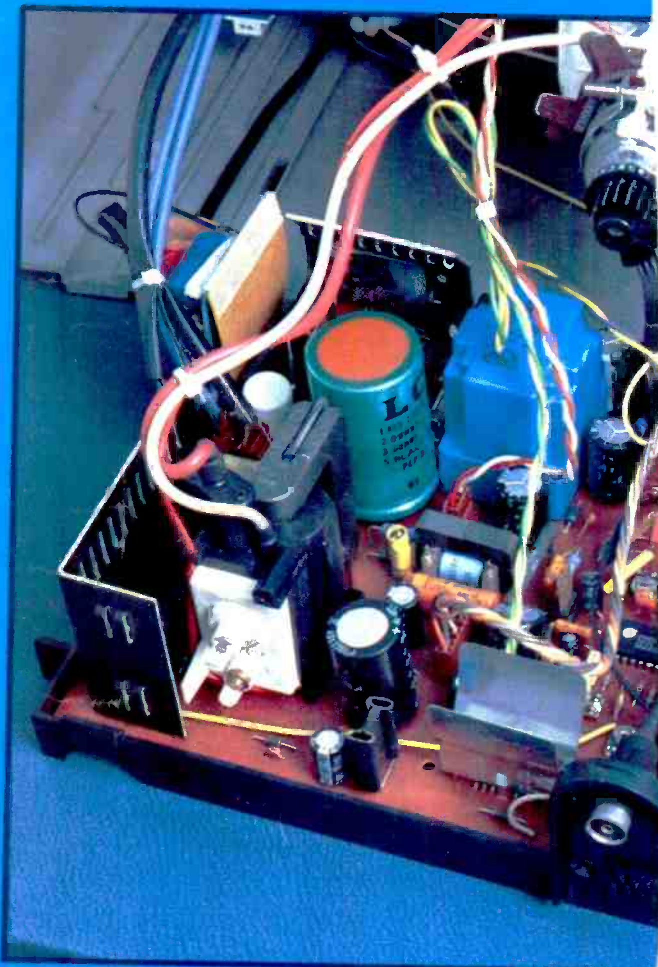
SEPTEMBER 1986

TELEV

SERVICING·PROJECTS



Servicing t

DX-TV • Behi

TELEVISION

September 1986

Vol. 36, No. 11
Issue 431

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

SUBSCRIPTIONS
An annual subscription costs £14 in the UK, £17 overseas (by surface mail). Send orders with payment to Quadrant Subscription Services Ltd., Oakfield House, Perrymount Road, Haywards Heath, Sussex, RH16 3DH.

BINDERS AND INDEXES
Send orders for binders (£4·50) and indexes (75p) to the Editorial Office, Television, IPC Magazines Ltd., King's Reach Tower, Stamford Street, London SE1 9LS. Prices include VAT and postage. Add 60p for overseas orders.

BACK NUMBERS
Some back issues published during the last six months are available from the Editorial Office at £1·40 inclusive of postage and packing. Address as above.

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

this month

701 Leader

702 Servicing the Fidelity ZX3000 Chassis — *David Botto*
An account of the TDA4600/BU426A chopper power supply circuit and the steps to take when dealing with a dead set.

707 June's Daughter — *Les Lawry-Johns*
June's daughter's set was an ITT CVC5 that caused quite a problem. Then there was another Dawe, with a troublesome TX10.

708 Teletopics
News, comment and developments.

710 Letters

711 Servicing Sinclair Microcomputers, Part 5 — *Ken Taylor*
Notes on earlier versions of the Spectrum.

714 Satellite TVRO Installation, Part 2 — *Harold Peters*
Back to basics plus a survey of who sells what in the TVRO market.

718 The Toshiba V5470B – fault-finding guide — *John Coombes*
A run-down on common faults with this piano-key operated Betamax machine.

720 The Development of Colour Tubes, Part 4 — *Eugene Trundle*
This time the screen end of the tube – the phosphors and characteristics of the glass faceplate. Also tube safety features and definition enhancement.

723 Correction and Next Month in Television

726 The Operation of Electric Motors, Part 2 — *Mike Phelan*
Split-phase and synchronous motors plus some hints on servicing.

728 Sinclair QL Test Pattern Program — *John de Rivaz, B.Sc. (Eng.)*
The program provides colour bars, a crosshatch and full test pattern.

729 Modern Receiver Circuitry, Part 6 — *J. LeJeune*
Infra-red remote control for TV sets, taking the Mullard SAA5000 system as an example.

732 Cable '86
Harold Peters reports on the 1986 cable/satellite TV show at Brighton.

733 VCR Clinic
Reports from Hugh Allison, Christopher Holland, Philip Blundell, Eng. Tech., Steve Leatherbarrow, K. N. Bayes, Brian Wright and R. T. Rees

734 TV Fault Finding
Reports from Richard Roscoe, Roger Burchett, Alan Shaw, J. R. Armagh, Geoff Fardon and L. Dinsdale.

736 Long-distance Television — *Roger Bunney*
Reports on DX conditions and reception plus news and band changes.

739 Service Bureau

740 Test Case 285

OUR NEXT ISSUE DATED OCTOBER WILL BE PUBLISHED ON SEPTEMBER 17

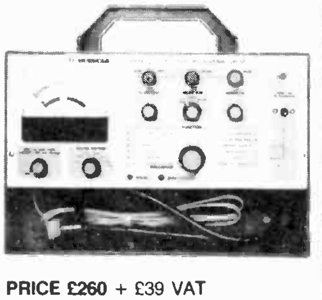
INCREASE YOUR PROFITS IMPROVE YOUR SERVICE WITH RELIABLE COST EFFECTIVE TEST EQUIPMENT

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

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

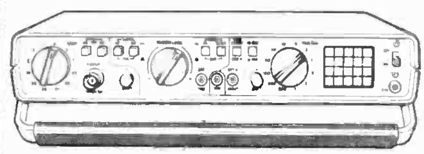
- ★ Tests for shorts and leakage between electrodes.
- ★ Tests cathode emission characteristics.
- ★ Separately checks condition of guns.
- ★ Removal of shorts and leakage between electrodes.
- ★ Checks heater warm-up characteristics.
- ★ Rejuvenation of low emission cathodes with automatic timing.
-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

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



PRICE £260 + £39 VAT

THE VERY LATEST SC110A LOW POWER, FULLY PORTABLE OSCILLOSCOPE.



