lock the machine in the timer mode after it's been programmed: after this you can push the buttons till you're blue in the face and the machine will ignore you. This is a frequent cause of service calls, especially if only half the family is aware of the presence of such a control.

### **Dew**

The dew lamp lights when the humidity reaches a dangerous level. Never run a VCR in conditions liable to cause condensation, otherwise it will tear the tape to shreds. More about this later.

### **Round the Back**

The rear of the machine is either crammed with lovely knobs and sockets or empty. Assuming the former, you can expect to encounter any of the following: Aerial in. Aerial out. Mains in. (These three must be present of course). Video in and out – sockets to permit a camera's output to be recorded or the signal to be taken out at video frequency (or baseband as it's coming to be called), at 1V peak-to-peak, 75Ω. Sound in and out – the same facilities as with an audio recorder, permitting sound transfer both ways. This is useful for making TV programmes, monitoring the recorder

in sound only, and for camera work. A multi-position tune/colour (or normal)/mono/weak signal switch. In the tune position this gives the tuning bar; colour or normal is the usual operating position; the mono position gives improved definition on monochrome by extending the luminance bandwidth down into the region otherwise occupied by the colour signal; the weak signal position optimises the noise/gain performance under poor reception conditions.

A multipoint socket may be provided to take either a long cord remote handset or an infra-red receiver: no two models are alike in this respect. A round multiplug is usually present to take the standard multiway camera cable. This is very useful when used with the right camera, as you'll be able to start and stop the recording using the camera's pistol grip. More about cameras next month.

### **Summary**

By now you ought to be thoroughly confused about all the different options available. If you are, just think of the user/customer. Many of them get the wrong machine or one they only half use. The facilities our own customers seem to feel they need the least are: stop motion (once the novelty has worn off), and the ability to store more than one programme in the timer (the selection of which they never seem to trust or get the hang of).

### **Tapes**

Finally this month, tapes. These can cause as much aggravation as the rest of the system put together. Unlike audio tapes, they have a consistent base thickness regardless of length. This is because the rotating heads are designed to "dig in" by a prescribed number of microns in order to make optimum contact with the recording surface. The following requirements must be exactly right for good reproduction: the tape must have clean, sharp edges; the tape must have a consistent polish, and not be swollen through being stored or used in damp or humid conditions; and the mechanical alignment of the tape guides must be impeccable.

Most of the problems with the old Philips N1500/N1700 machines incidentally were due to damp operating conditions, causing the tape to buckle on its way up from the bottom spool to the top one.

In manufacture, the tape comes in a reel as wide as a newspaper and is cut by razor sharp blades to the right width for spooling. If one of the cutting edges is the slightest bit blunt, it will impart a wavy edge to the two adjacent tapes. This will not show up immediately, but if the tape is stored under the prescribed conditions of temperature and humidity (a curing process) it will show up as a crinkling of the tape edge as it lays in the spool – anyone old enough to remember reel-to-reel audio tape will know what this looks like.

If a tape is jammed, it's better to get it out whole and let the crinkles iron themselves out by tight winding rather than to cut and splice the tape.

Tape *can* be spliced, but much greater care is needed than with audio tape. Only the correct backing tape must be used, or the adhesive will ooze out all over the heads. The joints must be made absolutely straight, using a splicing jig and wearing cotton gloves. Don't remove the transparent end leaders – these stop the tape before it's pulled off the end of the spool. Clean any dust off the cassette before opening it up, and when using the tape make sure that the dew lamp on the recorder does not light.



# Microcomputer Clock-Timer

## Part 2

Luke Theodossiou

The power supply section, which is part of the main board assembly, is shown in Fig. 1. It is a straightforward design using a p.c.b.-mounting transformer with a 9V secondary whose output is rectified by a bridge, with C103 acting as the reservoir. Note that the common rail is positive. A 5V negative regulator (IC105) provides the supply for the memory and display sections. A second voltage regulator i.c. (IC106) provides the -9V required by the timer i.c. itself. This is achieved by applying a d.c. pedestal to the common pin of the -5V regulator i.c. This is provided by the emitter follower Tr111 whose base is clamped by the potential divider comprising R131 and R132.

The main p.c.b. has been designed to accept the solid state relays stocked by RS Components Ltd (stock no. 348-431) but as previously mentioned, either electromechanical relays or heavier duty solid state types may be used instead. For instance, RS Components also stock 10A and 25A solid state units (stock nos. 349-484 and 349-670 respectively) but since both of these require heatsinking when operating close to their load limits, they have to be mounted outside the unit or an appropriately larger box for housing the complete system will have to be used. The circuit diagram detailing connections for the 2.5A type is shown in Fig. 2. Although the main board has been designed to accommodate four of these relays, the output fuses and outlet sockets are mounted on the rear panel.

Fig. 3 shows details of the front panel and it is essential that the given dimensions are followed, since the panel has to fit over the display board. For our prototype we used 16 s.w.g. aluminium but virtually any material is suitable. After cutting to size (the actual size is dependent on the overall dimensions of the case so this is left to the constructor's own preference and judgement) and drilling/cutting out, instant letter transfers can be used to identify the switch and indicator l.e.d. functions.

Figs. 4 and 5 show the actual size of the copper pattern for the main and display boards respectively. Figs. 6 and 7 show the component locations for each board. The main board is quite simple to construct, although we suggest you start with the smallest components, gradually progressing to the larger items and finishing off with the mains transformer. We strongly recommend the use of i.c. sockets for all d.i.l. i.c.s, especially the timer i.c.

The display board is slightly trickier to construct - note the four insulated wire links which have to be made on the back (copper side) of the p.c.b. Ensure that all the l.e.d.s are pushed into the board as far as they will go, i.e. to the 'shoulder' of the leads. All other components must be soldered flat to the board and do not use an i.c. socket for IC1 as this will cause it to stand proud of the switches and thus prevent correct positioning of the front panel. The switch S1 is actually mounted on the front panel but an "escape" hole has been provided on the display board so that it can protrude through the p.c.b. We suggest that the connecting wires are soldered from the component side of

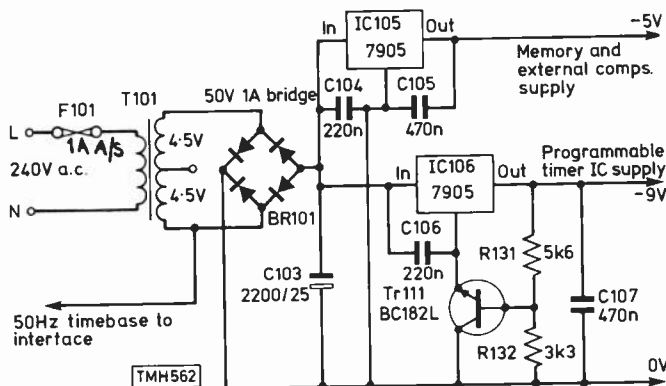


Fig. 1: Circuit diagram of the power supply section which is part of the main board assembly.

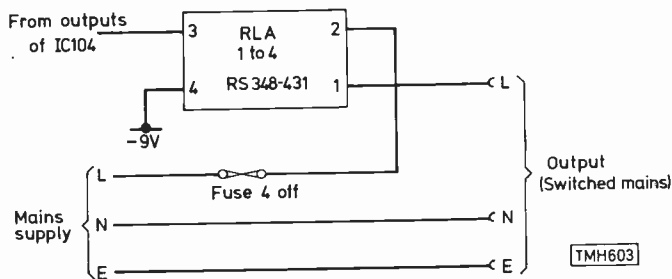


Fig. 2: Circuit of the solid state relay circuits used on each of the four outputs.