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

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

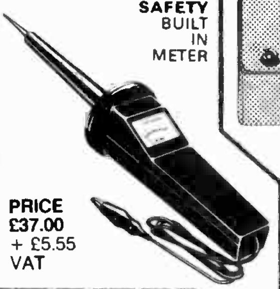
PRICE £165.00 + £24.75 VAT

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

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

LEADER HIGH VOLTAGE METER EHT PROBE

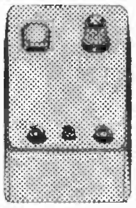
Measures up to 40 K.V. D.C. with **SAFETY** BUILT IN METER



PRICE
£37.00
+ £5.55
VAT

✱ FULLY GUARANTEED

LOPT TESTER



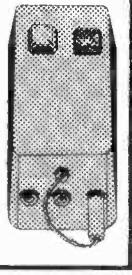
BK's REVOLUTIONARY DYNAMIC 'LOPT' TESTER
Revolutionary L.O.P.T. tester. Operates in dynamic mode which actually tests the L.O.P.T. under high voltage conditions without de-soldering or removal.
Size 75×100×40 mm. Supply 240V AC

PRICE £25.99 + £3.90 VAT

CRT TESTER-REJUVENATOR

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

PRICE £32.00 + £4.80 VAT



HAMEG HM 203-5 20MHz DUAL TRACE OSCILLOSCOPE

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

2 YEAR WARRANTY

WITH COMPONENT TESTER

PRICE
£270.00 + £40.50 VAT
Optional probes as above

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

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

VISA

P. V. TUBES

104 ABBEY STREET, ACCRINGTON, LANCS BB5 1EE.
Tel: 0254 36521/32611 Telex: 635562 Griffin G (For P.V.)

WE CAN NOW SUPPLY ON AN EXCHANGE "HEAD FOR HEAD" BASIS

ONLY
£22
+ VAT
inc P&P

Newlife VIDEO HEADS

THORN EMI VIDEO HEAD UPPER DRUM ASSEMBLIES

ORDER FROM 3 VHS TYPES

	L	J	M
JVC MODELS	HR 3660 HRD 110 HR 7650 HRD 120 HR 7700	HR 7200 HR 7300 HR 7350	HR 3320 HR 3300 HR 3330 HR 4100
AKAI MODELS	VS 9700 VP 77 VS 9800		VS 9300
FERGUSON MODELS	3V16 3V31 3V23 3V35 3V24 3V36 3V38 3V39 3V49	3V29 3V30	3V01 3V00 3V22 3292
BAIRD MODELS	8904 8943 8924 8944 8941	8930 8940	8900 8928 8902 8922
DECCA MODELS	8400 8500	8300	
TATUNG MODELS	8400	8300	
I.T.T MODELS	VR3605 VR3905	VR3913	

New Life Upper Drum Assemblies have been thoroughly life tested and carry a 12 month guarantee covering normal domestic use.

SEND YOUR OLD HEAD PACKED UP CAREFULLY AND WE WILL SEND AN EXCHANGE ONE BY RETURN POST

P.V.
NAMES TO TRUST

THORN EMI

CELTEL

SUMMER CLEARANCE SPECIALS

VHS VIDEO FROM £40 IN TENS
THORN · PHILIPS · DECCA · PYE · ITT
SONY · SANYO · ETC. ETC.
SONY C7 OFF PILE ONLY £35
SANYO 5000 WORKING £75
FOR THE BEST PRICES IN TOWN
RING 0708 861404
2 BREACH ROAD, WEST THURROCK ESSEX RM16 1NR

LINEOUT TRANSFORMERS

3600	DECCA 100	7.95
3601	DECCA 110	9.80
3604	DECCA 1730/1830	11.08
3599	DECCA 80	7.98
3727	DECCA MS1700-2420	10.13
3729	FIDELITY FTV12/TVR120	5.50
5528	FIDELITY ZX3000 22"	14.50
3808	FIDELITY ZX2000/3000	14.50
3731	GEC 2100/2040	5.50
3732	GEC 2114	3.50
3734	GEC 3133	3.60
3733	GEC M1201/M1501H	13.25
3614	GRUNGIG 5010/6010ETC	12.95
3755	INDESIT 24EGB	11.25
3617	ITT CVC30	8.75
3618	ITT CVC45	9.75
3615	ITT CVC5-8	10.25
3620	KORTING A21100 90° HYBRID	14.95
4508	PHILIPS E2 CHASS	10.00
2862	PHILIPS G9	10.95
5305	PYE 691 WIRED	5.00
3628	PYE 725 90°	14.65
3629	PYE 731 110°	13.28
3632	RANK A823	5.50
3634	RANK T16A	8.95
3636	RANK T20A	12.95
3726	RANK T26A	15.50
3637	RANK Z179	11.25
3639	RANK Z718 22"	21.75
3770	REDIFUSION MK1 CHAS	9.38
3771	REDIFUSION MK3 CHAS	15.95
3775	SANYO CTP5101	16.50
3643	THORN 1400 SERIES	5.95
3644	THORN 1500 20"	5.95
3645	THORN 1500 24"	5.95
3646	THORN 1590 SERIES	10.85
3647	THORN 1600 SERIES	10.85
3648	THORN 1615 SERIES	8.95
3649	THORN 1690/91 SERIES	10.50
3713	THORN 1790	8.95
3714	THORN 3787	15.23
3652	THORN 3K 3K5 EHT TX	7.98
3651	THORN 3K 3K5	8.96
6172	PHILIPS G8 SPECIAL	7.98
2868	PHILIPS KT3	10.95

EHT TRAYS

5400	BG1895-641	7.50
5403	BG1897-642	7.50
5404	BG2097-642/333	7.50
3663	DECCA 100	7.25
3665	DECCA 1830	3.00
3662	DECCA 80	7.11
3667	GEC 1028/CS108	3.50
3677	ITT CVC45	7.95
3675	ITT CVC5/9	4.00
3678	KORTING HYBRID	7.95
3683	PHILIPS 550 G8	6.60
3681	PHILIPS 570 (5 LEAD)	4.50
3684	PHILIPS G9	4.00
3685	PHILIPS KT3	6.95
3686	PYE 691/697	6.95
3688	PYE 725/731/741	8.91
5395	SEIMANS TVK186/5	9.50
5393	SEIMANS TVK52	8.50
4696	SEIMENS TVK196/17	11.95
5406	TCE 1400 LARGE SCRN	4.95
3696	TCE 1500 17"-19"	5.65
3697	TCE 1500 23"&24"	4.95
3698	TCE 1600 SERIES	2.95
3700	TCE 4000	4.50
3703	TCE 9000	7.85
3699	TCE3000/3500	7.75
3706	TV11 EHT STICK	0.95
3709	TV20 EHT STICK	0.95
5275	TV45 EHT STICK	2.45
3705	UNIVERSAL EHT TRAY U.K.	4.95

TV ELECTROLYTICS

3547	DECCA 10/30 400X2/350V	2.90
3549	DECCA 100 400+800 350/250V	4.65
3548	DECCA 80/100CHAS 100/400V	2.90
5304	FIDELITY ZX2000 330 385V	4.95
5303	FIDELITY ZX3000 220 385V	3.98
3557	ITT CVC20/RRI T20 220/400	1.20
3556	ITT CVC5/9 200X2+25+75ETC	3.26
3560	PHILIPS G11 470UF/250V	1.79
3559	PHILIPS G9 2200/63V	1.55
3561	PHILIPS KT3 200+25X2/385V	2.65
3554	PHILIPS G8/GEC 2110 600/300V	3.16
3558	PHILIPS G9/PYE 731 600/300 PC	3.16
3565	PYE 725/731 800/250V	1.90
3564	PYE 691/697 200+300/350V	2.00
3576	RRI A823 2500X2/25V	1.48
3588	TCE 3000/3500 1000/70V	0.89
3585	TCE1500 150X2+100/300V	2.35
3587	TCE3000 200+100X2/350V	2.86

MIXED DIALECTRIC CAPACITORS

4270	0.01 600V X5	0.75
4272	0.022 1KV X5	1.95
4273	0.033 1KV	1.40
4274	0.047 600V X5	0.85
4275	0.047 1KV X5	2.47
4276	0.1 600V X5	1.20
4277	0.1 1KV X5	1.98
4278	0.1 1250V X5	2.39
4279	0.1 2KV X1	0.75
4280	0.22 600V X5	1.45
4281	0.22 1KV X1	0.74
4282	0.47 1KV X1	1.02
4283	4700PF 1.5KV X5	1.89
4271	0.01 1KV X5	1.60

SLIDE CONTROLS

4883	100K LIN STD TV	0.55
4884	150K LIN STD TV	0.55
4874	1K LIN STD TV	0.55
4880	22K LIN STD TV	0.55
4881	22K LOG STD TV	0.55
4875	3K3 SEMI LOG STD	0.60
4885	470K LOG STD TV	0.55
4720	470R LG STD	0.99
4719	470R LM STD TV	0.99
4876	4K7 LIN STD TV	0.60
4877	4K7 LOG STD TV	0.55

PRESETS

STANDARD RANGES

VERTICAL STANDARD X 5	0.60
HORIZONTAL STANDARD X 5	0.60
VERTICAL MINI X 5	0.60
HORIXONTAL MINI X 5	0.60

TUNER UNITS

4662	DECCA 30 SERIES MECHANICAL	4.95
4664	ELC 1043/05 EXCH TUNER	6.00
4663	ELC 1043/05 NEW TUNER	8.25
4666	ELC 1043/06 EXCH TUNER	6.00
4665	ELC 1043/06 NEW TUNER	8.25
4972	ELC 2003 EXCH TUNER	12.50
5534	GEC 2100 TYPE REPAIR CHGE	10.25
4675	PHILIPS G8 EXCHANGE TUNER	7.25
4679	RRI RANGERI/2 EXCH TUNER	9.75
4680	RRI 720 NEW TUNER	12.40
4678	RRI RANGER2/3 NEW TUNER	13.15
4668	U321 EXCH TUNER	6.50
4667	U321 TUNER NEW	6.25
4670	U322 EXCHANGE TUNER	6.50
4669	U322 NEW TUNER	7.95
4673	U341 EXCHANGE TUNER	7.25

VALVES

3883	DY802 VALVE	0.75
3932	PCF802 VALVE	0.95
3938	PCL805	1.08
3935	PCL82 VALVE	0.95
3936	PCL84 VALVE	0.85
3937	PCL86 VALVE	0.95
3940	PFL200 VALVE	1.20
3943	PL504 VALVE	1.50
3944	PL508 VALVE	2.06
3945	PL509 VALVE	6.25
3946	PL519	5.95
4870	PL802 VALVE	4.95
3950	PY500A VALVE	2.25
3951	PY801 VALVE	0.95

THORN SPARES

2897	T1590 MAINS TRANSFORMER	9.80
2920	TX10 FOCUS UNIT	7.54
4590	T1600 MAINS TX	7.92
5430	T1690 MAINS TRANSFORMER	9.00
4973	T1690 SLOW MOT. TUN. POT	3.99
2906	T3000/3500 A1 SWITCH	1.68
2904	T3000/3500 MAINS TX	5.00
2908	T3000/3500 METAL CUT OUT	2.34
4587	T3500 100R CONVERG POT	0.85
3277	T3500 200R CONVERG POT	0.56
3278	T3500 500R CONVERG POT	0.56
4585	T3500 50R CONVERG POT	0.65
2905	T3500 5MEG A1 POT	1.17
4589	T3500 SPARK GAP .1/1500	0.51
2907	T3500 THICK FILM VID LOAD	1.45
4563	T38000 MAINS ON/OFF SW.	3.10
4412	T4000 FOCUS CONTROL UNIT	7.60
3273	T6818 220K BRIGHT CTRL	2.18
2909	T8500 FOCUS CONTROL UNIT	2.56
2911	T8500 MAINS CHOKE	17.45
4415	T8500 MAINS TX	12.75
2910	T8500 PLASTIC CUT OUT	3.72
2918	T9000 FOCUS UNIT	4.95
4556	T9000 FR1 THICK FILM	1.65
2919	T9000 OVER VOLT THICK FILM	3.95
4555	T9000 T701 CHOPPER TX	13.75
4982	T9600 0.33 2KV CAP	2.35
2914	T9600 CHOPPER TX T512	8.11
2916	T9600 FOCUS UNIT	2.95
2913	T9600 SWITCH MODE TX T511	9.98
2917	T9800 FOCUS UNIT	5.93
4429	T9800 MAINS CHOKE	11.03
4437	TX10 .0022 2KV	0.25
4658	TX10 100K TUNING POT	0.64
2938	TX10 CHOPPER DRIVER TX	3.27
5427	TX10 SW NONREM CONT.	2.32
2922	TX10 TUNER DRAWER ASSY	1.95
4859	TX9 4" RND 15R SPEAKER	6.95
2937	TX9 INPUT CHOKE L65	12.05
2936	TX9 L64 BILIFAR CHOKE	4.25