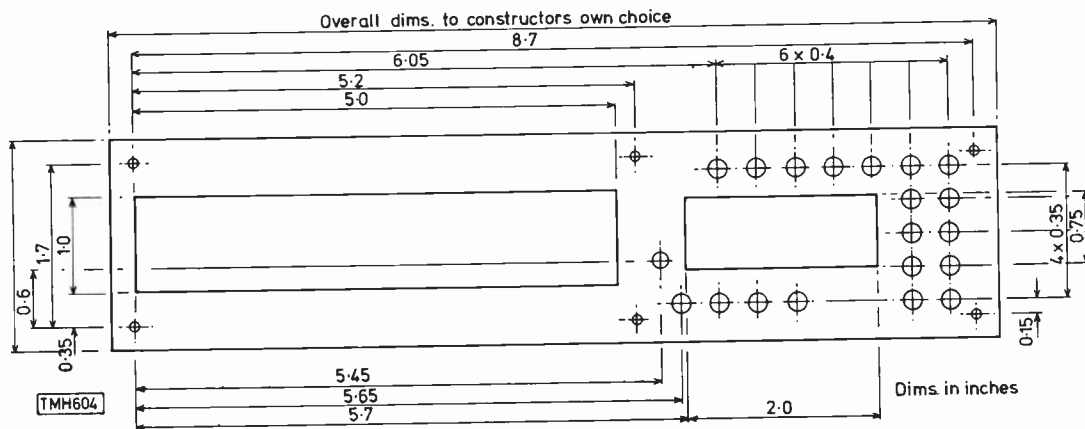


Fig. 3: Front panel details. It is important that the diagram is accurately followed. Use aluminium or mild steel but the thickness should not exceed 2.5mm.

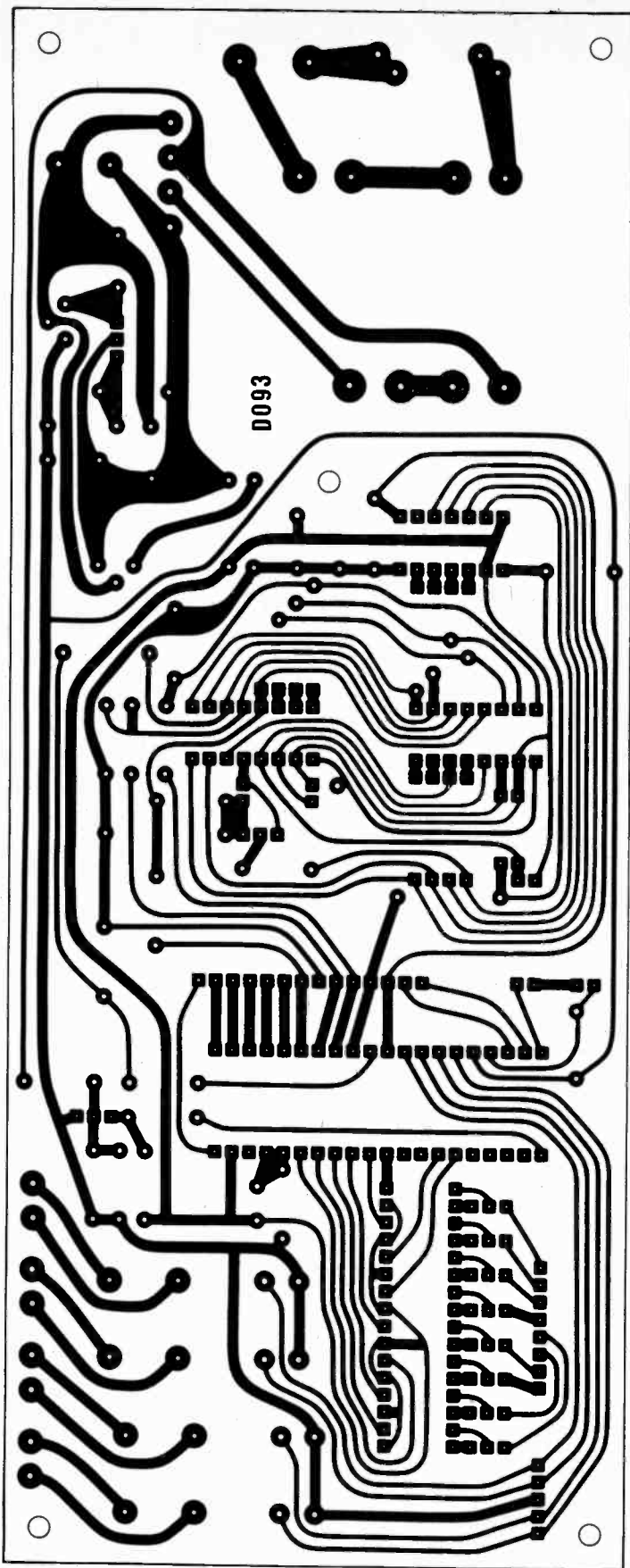


Fig. 4: Copper foil pattern for the main board.

the board and then taken to the switch through the hole in the p.c.b.

Interconnecting the two boards is made particularly easy through the use of ribbon cable. There are three sets of wires – a 14-way, an 8-way and a 5-way. The two boards

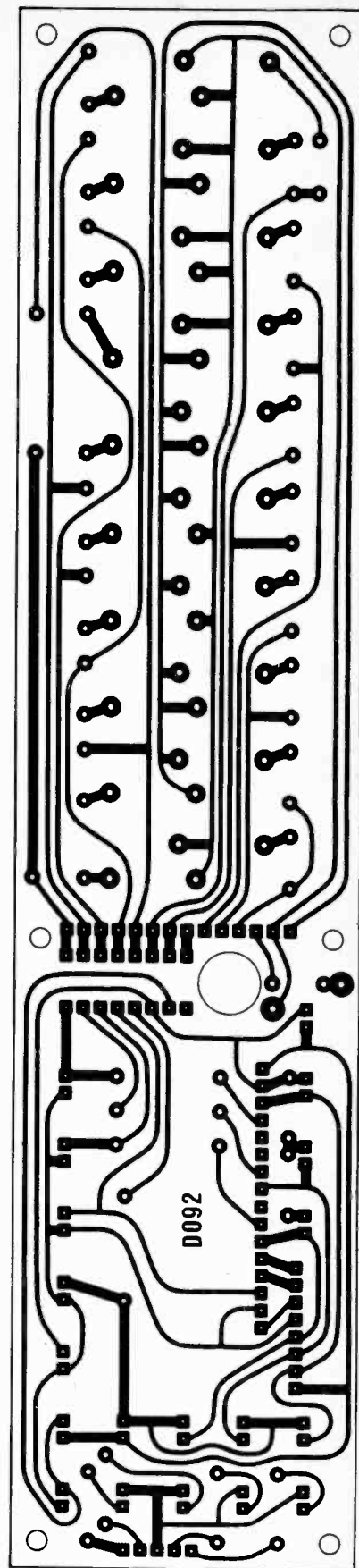


Fig. 5: Copper foil pattern for the display board.

have been designed so that the order of the cables from one board to the other is the same.

When testing the completed unit, it is worth remembering that the solid state relays use a triac as the switching

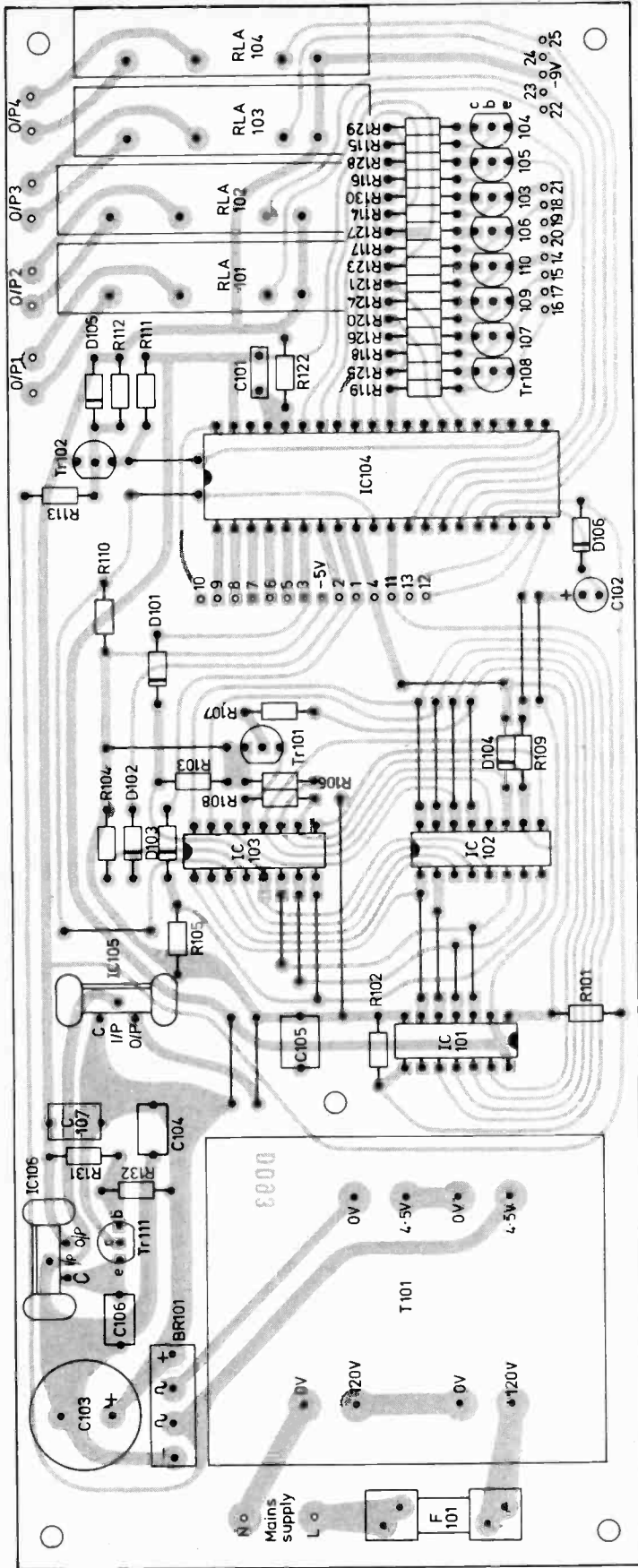


Fig. 6: Component location diagram for the main board, including the 2.5A solid state relays.

element. As a result, voltage checks carried out at the output socket in the absence of a load may be misleading. It is wise therefore to connect a visible load such as a lightbulb which demonstrates the state of the switch simply.

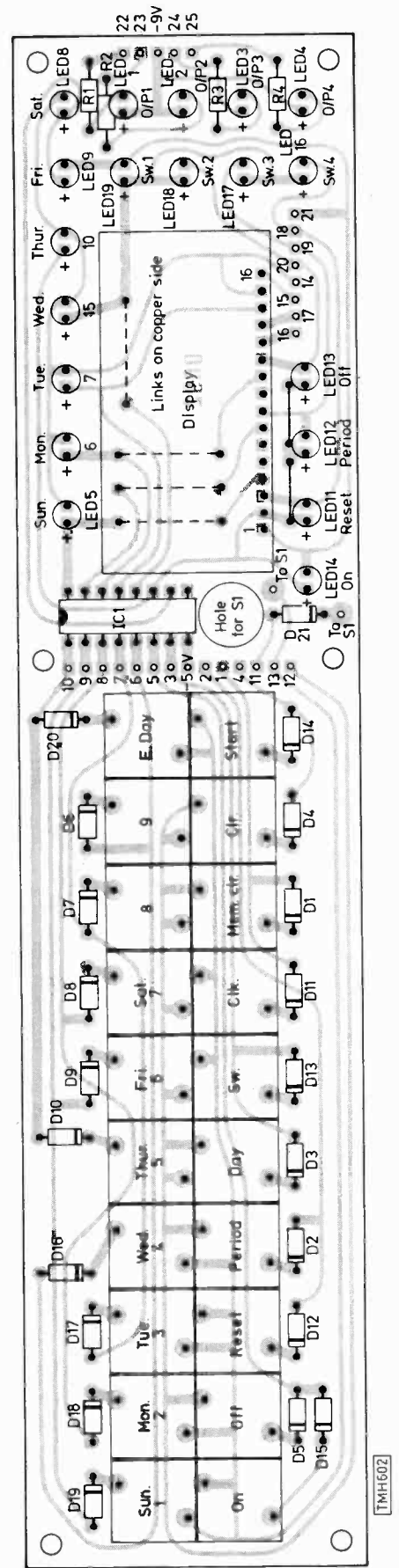


Fig. 7: component location diagram for the display board.

Due to pressure on editorial space we could not have included the entire programming guide in this issue. We therefore decided to hold this over until next month.

# Service Bureau

*Requests for advice in dealing with servicing problems must be accompanied by a £1.00 postal order (made out to IPC Magazines Ltd.), the query coupon from page 211 and a stamped addressed envelope. We can deal with only one query at a time. We regret that we cannot supply service sheets nor answer queries over the telephone.*

## GEC 2100 SERIES

The performance is good except for a predominance of green, especially on indoor scenes and mainly on people's faces nearest the right-hand side of the screen. Also white letters produce dark lines. Reducing the green by backing off the green first anode preset on the convergence panel only results in the blue predominating.

Check that the RGB output panel PC457 is properly earthed and that the frequency compensating capacitor C324 (0.001 $\mu$ F) in the green output stage is o.k. Also check the green first anode decoupling capacitor C552 (0.01 $\mu$ F) on the c.r.t. base. It could be that the c.r.t. is worn: if carrying out the grey-scale setting up procedure is unsuccessful, try to get its emission tested.

## PHILIPS N1700 VCR

When the clock switches the machine on in the record mode, threading takes place but there then seems to be a momentary reduction of power. The machine falters, the clock starts to blink, then the machine unthreads and switches off. There is normal operation if the cassette is removed or the clock switches the machine on in the playback mode. Normal operation is also restored when the 100mA bulb in the cassette compartment is removed. Manual operation is not affected. The trouble first arose when a cassette jammed. The lamp burnt out, and a 200mA bulb was supplied as a replacement. When the correct bulb was fitted, the problem disappeared. It's now returned however following a slight jamming problem with a new cassette.

The problem seems to arise when the 12V supply is called upon to provide a higher than normal current, e.g. with a 200mA bulb instead of a 100mA one, when the threading motor is stalled, or in the timed recording mode (another high current condition). Check the value of the surge limiting resistor R101 (1.2 $\Omega$ ) in the 12V supply – it will probably be much higher. If so, replace it and the fault will go away. The other main suspect is the 12V regulator control i.c. (IC101,  $\mu$ A723CA).

## ZANUSSI BR1026

The picture is good but vertical lines are ragged. The line lock is solid, and replacing the tripler and the luminance output transistor has failed to improve matters. The preset brilliance and line hold controls were found to be intermittent and replaced, but the fault remains.

It's difficult to comment on a symptom like this without seeing it. If the verticals are displaced regularly (cogging),

check whether C196 (5 $\mu$ F) in the flywheel sync filter circuit (between pins 11 and 12 of the TBA920 i.c.) is open-circuit. If the fault looks more like one caused by a faulty tripler but doesn't vary with brightness, try the line oscillator charging capacitor C193 (0.01 $\mu$ F, 2%) and the TBA920. Also check that the screws on the thyristors in the line output stage are tight. If the effect is worse at low brightness, look (in a darkened room) for signs of arcing from the tripler, the line output transformer and the focus components. If the fault becomes worse at high beam currents, check that the c.r.t.'s Aquadag coating is earthed, check the wound components in the line output stage (combi coil TR4, width transducer TR6 and coils L40 and L39) for dry-joints, examine the scan coupling capacitor C258 (1.8 $\mu$ F) for signs of overheating, and try replacing D41 (1N4003) in the width transducer circuit – it can cause similar effects.

Finally, suspect either the line output transformer or the three capacitors in the line output stage tuning network (C249 0.15 $\mu$ F, C250 0.14 $\mu$ F and C251 0.056 $\mu$ F). These capacitors can be replaced one at a time with ordinary types of the nearest value as a quick check, but don't run the set in this condition for long. The correct types (with high ripple current rating) must be used for any permanent replacements necessary.