DECCA SPARES

4616	DECCA 100 0.01 2KV CAP	0.98
2933	DECCA 100 BEDIGE TX	2.35
2932	DECCA 100 FOCUS CONTROL	2.77
4615	DECCA 100 LINE DRIVE TX	2.25
2928	DECCA 10SER 470K SH+VOL	2.15
4603	DECCA 2230 10R FUSIBLE	0.70
2930	DECCA 2233 PSH PSH SH	5.14
2931	DECCA 2263 PSH PSH SH	4.20
2926	DECCA 30 SER 3R9 RESIS.	0.50
2924	DECCA 30 SER MAINS TX	12.35
2929	DECCA 30 SER 47K SH+VOL	2.45
2939	DECCA 80 470R SH+VOL	2.45

RESISTORS

CARBON
STANDARD RANGES

1/4 WATT X 10	0.29
1/2 WATT X 10	0.29
1 WATT X 10	0.45
2 WATT X 10	0.60

SAFETY CERAMIC
STANDARD RANGES

5 WATT X 5	0.90
7 WATT X 5	0.74
11 WATT X 5	0.89
17 WATT X 5	1.15

OTHER RESISTORS

3279	2M2 H/V FOCUS RESISTOR	0.46
3280	22M H/V FOCUS RESISTOR	1.50
3281	33M H/V FOCUS RESISTOR	1.50
3282	47M H/V FOCUS RESISTOR	1.50
3283	56M H/V FOCUS RESISTOR	1.50

MAINS DROPPERS

3025	MAINS DROPPER RANK A640	1.20
3013	MAINS DROPPER DECCA 80/100	1.60
3016	MAINS DROPPER GEC 2010	0.90
3031	MAINS DROPPER THORN 3600	0.98
3030	MAINS DROPPER THORN 1600	1.45
4910	MAINS DROPPER DECCA 100 2R5	0.82
3034	MAINS DROPPER THORN 9800	1.48
3027	MAINS DROPPER THORN 1400	1.50
3026	MAINS DROPPER RANK A823	1.10
3028	MAINS DROPPER THORN 1300	1.60
3029	MAINS DROPPER THORN 1500	1.75
3018	MAINS DROPPER PHILIPS G8	0.99
3022	MAINS DROPPER PYE 725/731	1.40
3017	MAINS DROPPER PHILIPS 210	0.98
3019	MAINS DROPPER PHILIPS G8 47R	0.65
3033	MAINS DROPPER THORN 8500/8800	0.98
5385	MAINS DROPPER DECCA 80	2.97
5386	MAINS DROPPER DECCA 100	1.88
5533	PYE CT200 PHILIPS 579 DROPPER	3.45

UNIVERSAL CONVERGENCE POTS

5R, 10R, 22R, 20R, 25R, 50R, 75R, 100R, 200R, 250R, 500R	0.48

FIDELITY SPARES

2940	CHOPPER TX FIDELITY CTV14R	4.50
2942	DRIVER TX FIDELITY CTV14R	2.65
2941	FOCUS UNIT FIDELITY CTV14R	0.50
5408	MAINS INPUT CHOKE ZX2000	3.45
5504	MAINS FILTER TX CTV14R	2.95
5505	DRIVER TX ZX3000 404387	2.95
6162	ON/OFF SH FIDELITY CTV14R	3.65
6163	ON/OFF SH FIDELITY CTV14S	1.65

GEC SPARES

2965	GEC 1401 CHOPPER TX	16.56
2964	GEC 1401 INPUT CHOKE	9.63
5531	GEC 1501 MAINS TX	5.25
4758	GEC 2100 3R FUSIBLE RES	1.45
4759	GEC 2110 SH2 2KV CAPS	2.39
2959	GEC 2100 ETC FOCUS VDR	1.60
2958	GEC 2100 THERMAL CUT OUT	0.97
4760	GEC 2110 FOCUS CONTROL	5.98
4771	GEC 2110 LUM. DELAY LINE	1.83
4728	GEC 2110 MAINS CHOKE	10.50
4996	GEC 2110 NEONS	0.20
4751	GEC 2114 VOL+SWITCH CONT	1.98
4656	GEC 22K MULTI TURN POT	0.98

GRUNDIG SPARES

2949	GRUNDIG 5010 FOCUS VDR	3.35
4633	GRUNDIG 5010 CONTROL TX	4.76
2948	GRUNDIG 5010 FOCUS UNIT	3.75
4865	GRUNDIG 5010 L515 CHOKE	1.63
4744	GRUNDIG 5010/6010 LID	2.62
4745	GRUNDIG 5011 LID	2.59
4637	GRUNDIG 5011 SH+SLIDERS	11.69
2952	GRUNDIG 6010 MIXIE MOD	22.50
4630	GRUNDIG 6011 MAINS SH	3.60
4631	GRUNDIG 6110 MAINS SH	4.86
2947	GRUNDIG A6400 MAINS SH	4.95

REMOTE CONTROL UNITS

PLEASE STATE MODEL NUMBER

4311	DECCA 100 NONTEXT RCU	21.50
4314	DECCA 100 (TEST+PREST) RCU	22.28
4310	DECCA 80/100 SERIES RCU	21.76
4315	DECCA 90/100 N/TXT RCU	20.78
4324	GEC 2 FUNCTION RCU	18.45
4325	GEC C2057H/2067H RCU	21.43
4326	GEC TELEMASTER 12 RCU	20.03
4327	GEC TELEMASTER 16 RCU	20.03
4328	GEC TELEMASTER 8 RCU	23.25
4332	GRUNDIG TELEPILOT 12 RCU	30.83
4333	GRUNDIG TELEPILOT 16 RCU	25.05
2955	GRUNDIG TELEPILOT 7	24.95
4334	GRUNDIG TELEPILOT 8 RCU	20.83
4357	KORTING 12 CHANNEL RCU	22.13
4358	KORTING 16 CHANNEL RCU	24.05
4380	PHILIPS G11 NONTEXT RCU	22.52
4378	PHILIPS G11 T/TEXT 8CH RCU	20.78
5409	PHILIPS G11 T/TEXT U/SONIC	25.16
5453	PHILIPS KT3 REMOTE RC4001	16.00
4379	PHILIPS/PYE G11 2 FUNC RCU	18.90
4359	PHILIPS/PYE KT3/KT30	16.13
4385	RBM 16CH NONTEXT RCU	21.95
4386	RBM 8CH NONTEXT RCU	19.20
4387	RBM TEXT&V/DATA RCU	20.78
2980	REMOTE CTRL UNIT PHILIPS G9	9.85
4390	TCE 9000CHAS 2 FUNC RCU	19.20
4398	TCE TX10(9653)+TEXT RCU	24.78
4400	TCE TX10(9670)+PREST RCU	21.78
4397	TCE TX9/TX10	19.20