## SABA H CHASSIS

When the set has been on for a few minutes the picture starts to roll across the screen from left to right. After about five minutes it starts to slow down, then eventually starts to roll from right to left. This continues for some forty minutes. The circuit breaker then operates and the set goes off.

The line oscillator is unsynchronised. This will result in excessive ripple on the h.t. line so that the overload trip operates. The TBA920 sync/line oscillator chip could be faulty, or it could be free-running due to the absence of the 48V peak-to-peak pulse from pin 8 of the line output transformer to pin 6 of the line oscillator board.

## TOSHIBA 12SBB

When this portable is switched on there's a raster but no sound or picture. The first i.f. amplifier's collector voltage is then high, with nothing at the base or emitter. Inject a signal at its collector and the whole thing starts up, with sound and a good picture. When you try to change stations however, or switch off and on again, the vision and sound disappear. The transistor tests o.k., and the resistors and capacitors in this stage seem to be in order.

The first i.f. amplifier transistor Q101 receives its base bias from the a.g.c. line, which explains why the voltage appears only when a signal is injected. It seems that signal injection is sealing up a faulty item in the a.g.c. circuit. The main suspects are the gated a.g.c. amplifier transistor Q104, its series diode D102, and the a.g.c. reservoir electrolytic C142.

## GRUNDIG 5010

The initial problem was smoke coming from the back. On investigation, part of the panel in the line timebase area was found to be burnt. This was cleaned up and the combi coil replaced – the core had broken and the windings appeared to have been overheating. A check was then made for shorts etc. in this area. We now have a reasonable picture, but the combi coil gets quite hot after an hour or so and there's slight lack of width.

The coil does run very hot in this chassis – it has to work hard in driving the thyristor line output stage and a high

operating temperature is normal. Adjusting potentiometer HS (R508) should enable correct width to be obtained. If you have an oscilloscope, it would be as well to adjust coil KA (L516, part of the commutating circuit) as set out in the manual.

### THORN 3500 CHASSIS

There's no voltage at the collectors of the RGB output transistors. With the transistors removed, there's about 160V at the c.r.t. cathodes, but as soon as one of the output transistors is replaced the voltage falls to zero. The output transistors have been replaced and associated components checked, but the problem remains.

The output transistors are clearly being turned on hard. We've known this to be due to failure of all three colour-difference driver transistors VT208, VT211 and VT214, but it's more likely that the output transistor base voltages are excessive due to failure of the luminance emitter-follower VT206 or the offset pulse adder transistor VT205.

### THORN 1690 CHASSIS

After about thirty five minutes this portable goes off, the l.t. rail falling to about 5V. If the set is switched off for a while then switched on again, one gets another thirty five minutes' operation.

Connect an ammeter in place of the l.t. fuse FS2. If the current decreases when the fault occurs, concentrate on the l.t. stabilizer circuit – check the regulator transistor VT10, its control transistor VT13 and the zener diode W5. If the current increases however it's likely that something in the line output stage is heavily loading the supply. Rectifier W15 and the line output transistor VT17 are suspect, but it may well be that the e.h.t. stick is faulty. It's encapsulated in the line output transformer assembly.

### GRUNDIG 1500

The picture and sound are perfect when the set is first switched on. After a short while however the brightness slowly increases and the signals slowly disappear, leaving just a plain white raster. The sound and picture return when the setting of the brightness control is decreased, but again the brightness slowly increases and the sound and vision fade to nil. This continues until the end of the range of the brightness control is reached – it takes a few minutes. Nothing will then restore the signals apart from switching the set off for a couple of hours.

It seems that a fault in the luminance channel is bringing the beam limiter into action, removing the signals. We suggest you check the three transistors Tr365 (emitter-follower), Tr375 (output) and Tr385 (black-level clamp) in the luminance channel, also if necessary Di392 in the clamp circuit, the luminance coupling capacitor C362 (1.5 $\mu$ F) and C385 (10 $\mu$ F) which decouples the brightness control.

### TOSHIBA C1480B

The luminance and sound are very good, but it's difficult to get the colour. It takes some minutes' fine tuning before the colour appears. Sometimes it will stay, but colour is lost again on changing channels. When the colour is present and a monochrome picture is displayed, turning up the colour produces a rainbow effect.

All the colour processing is carried out within the TA7193P i.c. (IC501). The symptoms suggest that the problem may be simply misadjustment of the reference oscillator preset R552. Note its position and try slight

adjustment when the colour goes. If this doesn't work, reset the control to its original position and check the voltages around the i.c., particularly pins 5-12. Possible culprits are the crystal and capacitors C511-C515.

### BEOVISION 3400 CHASSIS

There's a single vertical black and white striation an inch from the left-hand side of the screen. It's about an inch wide and visible only on BBC-1. With no signal (transmitter closed down) the fault appears as a one inch black band whose position can be altered slightly by varying the tuning between BBC-1 and ITV.

We've known this to be caused by internal oscillation in one of the two PL509/PL519 line output valves. If valve replacement doesn't cure the problem, make sure that the foil in the back cover is earthed to its copper finger, fixed to the upper left-hand screw on the line output stage screening cover. If necessary, check the line timebase power supply decouplers 9C3 and 9C11 (both 0.47 $\mu$ F) and the feedback transformer damping resistor 9R7 (12 $\Omega$ , 1W).

### THORN 8800 CHASSIS

This set has given trouble free service for many years, but now the colour has gone. I've changed the crystal, also R404 which couples the line pulse to the decoder, but the problem remains. Voltage checks around the i.c.s show that the voltages at pins 10 and 11 of the TBA395 reference oscillator i.c. are somewhat lower than they should be.

In view of these incorrect voltages we suggest you check C187 (1 $\mu$ F) and C189 (3.3 $\mu$ F): if these are o.k., replacing the chip should cure the fault.

### INDESIT T24EGB

Faults that have been corrected in the past include lack of height due to R505 (in series with the height control) increasing in value and lack of width due to R427 and R428 in the width/e.h.t. stabilization circuit going high in value. Now the tube seems to be in need of replacement – the detail and focus are all right, but there's an overall grey effect. The reading across the tube's heater is 7.5V, which seems rather high – in fact all the heater voltages seem to be on the high side.

The tube's heater should be operated at 6.3V, though it's difficult to obtain a true reading with an ordinary meter due to the pulsed d.c. waveform. It would be wise to check the heater supply before replacing the tube. Check that the heater supply diode D901 is not leaky. Do the same with its protection capacitor C903. Then check the value of the dropper resistor R902. The value shown on the official circuit is 120 $\Omega$ , but 150 $\Omega$  is better. These measures should ensure correct operation of the heater chain and enhance the life of a new tube.

## QUERY COUPON

Available until 17th February, 1982. One coupon, plus a £1.00 (inc. VAT) postal order, must accompany EACH PROBLEM sent in accordance with the notice on page 210.

## TELEVISION FEB. 1982

## DECCA 100 CHASSIS

The following fault has developed: the width is about three inches short on each side across the centre of the screen and about an inch short on each side at the top and bottom.

This fault is fairly common on the 100 chassis and is almost always due to dry-joints around the EW correction loading transformer T402 or its associated plug/socket joints. The line output panel has to be removed to get at them.

# TEST CASE

## 230

*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.*

WE were unacquainted with Roberts Video products until one arrived in the workshop recently for repair. A beautiful cabinet, touch tuning, good sound and, we discovered, a Philips G9 chassis inside. The set had more than one problem, but the main symptoms were lack of width and brightness. The first step to take under these circumstances is to check the h.t. voltage, which we found to be low at just 135V instead of 205V. We wound up the set h.t. potentiometer to see what effect this would have: the h.t. rose but little, with correspondingly little change in picture width.

Some time was spent on the power supply unit, checking the values of the resistors associated with the set h.t./e.h.t. control and investigating the reference/temperature compensating zener diode D8017 and the control transistor Tr8007. These tests were fruitless, and connecting the output from the power supply to a dummy load then proved that the unit was capable of providing the correct h.t. voltage with a normal current drain.

Attention was turned to the line output stage therefore, the suspicion being that something here was loading down the h.t. line. One by one we disconnected the tripler, the scan coils and the diodes associated with the line output transformer. Disconnecting each of these items reduced the problem to some extent, but still the fault remained. Further voltage checks revealed that the 45V supply, which is obtained from the emitter of the line output transistor, was low at 34V, and that the other line output transformer derived voltages were proportionately low. Out came the oscilloscope. The amplitude of the waveform at the collector of the line driver transistor was found to be low, due to the low h.t. of course, and the waveform at the collector of the BU208 line output transistor was also of low amplitude.

## GRUNDIG 2055GB

The fault on this monochrome portable is the display of teletext lines and test signals across the screen some three inches from the top. Fitting a new PCL805 field timebase valve has made no difference.

The cause of the fault is slow field flyback, and on this model it's usually due to short-circuit turns in the primary winding of the field output transformer. The only test is to fit a replacement.

With a sinking feeling we decided to try replacing the flyback tuning capacitor C5131 – no change. Perhaps the line output transformer was in trouble? None in the stores, the G9 not being a very common chassis.

When we returned to the set we noticed that the weatherman was on and turned up the volume to hear what he had to say... no sound either! With a jaundiced eye we peered at the sound department on the signals panel. The l.t. supply feed resistor R3141 (39Ω) was badly burnt, accounting for the hot smell we'd noticed whilst wielding the meter. Short-circuit sound output transistors on top of everything else? Could this be part of the problem? What do you think? Answer next month.

## ANSWER TO TEST CASE 229

– page 158 last month –

Last month found us struggling with a Philips G8 which produced good off-air pictures but suffered from a niggling fault when replaying VCR tapes – fluttery horizontal bars were present in this mode, and a new tuner and both fair and foul attacks on the a.g.c. line did nothing to alleviate the symptom. With some help from Newark (thanks Steve!) we finally managed to sort it out.

The first point to bear in mind is that the replay signal from a VCR is noisier than an off-air signal. Now all colour sets incorporate a black-level clamp, which usually operates during the video signal's back porch period. The idea is that the clamp circuit samples the signal level during the back porch, when the transmitted signal is at black level, and clamps the luminance d.c. level accordingly. If the sampling period is very short however, and the set is looking at a noisy off-tape signal, the sample will be at a different level each time. As a result, the clamp circuit will keep changing the brightness level – depending on the instantaneous voltage it sees during the brief sampling period.

In the G8 chassis (with BA00 signals panel) the clamp resides in the TBA560C chip. Its reservoir/time-constant capacitor is C224 at pin 4. We found that by increasing the value of this capacitor from 0.15μF to 1μF the time-constant was increased sufficiently to eliminate the problem, i.e. the variations were smoothed out.

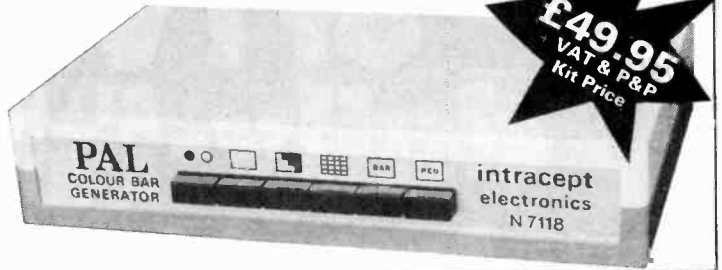
We've since found that the same effect can occur with other TV set/VCR combinations where the time-constant of the clamp circuit is short. Be wary of increasing the time-constant too much though, as a shading effect may appear on the picture. This happened on our Philips set when more than 1μF was hung on pin 4 of the TBA560C.

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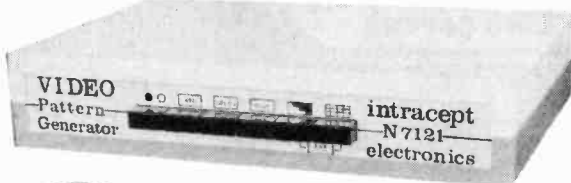
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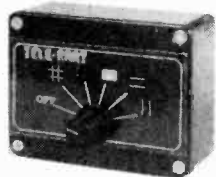
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Goods despatched on receipt of order.  
All Prices Include VAT at 15%. P & P per Order 30p. S.A.E. for Leaflets. Access Cards.

**ELECTRONIC MAILORDER LTD,**  
62 Bridge St, Ramsbottom, via Bury, Lancs. BLO 9AGW.  
Tel Rams (070 682) 3036.

### AERIAL AMPLIFIERS

Aerial amplifiers can produce remarkable improvement on the picture and sound in fringe or difficult areas.

**B45** - For Mono or Colour this is tunable over complete UHF television band.

**B11** - For stereo or standard VHF/FM radio.

**B12** - for VHF television band 1 & 3. All amplifiers are complete and ready to use Battery type PP3 or 8V to 18V DC next to the set type fitting. **PRICES £6-70 each.**

## MAIL ORDER ADVERTISING

### British Code of Advertising Practice

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

### Mail Order Protection Scheme

If you order goods from Mail Order advertisements in this magazine and pay by post in advance of delivery, Television will consider you for compensation if the Advertiser should become insolvent or bankrupt, provided:

- You have not received the goods or had your money returned; and
- You write to the Publisher of Television summarising the situation not earlier than 28 days from the day you sent your order and not later than two months from that day.

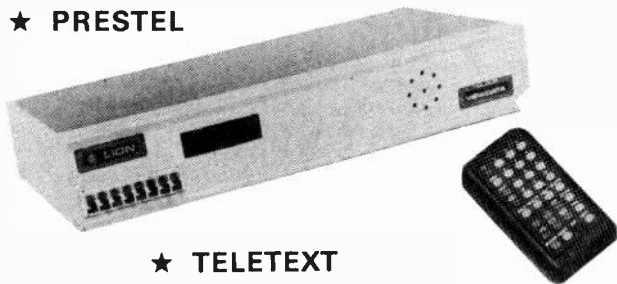
Please do not wait until the last moment to inform us. When you write, we will tell you how to make your claim and what evidence of payment is required.

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

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

**LION TELETEXT PRESTEL ADAPTOR**  
 why buy two separate adaptor's when one will do?

★ PRESTEL



★ TELETEXT

Our adaptor has the plug-in Lion Teletext or Prestel and Teletext board which is used in our Television TXV 56 and our Ferguson Colourstar adaptor. Features include: Full Infra Red Remote Control, Printer Facility, Full alphanumeric Keyboard or microcomputer input, Cassette Recording Output, Autodial of Viewdata numbers, 8 Page Memory Option. Local Editing Facility and many other features.

*Realistic Prices:*

AXV03 £250 AXV04 £199 (teletext only)

**LION TV**

18 HARCOURT TERRACE, LONDON SW10  
 Tel: 01-373 5218

**TELEVISION TUBE SHOP LTD**

BRAND NEW TUBES AT CUT PRICES

A28-14W.....	£21.95	9AGP4.....	£21.82
A31-19W/20W.....	19.95	190AB4/C4.....	23.00
A31-120W/300W.....	17.95	230DB4/CT468.....	31.00
A31-410W/510W.....	17.95	CT507 equiv.....	21.95
A34-100W/510W.....	18.50	CT512.....	27.50
A38-160W/170W.....	17.50	310DGB4/DMB4.....	23.00
A44-120W/R.....	27.00	310EUB4.....	19.95
A50-120W/R.....	17.95	310EYB4.....	18.75
A59-23W/R.....	21.50	310FXB4.....	17.50
A61-120W/R.....	19.95	310GNB4A.....	31.00
		310HCB4.....	31.00
		340AB4.....	22.50
		340AYB4.....	30.00
		340AXB4.....	30.00
		340RB4/CB4.....	26.00
		340AHB4.....	26.00
		RIGONDA 6''.....	14.00

**Some Rebuilt Japanese  
 & European Types  
 Available from  
 £14.00 + VAT £2.10**

**COLOUR TUBES**

(NEW & MULLARD/THORN COLOREX)\*

12VARP22.....	£62.50	A56-120X.....	£54.00
330AB22.....	73.50	A56-500X/510X.....	63.00
A44-271X.....	60.00	A63-120X.....	69.50
A47-342X.....	63.00	A66-120X.....	65.00
A47-343X.....	63.00	A66-140X/410X.....	70.50
A49-191X.....	53.00	A66-500X/510X.....	65.00
A51-161X.....	67.00	A67-120X.....	65.00
A51-220X.....	55.00	A67-140X/200X.....	69.50
A51-500X/510X.....	64.50	A67-150X.....	75.00

\*Old Bulb Required for Colourex\*

ADD 15% VAT TO ALL THE ABOVE PRICES.