PUSH BUTTON UNITS

2870	4 WAY DECCA ETC	8.25
2871	6 WAY DECCA	11.78
2873	4 WAY HITACHI ETC	5.50
2875	4 WAY PYE/TCE	10.87
2877	6 WAY GEC 2110	11.25
2878	7 WAY GEC 2112	10.95
2879	6 WAY T3500	2.75
2880	6 WAY PYE 713	15.75
2881	6 WAY T9000	7.25
2882	4 WAY BUSH A823	10.93
2884	6 WAY MOD CVC9	12.85
2885	6 WAY 520 PHILIPS	19.30
2886	6 WAY PHILIPS 550	21.25
2887	T1P SWITCH UNIT PHILIPS G11	27.50
2888	6 WAY PHILIPS G11	11.25
2889	PIANO KEY MOD DECCA 2631	22.48
4935	7 WAY ITT CVC5	12.90
5278	GEC 2136 TAPERED	10.95
5279	ITT 6 WAY +VCR	10.70
5280	6 WAY BUSH T20	13.81

ITT SPARES

2972	ITT CP340 PB ASSY	34.00
4501	ITT CP340 SLIDER ASSY	7.58
4683	ITT CV40 FOCUS UNIT	1.95
5543	ITT CVC20 LINE DRIVE TX	3.05
4571	ITT CVC20 MAINS SWITCH	1.36
4787	ITT CVC25 6N2 2KV CAP	1.35
4786	ITT CVC25 8N2 2KV CAPS	2.15
2970	ITT CVC25 BRIDGE COIL	4.05
4789	ITT CVC25 E/W LOAD COIL	1.92
4567	ITT CVC25/30 MAINS SW	6.89
2969	ITT CVC32 DRIVER TX	2.55
4568	ITT CVC32 REMOTE MAIN SH	7.67
2971	ITT CVC32 SH MODE TX	5.00
4795	ITT CVC45 ON/OFF SWITCH	2.09
3286	ITT CVC5 1MFD 250V CAP	0.40
4569	ITT CVC5 MAINS SWITCH	1.85
4781	ITT CVC5 SHIFT POT 25R	1.82
4780	ITT CVC5 SLIDER BANK	7.41
2967	ITT CVC5-9 MAINS TX	8.48
4570	ITT CVC9 MAINS SWITCH	5.61

FUSES

STANDARD RANGES

20MM Q/B FUSE X 10	0.66
20MM A/S FUSE X 10	
63MA - 160MA	1.80
200MA - 5A	1.20
1.25" Q/B FUSE X10	
250MA - 800MA	0.95
1A - 5A	0.70
1.25" A/S FUSE X 10	
250MA - 2A	1.50
2.5A - 5A	2.30
PLUG TO P FUSE X 10	
2, 3, 5, 7, 10, 13A	0.95

SERVICE MANUALS

5011	DECCA 101/100	6.00
5047	DECCA 80 CHASIS	6.00
5442	DECCA/TATUNG 120	7.00
5022	GEC C2065H-C2255H	6.00
5023	GEC C2065H-C2265H	4.95
5026	GEC C2110-C2149	6.00
5068	HITACHI CPT2024	5.00
5074	HITACHI CPT2234	5.00
5094	ITT CVC20	4.00
5095	ITT CVC25+30	9.00
5096	ITT CVC40	9.00
5097	ITT CVC45/1	5.00
5513	ITT CVC800/801	5.00
5093	ITT CVC9	4.00
5123	MITSUBISHI CT200B	5.00
5527	PANASONIC TC2205	9.00
5116	PANASONIC TX2234	5.00
5127	PHILIPS G11 CHASSIS	4.00
5126	PHILIPS G8 CHASSIS	6.00
4515	PHILIPS KT3 SERV.	5.00
5135	PHILIPS T8-E	2.00
5136	PHILIPS TX	2.00
5143	PYE 725 731 SER	5.00
5145	REDIFFUSION MK1	3.00
5146	REDIFFUSION MK3	3.00
5147	REDIFFUSION MK4	5.00
5148	REDIFFUSION MK5	4.00
5167	THORN 1500	2.00
5168	THORN 1600	1.50
5171	THORN 1615	3.00
5172	THORN 1690-1691	5.00
5184	THORN 3800	2.00
5187	THORN 3V01	12.00
5188	THORN 3V16	12.00
5178	THORN 9000	6.00
5182	THORN 9800	10.00

RANK RADIO SPARES

4650	RRI T20 SPEAKER	2.36
5524	RRI T24E ON/OFF + VDL SH	2.35
4842	RRI 1122 SH+VDL 22K PULL	3.10
4843	RRI A823 100K TUNER POT	1.78
4847	RRI A823 FOCUS ASSEMBLY	6.03
2998	RRI A823 PLASTIC CAM	0.35
5300	RRI A823ETC RING SPK GAP	0.55
4988	RRI T20 (TYPE) FOCUS ASY	0.60
3001	RRI T20 3K3 SH+VOL CTRL	2.67
4852	RRI T20 9N1 2KV CAP.	1.98
4853	RRI T20 CONTRAST+AFC POT	3.23
3003	RRI T20 E/W CORR. COIL	3.29
3000	RRI T20 FOCUS ASSY	5.69
3004	RRI T20 SH MODE TX	11.20
4849	RRI 2718 3K3 SH+VOLUME	3.36

PHILIPS PYE SPARES

4969	PHILIPS 128711 4K7 VOL+SH	4.45
3288	PHILIPS 300 470L VDL+SWITCH	3.25
4449	PHILIPS 570/713 IF MODULE	7.00
5425	PHILIPS CTX-S EHT LEAD	10.11
5418	PHILIPS CTX-S FOCUS UNIT	5.50
4655	PHILIPS G11 100K TUNER POT	0.66
2983	PHILIPS G11 CVC32 B/COIL	1.95
2984	PHILIPS G11 E/W CORR COIL	2.45
2985	PHILIPS G11 FILTER COIL	12.80
2986	PHILIPS G11 FOCUS UNIT	9.15
2987	PHILIPS G11 G2 CONTROL ASSY	7.98
4575	PHILIPS G11 RND SHAFT SH.	2.32
4576	PHILIPS G11 SQ SHAFT SWITCH	2.32
4645	PHILIPS G11 TDA2600 HOLDER	0.65
5284	PHILIPS G8 100K TUN P/SET	0.84
2977	PHILIPS G8 10K COLOUR CTRL	0.98
4525	PHILIPS G8 10K CON POT (550)	0.87
4524	PHILIPS G8 15R CON POT (550)	1.07
2975	PHILIPS G8 2K2 BRIGHT CONTL	2.11
4526	PHILIPS G8 2H A1 POT (550)	3.80
4522	PHILIPS G8 5N1 1500V CAP	1.88
4523	PHILIPS G8 5R CONV POT (550)	0.64
4858	PHILIPS G8 6×4" 70R SPKR	5.98
2979	PHILIPS G8 EQUALIS. COIL	3.20
4503	PHILIPS G8 METAL SH	1.72
2978	PHILIPS G8 RED/GRW SYM COIL	4.63
4504	PHILIPS G8/G11 NON REM SH	1.72
5307	PHILIPS K12 THICK FILM UNIT	14.99
4649	PHILIPS KT3 4X4 SPEAKER	2.85
4566	PHILIPS KT3 MAINS SWITCH	8.60
4907	PHILIPS KT4 THICK FILM UNIT	10.29
4564	PHILIPS T173 MAINS SWITCH	3.45
4648	PHILIPS G11 6X4 SPEAKER	3.85
2992	PYE 169 LINE OSC COIL	3.45
4839	PYE 731 3R3 50W RESISTOR	1.98
4535	PYE 731 47K VOL SWITCH	5.25
2992	PYE 731 FOCUS UNIT	3.45
5545	PYE 731 L/H 3X 100K PSET	3.20
5546	PYE 731 R/H 3X 100K PSET	3.20
2994	PYE 731 THICK FILM ASSY	1.55
4938	PYE KT2 FOCUS UNIT	2.85
4864	PYE T194/6 SPEAKER	5.05
5556	PHILIPS G11 SHORT SHAFT SH	2.01

THORN VIDEO SPARES (OVER 450 PARTS)

QUOTE THORN PART NUMBER IF POSSIBLE

5561	T3292 BOOSTER	44.62
5562	T3292 CAPSTAN BELT	3.48
5563	T3292 CAPSTAN MOTOR	51.16
5568	T3292 CASSETTE LAMP	1.80
5569	T3292 COUNTER BELT1	0.60
5571	T3292 COUNTER BELT2	0.60
5575	T3292 DRUM MOTOR	47.70
5577	T3292 F/F IDLER	2.02
5582	T3292 GUIDE ROLL ASSY	11.40
5585	T3292 LOWER DRUM ASY	80.48
5587	T3292 PINCH ROLL ASSY	9.84
5591	T3292 REWIND IDLER ASSY	7.04
5592	T3292 REWIND RUBBER TYRE	0.60
5621	T3292 UNLOADING BELT	0.78
5622	T3292 UNLOADING IDL ASSY	6.43
5624	T3292 UPP/DRUM KIT+MOD	35.94
5629	T3V00 CAPS. MOTOR BELT	0.60
5635	T3V00 COUNTER BELT 1	0.60
5637	T3V00 DRUM MOTOR	49.39
5646	T3V00 PINCH ROLLER ASSY.	7.31
5648	T3V00 RECORDING LAMP	2.34
5650	T3V00 SERVICE MANUAL	17.57
5655	T3V00 T/U IDLER ASSY	6.35
5657	T3V00 UPPER DRUM+MOD KIT	35.94
5663	T3V16 PINCH ROLLER ASSY	7.31
5666	T3V00 CAPSTAN MOTOR	51.16
5688	T3V00 TENSION BAND	2.16
5689	T3V00 TIMING GEAR	4.12
5692	T3V00 UNLOADING IDLER ASSY	6.43
5710	T3V01 TENSION BAND	2.16
5716	T3V16 CAPSTAN BENT	3.85
5720	T3V16 CASSETTE LAMP	1.80
5721	T3V16 CHANGE GEAR	0.86
5726	T3V16 DIODE STACK	3.41
5727	T3V16 DRIVE ARM ASSY	4.50
5750	T3V16 SERVICE MANUAL	26.24
5758	T3V16 T/U IDLER ASSY	6.25
5759	T3V16 T/U IDLER ASSY (LA)	8.95
5765	T3V16 UNLOADING IDLER	6.43
5772	T3V22 CAPSTAN MOTOR	51.16
5773	T3V22 CAPSTAN MOTOR BAND	0.60
5774	T3V22 CAPSTAN BELT	3.86
5790	T3V22 F/F IDLER	1.74
5803	T3V22 GUIDE ROLLER ASSY	8.39
5807	T3V22 MICRO SWITCH	4.25
5809	T3V22 PINCH ROLLER ASSY	7.31
5814	T3V22 REWIND IDLER ASSY	7.04
5822	T3V22 SUPP SPOOL CARRIER	4.00
5824	T3V22 TAKE UP IDLER SMALL	6.25
5825	T3V22 TAKE UP IDLER LARGE	8.95
5828	T3V22 TENSION BAND	2.16
5834	T3V22 UPPER DRUM ASSY	35.94
5840	T3V23 BOOSTER	24.71
5844	T3V23 CAPSTAN MOTOR	55.83
5852	T3V23 CONNECT GEAR ASSY	6.56
5856	T3V23 GUIDE ROLLER TYRE	0.60
5862	T3V23 PINCH ROLLER ARM AS	4.10
5868	T3V23 REEL IDLER ASSY	2.87
5869	T3V23 REEL MOTOR ASSY	32.81
5879	T3V23 T/U REEL DISK ASSY	5.17
5880	T3V23 TAKE UP REEL ASSY	2.58
5882	T3V23 UPPER DRUM ASSY	35.94
5885	T3V23 WORM GEAR SPINDLE	5.95
5886	T3V23 WORM GEAR SPROCKET	1.63
5888	T3V24 BRAKE SHOE	0.60
5896	T3V24 CASSETTE LAMP	1.80
5899	T3V24 DEW SENSOR ASSY	9.05
5902	T3V24 F/ERASE HEAD ASSY	10.41
5908	T3V24 LOADING GEAR ASSY	28.91
5909	T3V24 LOADING MOTOR	10.25
5912	T3V24 PINCH RLR LVR ASSY	0.62
5920	T3V24 SERVICE MANUAL	28.50
5945	T3V29/30 BOOSTER	24.71
5946	T3V29/30 BRAKE SHOE	0.67
5951	T3V29/30 CAPSTAN BELT	1.95
5952	T3V29/30 CAPSTAN MOTOR ASSY	36.88
5957	T3V29/30 CASSETTE LAMP	1.65
5962	T3V29/30 EJECT LCK ARM	0.60
5974	T3V29/30 LOADING MOTOR	10.25
5976	T3V29/30 LOHR DRUM ASSY	78.72
5980	T3V29/30 PINCH RLLR ASSY	8.66
5981	T3V29/30 PINCH RLLR SLND	19.50
5985	T3V29/30 REEL MTR ASSY	34.66
5990	T3V29 SERVICE MANUAL	25.85
5991	T3V30 SERVICE MANUAL	15.75
5998	T3V29/30 TAKE UP CLUTCH	0.60
5999	T3V29/30 T/U CLUTCH ASSY	2.78
6001	T3V29/30 T/U LDG RING ASSY	2.73
6003	T3V29/30 T/U SPL IDLER	2.60
6012	T3V31 BOOSTER	32.37
6016	T3V31 CAPSTAN BELT	1.95
6017	T3V31 CASSETTE LAMP	1.71
6027	T3V31 LOADING GEAR ASSY	6.60
6028	T3V31 LONG TRIMMING TOOL	0.93
6030	T3V31 PINCH ROLLER ASSY	8.66
6033	T3V31 SERVICE MANUAL	27.31
6034	T3V31 SERVO TEST JIG	49.94
6038	T3V31 TAKE UP CLUTCH ASSY	2.75
6039	T3V31 T/U LOADRING ASSY	2.73
6042	T3V31 UPPER DRUM ASSY	35.94
6044	T3V32 BOOSTER	32.37
6048	T3V32 CAPSTAN BELT	1.95
6053	T3V32 CASS MOTOR ASSY	9.45
6066	T3V32 LOADING GEAR ASSY	6.60
6068	T3V32 PINCH ROLLER ASSY	8.66
6071	T3V32 SERVICE MANUAL	18.65
6072	T3V32 SUPP/LDG RING ASSY	2.58
6081	T3V32 UPPER DRUM ASSY	35.94
6085	T3V35/6 BRAKE PAD X2	0.67
6086	T3V35/6 BRAKE SHOE	0.67
6087	T3V35/6 BRUSH ASSY	2.07
6090	T3V35/6 CAPSTAN MOTOR	23.91
6091	T3V35/6 CASSETTE MOTOR	8.10
6103	T3V35/6 PINCH ROLLER	9.84
6105	T3V35 REMOTE CONTROL	19.43
6107	T3V35/6 SERVICE MANUAL	27.00
6117	T3V35/6 TENSION BRAKE	0.60
6118	T3V35/6 UPPER DRUM ASSY	35.94
6119	T3V40 SERVICE MANUAL	15.00
6158	T3V29/30 UPPER DRM ASSY	35.94