Allow 14 days for delivery.

ALL TUBES TESTED BEFORE SALE & FULLY GUARANTEED  
 52 BATTERSEA BRIDGE RD., LONDON, SW11.  
 Tel. 228 6859/223 5088 CARRIAGE: Mono £3, Colour £10

**N.G.T. COLOUR TUBES**

First Independent Rebuilder with

**B.S.I. CERTIFICATION**

(Certificate No. 004)

2 year guarantee: 4 year option

All Colour Tubes are debanded, high temperature pumped and rebanded using new adhesives and new tension band.

19'' £30, 20'' £32, 22'' £33, and 26'' £38.

No exchange tube required on delta types.

**N.G.T. ELECTRONICS LTD.,**

120, SELHURST ROAD, LONDON S.E.25

Phone: 01-771 3535.

20 years experience in television tube rebuilding. add VAT at 15%

**It's easy  
 to complain  
 about  
 advertisements.**

Every week, millions of advertisements appear in the press, on posters or in the cinema.

Most of them comply with the rules contained in the British Code of Advertising Practice and are legal, decent, honest and truthful.

But if you find one that, in your opinion, is wrong in some way, please write to us at the address below.

We'd like you to help us keep advertising up to standard.

**The Advertising  
 Standards Authority.**

A.S.A. Ltd., Brook House, Torrington Place, London WC1E 7HN.

**EMO - EUROSONIC - GRUNDIG - TELETON + ALL BRITISH MAKES  
 ETC., ETC. ● ALL SPARES READILY AVAILABLE ●  
 IMMEDIATE CREDIT AVAILABLE—TRADE ONLY**

Almost any TV Component supplied by return "off the shelf" e.g. LOPTX - EHT trays - droppers - OSC coils - switches - cans - smoothers - I.C.'s, etc., etc.

**YOU CAN BE 95% SURE WE CAN SUPPLY ANY  
 TV COMPONENT BY RETURN  
 IF YOU NEED SPARES FAST - RING NOW!**

ACCESS AND BARCLAYCARD ACCEPTED.

S.A.E. FOR FREE WALL CHART

**TELEPART (WTON) THE TELECENTRE, WORCESTER ST.,  
 WOLVERHAMPTON (0902) 773122**



## SETS & COMPONENTS

CASED ISOLATION TRANSFORMERS. 500W max suitable TV work £8.00 + £2.65. Good working test equipment P.S.U.s. Lists. Tel. (0396) 841631, or write S.H.E., 5 St. Josephs Park, Ballycruttle, Downpatrick BT30 7EN.

## QUALITY REBUILT TUBES

HIGH TEMPERATURE PUMPING

COLOUR (2 year Guarantee)

90° up to 19"	£33
90° 20" - 22"	£35
90° 25" - 26"	£36
110° and PIL	£40

MONO (including thin necks) from £14.

All prices + VAT

Delivery UK Mainland £6.

4 year Optional Guarantee

Send or phone for full list and terms.

### WELTECH PICTURE TUBES

Unit 3-10 Wembley Commercial Centre, East Lane, Wembley, Middx. 01-908-1816

Telephone: Northwood (Middx.) 27019 01-845 2036

## RETACH LTD.

Rear 78 High St., Northwood, Middx.

NOW OFFER!!!

RANK 823 and THORN COLOUR from £20  
ALSO  
REBUILT COLOUR TUBES. From £28  
2 year Guarantee.

ALL PRICES + VAT.

## SMALL ADS

The prepaid rate for classified advertisements is 29p per word (minimum 12 words), box number 60p extra. Semi-display setting £5.64 per single column centimetre (minimum 2.5 cms). All cheques, postal orders etc., to be made payable to Television, and crossed "Lloyds Bank Ltd". Treasury notes should always be sent registered post. Advertisements, together with remittance, should be sent to the Classified Advertisement Manager, Television, Room 2612, IPC Magazines Limited, King's Reach Tower, Stamford St., London, SE1 9LS. (Telephone 01-261 5846).

## NOTICE TO READERS

Whilst prices of goods shown in classified advertisements are correct at the time of closing for press, readers are advised to check with the advertiser to check both prices and availability of goods before ordering from non-current issues of the magazine.

## TRADE ONLY N. W. ELECTRONICS

Have for disposal large quantities of good class

## COLOUR TVs,

Bush, Pye, GEC, Thorn, Hitachi, Philips, etc. (Ex Co-op). Not junk, very clean cabinets.

Genuine change over TVs and repossessions.

From only £20. Delivery arranged.

We export large quantities of TVs weekly, can we help you? Call now and see our selection, over 1000 TVs to choose from.

N. W. Electronics, Bolingbroke Buildings,

Bolingbroke Street, Bradford 5.

3 Mins from Motorways.

Tel. 0274 390121.

TRIANGLE TELEVISIONS Coleraine, N.I. Quality working sets. Clean cabinets, Decca, Bush, Korting. Bulk non workers available. Phone Coleraine 3600.

### CAMPBELL ELECTRONICS LTD.

Distributors of specialist spares to radio and television service depts.

We stock semiconductors, I/Cs, special T.V. and audio spares, service aids, rebuilt CRTs etc.

Fast off the shelf delivery of stock items.

Send S.A.E. or telephone for full catalogue and price list.

### CAMPBELL ELECTRONICS LTD.,

Unit 5, Heath Hill Estate,

Dawley, Telford, Shropshire.

Telephone Telford (0952) 502422.

EX-EQUIPMENT PANELS. Thorn 2000, 3000, 3500, RBM A823, Decca 30, GEC 2040, plus many others. Also complete mono televisions. SAE list Camber Television Centre, Lydd Road, Camber, Sussex.

## LOPT TESTER

An entirely new instrument development for checking Line O.P. transformers for shorted turns. It needs only one shorted turn on a LOPT to render it useless and this sensitive unit will detect it.

This will save every service workshop many hours every week in the increasingly endless elimination process of checking the Line OP stage and as often happens the unnecessary fitting of a new LOPT and putting the old one back.

Test in the set or out of it in moments. We guarantee that you will become very dependant on this Test Set. We also anticipate that it will become a must in all workshops both here and overseas. Mains operated. Led indicators measures 4" x 3" x 1 1/2" with instructions and useful hints.

£16.50 inclusive C.W.O.

Additional postage please overseas.

### J. BAKER & CO.

1, Old Shoreham Rd., Southwick, Sussex BN4 4RD.

Tel. Brighton 593315.

## T.V.s FOR EXPORT

We have a selection of Bush and Ferguson colour T.V.s in good working order.

VHF/UHF suitable for countries using PAL system. We also supply The Home Market.

Write:

Tele Spares Ltd.,  
7 Walkinstown Road,  
Dublin 12, Ireland.  
Tel: Dublin 520485.

When replying to Television Classified Advertisements please ensure:

- That you have clearly stated your requirements.
- That you have enclosed the right remittance.
- That your name and address is written in block capitals, and
- That your letter is correctly addressed to the advertiser.

This will assist advertisers in processing and despatching orders with the minimum of delay.

TURN YOUR SURPLUS capacitors, transistors, etc., into cash. Contact Coles-Harding & Co., 103 South Brink, Wisbech, Cambs. 0945 4188. Immediate settlement.

## TRENT TUBES

31 Radcliffe Road,  
West Bridgeford,  
Nottingham  
0602 813329

**IN LINES** **NOW** **P.I.L.S.**  
AT  
CASH AND CARRY  
PRICES

**TWO YEAR GUARANTEE**  
FOUR YEAR OPTION EXTRA

A51-161x  
490 OVB 22 510 CJB 22 510 JCB 22  
510 UFB 22 12 VARP 22 510 HWB 22

**ONLY £30.00** exchange + VAT  
470 ELB 22 560 HB 22 560 TB 22  
560 AKB 22 470 ESB 22

**ONLY £35.00** exchange + VAT  
A56-510x A66-510x  
510 JKB 22 510 JEB 22

**ONLY £38.00** exchange + VAT  
MANY MORE TYPES AVAILABLE.  
PLEASE ENQUIRE FOR PRICES

**ALL standard DELTA**  
**Colour Tubes**

**ONLY £25.00** exchange + VAT  
on our Cash & Carry trade counter  
**TWO year standard GUARANTEE**  
Four year optional extra

### ALL TUBES

- \* Fitted with **High Definition** guns
  - \* **High Temperature** pumped 385°C
  - \* **Electronically** and **Picture** tested
  - \* **Delivery** service available
  - \* **Quantity Discount**
  - \* Suppliers to **Major** national companies
  - \* **Automated Computer** controlled production ensures **Quality & Reasonable Prices**
  - \* **VDU** and **Mono's** certainly
  - \* **Technical Advice** service available.
- NOW YOU HAVE SEEN THE BEST**  
**GET THE BEST FROM TRENT TUBES**

GRUNDIG, NORDMENDE colour sets ex-rental, small quantities only. Also all tested panels. Telephone 0785 814643.

# SUFFOLK TUBES LIMITED

214 Purley Way, Croydon, Surrey.  
Tel: 01-686 7951/2/3/4

SUPPLIERS OF MONO AND COLOUR TUBES TO MAJOR RENTAL COMPANIES.

ALL COLOUR TUBES HOT PUMPED AT 385c AND REBANDED TO BRITISH STANDARD. 415 1972 CLAUSE 18-2.

19" and 22" TUBES APPROVED. OTHER TYPES PENDING.

BRITAINS LARGEST INDEPENDENT REBUILDER FOR 21 YEARS.

### BILLINGTON VALVES Valve Experts

Proprietor Mr M. Billington,  
23 Irwin Dr., Horsham, W. Sussex.  
We stock a full range of valves at the cheapest prices, anywhere. For example: Mullard PCL84 70p. EF80 55p. KT66 (UK) £6.85. All valves by well known, reputable makers, guaranteed 90 days. We also stock wireless world's, components, rare vintage valves.  
½ kg high quality electrical solder £4.50+90p post! 400 ½, 1, 2 watt (5%) resistors £1.50+50p post.  
Old customers: please send an S.A.E. for our latest list/newsheet.  
Immediate despatch. Minimum order £1.25. C.W.O. please. SAE Lists. No callers please. No phone calls; sorry.

### CAMPBELL ELECTRONICS LTD.

COLOUR T.V. PANEL EXCHANGE/  
REPAIR SERVICE

THORN, RANK, PHILIPS, GEC,  
DECCA, TELPRO, GRUNDIG etc.  
90 Day Guarantee on all repairs - same day postal service.

Telephone Telford (0952) 502422  
for catalogue and price list.

**CAMPBELL ELECTRONICS LTD.,**  
Unit 5, Heath Hill Estate,  
Dawley, Telford, Shropshire.

### RANK, BUSH, MURPHY

Colour TV Panels repair

By top engineers from ex RRI workshop at Ware. A23, T20, Z718, T22, T24, T26 chassis covered. Contact for most competitive prices:

31 Leaves Spring,  
Stevenage, Herts.  
Tel. Stevenage 61567.

### TELFURB T.V. LTD.,

PHILIPS G8, 570. ITT. PYE  
262, CT200. BUSH. THORN  
8800, 8500, 3500. GEC 2110.  
DECCA VARI. TOSHIBA &  
MONO. PLUS REFUR-  
BISHED SETS TO ORDER.

RING:

**WHEATLEY, OXFORD**  
086-77-3849

### TRIPLERS - PRICES REDUCED

Thorn 3000/3500 inc. p.p.  
Thorn 9000 Add 55p VAT.  
**UNIVERSAL** £3.65 1 year guarantee

The UNIVERSAL TRIPLER can be used in most G.E.C., I.T.T., Pye, Rank, Decca & Continental sets.

### WING ELECTRONICS

15 Waylands, off Tudor Rd, Hayes End, Middlesex

BUSH 24"/20" S/S MONO'S, good working order, clean, polished. £10 each, minimum ten. Delivery anywhere. (0706) 623404.

### T.V. PATTERN GENERATOR

- UHF output plugs straight into aerial socket no other connection required.
- Crosshatch + 4 patterns **£17.25**
- Crosshatch + Greyscale **£18.50**
- UHF Modulator with video and sound inputs **£22.50**

Prices include P&P and VAT.  
SAE for details:

**C. L. JERVIS**  
15 Mercer Grove,  
Wolverhampton, WV11 3AN.  
Tel. (0902) 23916.

### TV DX SPECIAL OFFER!

Schrader, tunable masthead amplifiers.  
UHF. RB45-M4 ch. 21-65. Gain 22-26dB. Noise ratio 3.5dB. Bandwidth 10-15MHz. max. overload 10mV. incl. power/tuning supply VR12/01 **£34.50**.  
UHF. RB45A-M4 (incl. amateurband) ch. 17-65. incl. power/tuning supply VR12/01 **£39.50**.  
VHF. RB3. ch. 5-11. Gain 26-30dB. Noise ratio 2.5dB. Bandwidth 10-15MHz. max. overload 10mV. incl. power/tuning supply VR12/01 **£44.50**.  
Extra for power/tuning supply incl. 6 presets **£13.50**.  
VHF. UHF P.S. incl. set side VV1/01 2x6dB. **£7.50** VV1 2x12dB. **£9.50**.  
CRT reactor, excluding CRT socket. Works beautifully **£20.00**.

Prices incl P&P. Send SAE for catalogue.

**REYSTRONICS,**  
28 Pemberton Road,  
East Molesey, Surrey.  
Phone 01-979 7380.

# TELEVISION

# R A D E

WE HAVE WAYS OF MAKING YOU BUY. WE ARE GOING TO THUMP YOU WITH BARGAINS, MAKE YOU SQUEAL WITH PAIN AT THE BIG DISCOUNTS, TWIST YOUR ARM WITH LOW PRICES.

NOW YOU'VE HAD ENOUGH, GET YOUR CASH AND A WAGON & COLLECT (OR YOU'LL BE SORRY!).

## GENERAL FACTORS

GOOD MOTORWAY ACCESS  
EXPORT ENQUIRIES

UNION ST, DONCASTER DN1 3AE  
TELEPHONE (0302) 49583-68416

OPEN MON to SAT

### PHILIPS N1700 VIDEO CONVERSION KITS

5 HOUR DUAL SPEED RECORDINGS,  
EASY FIT - SUPERB PICTURE QUALITY.

NEW... ADD ON MODULE WITH FREEZE,  
PAUSE, FRAME ADV, SLO-MO & SEARCH.

For details of all our Philips conversions contact

**EVANS VIDEO SERVICES**  
ON 061-439 8696... NOW

### UPCONVERTERS

**Wideband VHF to UHF Converter** 12 volt  
supply required. Simple connection. Ideal  
Eire, overseas use £10.80 inc. p.p.

**TVDX Equipment.** Amplifiers, filters.  
Special DX Upconverter.

SAE Data, Lists:

H. Cocks,

**Cripps Corner, Robertsbridge,  
Sussex. Tel. 058083 317.**

### COLOUR TUBES £24

22" (A56), 20" (A51) re-gunned to a high  
standard. 1 year guarantee. Prices inclusive  
plus £6 del. per tube (U.K. mainland). No  
need to spend £6 returning old tube if you buy  
from us.