SONY VIDEO

6133	SONY 8000UB FORWARD BELT	1.20
6136	SONY C6UB THREADING BELT	1.20
6138	SONY C6UB CAPSTAN BELT	1.77
6145	SONY C7UB BRAKE ASSEMBLY	1.77
6150	SONY C5UB CAPSTAN MOTOR	38.75
6152	SONY C6UB MK2 REEL MTR	23.00
6154	SONY C7 DC MTR (BHF/1100)	38.75
6155	SONY C7UB REMOTE CONTROL	43.75
6156	SONY C5UB REMOTE CONTROL	20.63
6157	SONY C6UB REMOTE CONTROL	18.13
4953	SONY C5/7 REWIND KIT	5.40
4954	SONY C6 REWIND KIT	5.40
4948	SONY SL-7/SL-T7 BELT KIT	4.00
4944	SONY SLC7/SLJ7 BELT KIT	5.50
4949	SONY SLT 9ME/J9 BELT KIT	4.50

GEC

6173	V4000H UPPER CYLINDER	40.50
6174	V4000H RELAY	4.12
6175	V4000H PINCH ROLLER	7.44
6178	V4000H CAPSTAN MOTOR	38.78
6181	V4000H TAPE SENSOR LAMP	0.79
6185	V4001H PINCH ROLLER	5.81
6192	V4002H UPPER CYLINDER	40.50
6204	V4004 CLUTCH ASSY	11.18
6212	V4100 AUDIO CONTROL	28.13
6253	V4000H SERVICE MANUAL	10.50
6254	V4001H SERVICE MANUAL	8.31
6255	V4002H SERVICE MANUAL	11.08
6256	V4004 SERVICE MANUAL	11.50
6257	V4100 SERVICE MANUAL	8.31

HITACHI VIDEO SPARES

6214	8000 UPPER CYLINDER	38.99
6218	8000 AUDIO CONTROL	23.85
6220	8000 F/FWD REWIND ASSY	0.69
6224	9300E RELAY	3.30
6230	9300E TAPE SENSOR LAMP	0.95
6231	9300E TUNER	18.21
6240	VT33E UPPER CYLINDER	38.99
6244	VT33E CAPSTAN MOTOR	27.72
6249	VT11E F/FWD REWIND ARM	4.85
6252	VT11E CAPSTAN MOTOR	23.63

VIDEO HEADS

SEE FULL LIST FOR COMPARISON CHART

6258	BETA - A VIDEO HEAD	40.50
6259	BETA - B VIDEO HEAD	40.50
6265	VHS - A VIDEO HEAD	33.50
6266	VHS - A VIDEO HEAD	32.50
6274	PHILIPS H1500 VIDEO HEAD	50.95
6275	PHILIPS H1700/2 VIDEO HEAD	66.20
6276	PHILIPS 2020/2 VIDEO HEAD	57.95
6277	PHILIPS 2030 VIDEO HEAD	53.98

GENERAL SPARES

4999	ANTEX BIT 1/8" DIAMETER	1.45
5000	ANTEX BIT 3/16" DIAMETER	1.45
4452	ATTENUATOR 12DB	1.68
4469	ATTENUATOR 18DB	1.37
4451	ATTENUATOR 6DB	1.38
5419	COLOUR CRYSTAL 8.86MHz	0.60
4659	HEAT SINK COMPOUND	1.08
5001	QUICK TEST MAINS CONN	9.30
4700	SERVISOL FOAM CLEANER	1.05
4453	SERVISOL FREEZE-IT	1.15
4724	SERVISOL SW CLEANER	1.05
4516	SERVISOL VIDEO HEAD CLEANER	0.95
4976	SOLDER 0.5 KILD REEL	8.60
4466	SUPER WICK 2MMX1.6M	0.99
4970	TV LOOP AERIAL	0.55
4998	WELLER INST HEAT GUN TIP	0.68

PLEASE ADD £1.25 POST & HANDLING THEN 15% VAT TO TOTAL.