#### CASH & CARRY ONLY

17", 18", 19"	£29	OLD
20", 22"	£24	GLASS
26"	£35	NEEDED

#### NEW MONO

20" & 24" £15

Callers ring first

#### U-VIEW (TUBES),

29, Warmsworth Rd., Doncaster,  
Yorkshire DN4 0RP.

Tel: (0302) 855017 (Open 7 days)

### T.V. SPARES, PANELS AND MANUALS PHILIPS · GRUNDIG

**TELEVIEW** 01-994 5537  
194, Acton Lane, London W.4.

### Southern Valve Co.,

2nd Floor, 8 Potters Road, New Barnet, Herts.

Tel: 01-440 8641 for current prices & availability, all popular  
valves stocked. SAE Lists, Cash with order. Same Day  
Postal Despatch. (Mornings Preferred). Not Thurs.

Valves, Tubes, Aerials etc by LEADING-MAKERS. Send SAE  
Lists or Phone for current prices. Counter. NO COD. Speedy  
Despatch assured. No order under £1.

Philip Bearman, 8 Potters Road, New Barnet, Herts.  
Tel: 01-449 1934/5 (1934 Recording Machine).  
Closed Thurs. Please phone for opening hours.

### VETERAN & VINTAGE

#### "SOUNDS VINTAGE"

The only magazine for all vintage sound  
enthusiasts, packed with articles by top  
writers, covering gramophones, phono-  
graphs, 78s wireless, news, history,  
reviews, etc.

All back-numbers to No. 1 available. Send  
75p for sample copy.

28 Chestwood Close, Billericay, Essex

### WANTED

WANTED. Newnes Radio and T.V. Servicing Books,  
up to 1967-68, and 1970-71, 1972-73 volumes. Phone  
0922-29387, Philip.

WANTED. Scancoil for a 26" Kuba Florence colour.  
Cash waiting. Phone Bakewell 4283.

NEW VALVES and CRT's required, PCL805,  
PL504, PL509, PY500A etc. Cash waiting. Bearman,  
8 Potters Road, New Barnet, Herts. Tel: 01-449  
1934/5.

WANTED. Television tube rebuilding equipment.  
Lathe drop sealer ovens etc. Phone 0742/481930.

### COURSES

**VIDEORECORDER TRAINING COURSE.** Yet  
another super technical training course for TV  
engineers who want to learn about videorecorders.  
Saturday and Sunday January 30th and 31st 1982.  
For details contact Mrs. Beeching, Newark Video  
Centre, 108 London Road, Balderton, Newark, Notts.  
Tel. (0636) 71475.

### EDUCATIONAL

### TELEVISION COMPUTER RADIOCOMMUNICATIONS & RADAR SERVICING

**2½ YEAR full-time Modular  
Diploma course to include a high  
percentage of practical work.**

- ELECTRONIC PRINCIPLES
- MONO TV & CCTV
- COLOUR TV & VCR
- MICROELECTRONICS &  
DIGITAL TECHNIQUES
- MICROPROCESSORS &  
COMPUTERS
- RADIOCOMMUNICATIONS &  
RADAR

Each of the above Modules are 13 weeks  
in duration. Individual Modules can be  
arranged for applicants with suitable  
electronics background.

Subject to approval, students will be  
awarded a TEC Diploma in Electronics &  
Communication Engineering on Com-  
pletion of the full course.

Next session starts April 19th.

Prospectus from:

### LONDON ELECTRONICS COLLEGE

Dept: PP, 20 Penywern Road,  
London SW5 9SU. Tel: 01-373 8721.

### BETTER JOB! BETTER PAY!

GET QUALIFIED WITH ICS IN:  
**COLOUR & MONO TV SERVICING**  
**COLOUR & MONO TV ENGINEERING**  
**COLOUR & MONO TV MAINTENANCE**  
PLUS: Telecommunications, radio, elec-  
tronics, electrical engineering, technical  
communications, radio communications,  
etc., etc.,

**NEW: Self-build radio courses with free  
kits**

Train in your own home, in your own  
time with ICS, the world's most experi-  
enced home study college.

**RETURN THIS COUPON TODAY  
FOR FREE BROCHURE!**

**ICS** Int. Correspondence Schools  
284R Intertext House, Stewarts Road,  
London SW8 4JJ. Tel: 01-622 9911

Name .....

Address .....

### PERSONAL

**CHRISTIAN SINGLES.** Friendship contacts. 1982  
Holidays. Weekend Houseparties. - C.F.F. Dept/369,  
Edenthorpe, Doncaster.

### BOOKS & PUBLICATIONS

**ANY PUBLISHED SERVICE SHEET £1 + S.A.E.**  
Thousands different repair/service manuals/sheets in  
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circuits £8.50). S.A.E. Newsletter, price lists,  
quotations. AUST, 76 Church Street, Larkhall,  
Lanarkshire. (0698 883334).

### FOR SALE

**EX-RENTAL PHILIPS G8s & PYE 205s** to clear.  
Phone Malcolm Watson, Fitzroy Electronics,  
Cambridge (0223) 68210.

**NEW BACK ISSUES** of 'Television' available 95p  
each post free. Cheque or uncrossed P/O returned if  
not in stock. - BELL'S TELEVISION SERVICES,  
190 Kings Road, Harrogate, N. Yorkshire. Tel.  
(0423) 55885.

**BUSH 24"/20" S/S MONO'S**, good working order,  
clean, polished. £10 each, minimum ten. Delivery  
anywhere. (0706) 623404.

**TV ENGINEERS** - Improve your efficiency by in-  
stalling an Answercall Twin-tape P.O. Approved  
Telephone Answering Machine with remote Call-in.  
£229 inc. V.A.T. and delivery. Tel. (063876) 410.

**G8 COMBINED SIGNAL** Panel Type BA00 new  
condition, tested on colour, 2 off at £15.00 each. Tulk,  
Weymouth 72759.

**PHILIPS G8s.** Good working order. Good clean  
cabinets, polished, ready to sell. £57 each, minimum  
five delivery anywhere. Tel. (0706) 623404.

### MISCELLANEOUS

**C.E.D., C.R.T., Tester** reactorvator suitable for most  
types of colour and mono including P.I.L. and 20AX  
types, checks emission, detects and measures inter  
electrode leakage, incorporates a very effective boost  
facility. Not a kit but a professional instrument £85.10  
inc. VAT 10 day money back assurance. C. E.  
Developments, 54, Baronsmead Road, High  
Wycombe, Bucks HP12 3PG. Tel. High Wycombe  
30307.

**PRE-PACKED.** Screws, nuts, washers, solder tags  
studding. Send for price list. A1 Sales (TV), P.O. Box  
402, London SW6 6LU.

**BURGLAR ALARM EQUIPMENT.** Latest  
Discount catalogue out now. Phone C.W.A.S. Alarm.  
0274 682674.

**RIGONDA AGENTS.** For all spares and repairs.  
Fast despatch trade service available. 01-476 1928.  
Star Radio, 272 Barking Road, London E.13.

**CENTURION BURGLAR ALARM EQUIPMENT.**  
Send SAE for free list or a cheque/PO for £11.50 for  
our special offer of a full sized signwritten bell cover,  
to: Centurion Dept. T.E.L., 265 Wakefield Road,  
Huddersfield, W. Yorkshire. Access & Barclaycard  
telephone orders on 0484-35527.

### SERVICE SHEETS

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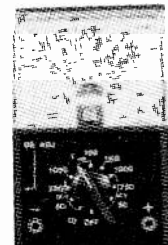
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TDA3560	£1.50	BC350	20p	MJE51T	25p		
SN168ZAN	£1.00	BC365	10p	MJE2801	30p		
SN16964AN	50p	BC413	7p	BY127	10p		
SN29764	£1.00	BC454	7p	BY133	10p		
SN29848	50p	BC460	25p	BY134	10p		
SN75108AN	£1.00	BC462	7p	BY176 Type	25p		
SN76001	£1.00	BC463	7p	BY179	35p		
SN76003*	£1.00	BC546	7p	BY184	25p		
SN76013*	£1.50	BC548	7p	BY187	10p		
SN76023*	£1.50	BC559	7p	BY190	40p		
		BC131	30p				

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