QUICK SAVE TV SPARES

THE COACH HOUSE, MUXTON LANE, TELFORD, SALOP

FULL LIST OF OVER 3000 ITEMS SENT WITH ORDER OR SEND 9" × 4" SAE. PLEASE USE STOCK NUMBER WHEN ORDERING, OR USE SET MAKER'S PART NUMBER. ACCESS AND VISA ACCEPTED. OFFICIAL ORDERS FROM GOVERNMENT OR SCHOOLS WELCOMED. ALL GOODS ARE STOCK ITEMS.

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

G.G.L. COMPONENTS

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

BUY WITH ACCESS

INTEGRATED CIRCUITS

TYPE	PRICE (£)
AN303	3.45
AN305	3.50
AN7114E	2.33
AN7115	2.37
AN7116	2.35
AN7145	3.25
AN7168	2.95
HA1166	2.65
HA1338	2.78
HA1339	2.40
HA1342A	2.20
HA1366W/WR	1.95
HA1374	2.45
HA1377	3.80
HA1388	4.20
HA1397	3.90
LA1201	1.75
LA1230	2.30
LA1365	2.45
LA4101	1.50
LA4102	1.95
LA4440	3.55
LA4445	2.65
LA4460	2.95
LA4461	2.95
SAA500A	1.50
SAA1250	3.85
SAA1251	4.95
SAA5010	5.10
SAA5012	5.70
SAF1032P	3.25
SAF1039P	4.55
SAS560S	1.95
SAS570S	1.95
SAS580S	2.40
SAS590S	2.40
SL470	2.95
SL480	2.85
SL490	2.60
SL1430	1.95
SL1432	1.75
STK0039	6.45
STK0040	5.95
STK077	7.25
STK078	7.45
STK2129	8.50
STK4332	5.95
STK433	6.50
STK435	6.75
STK437	7.25
STK439	7.55
STK441	8.50

TYPE	PRICE (£)
STK459	7.35
STK461	7.95
STK463	9.30
STK465	9.95
TA7193P	4.30
TA7204P	1.90
TA7205AP	1.40
TA7222AP	1.85
TA7223P	2.85
TA7227P	2.95
TBA120AS	.95
TBA120SB	.90
TBA120T	1.25
TBA120U	1.00
TBA520	1.30
TBA530Q	1.00
TBA540	1.37
TBA560	1.60
TBA720A	2.65
TBA750	2.45
TBA800	.80
TBA810	1.35
TBA820	1.40
TBA920	1.50
TBA950	2.65
TBA2800	2.65
TCA270	1.55
TDA440	3.25
TDA1035T	2.75
TDA1037	1.95
TDA1044	3.10
TDA1170	1.80
TDA1470	3.65
TDA1506	3.95
TDA1512	3.35
TDA1670A	4.50
TDA1770A	3.95
TDA2003	2.33
TDA2030	1.95
TDA2170	2.95
TDA2190M	6.95
TDA2270	2.95
TDA2521/3	4.55
TDA2522	1.80
TDA2523	2.25
TDA2525	3.35
TDA2530	2.10
TDA2532	2.20
TDA2540	1.95
TDA2541	2.95
TDA2545	4.95
TDA2560	1.80
TDA2571A	4.95
TDA2576A	3.60

TYPE	PRICE (£)
TDA2577	3.55
TDA2578A	2.95
TDA2581	2.15
TDA2582	2.20
TDA2591	2.30
TDA2593	2.30
TDA2594	2.95
TDA2600	6.35
TDA2611A	1.50
TDA2640	2.40
TDA2653A	3.55
TDA3560	5.10
TDA3561A	5.35
TDA3562A	6.95
TDA3650A	3.95
TDA3651AQ	3.80
TDA3652	3.35
TDA4500	5.85
TDA4600	2.85
TDA4600(18P)	3.30
TDA9503	2.35
UPC1031H	2.95
UPC1032H	.95
UPC1156H	2.45
UPC1181H	2.20
UPC1182H	2.20
UPC1185H	3.30
UPC1230H	3.95
UPC1363C	4.65
UPC1365C	5.05
UPC1394C	2.95
UPC2002H	1.85

VIDEO SPARES

TYPE	PRICE
9300 V/Head	33.95
VT11E V/Head	33.95
VT11E Idler	2.95
9300 Idler	4.35
VT11E Capstan Motor	24.95
9300 Capstan Motor	32.95
9300 P/Roller	5.35
VT11E P/Roller	5.25
9300 Belt Kit	1.95
VT11E Belt Kit	2.95

GEC/HITACHI SPARES TV

TYPE	PRICE
Frame Mount	
HM6251	4.95
STR 441	5.90
STR 451	5.90
STR 454	5.95
STR 6020	6.35

TRANSISTORS

TYPE	PRICE
BC107	14
BC108	14
BC109	14
BC141	26
BC142	23
BC147	09
BC148	09
BC327	11
BC328	12
BC337	11
BC557	10
BC558	10
BC637	35
BC638	25
BC639	25
BD124M	1.05
BD131	33
BD132	33
BD222	50
BD225	55
BD237	40
BD238	39
BD438	78
BD439	70
BD677	70
BD701	85
BD707	1.05
BF337	28
BF338	30
BF458	30
BF757	75
BFR90	1.60
BR100	18
BR103	1.95
BR303	2.95
BT106	1.15
BT116	1.30

TYPE	PRICE
BT151/800R	1.10
BU126	1.78
BU205	1.42
BU208A	1.45
BU208D	1.85
BU326A	1.48
BU407	1.12
BU500	1.95
BU508A	1.95
BU807	1.30
BUB26A	3.20
R2540	2.35
TIP31C	.46
TIP32C	.47
TIP33	.95
TIP41C	.48
TIP42C	.48
TIP47	.75
TIP2955	.70
TIP3055	.70
2N3055	.50
15/80H	2.25
15/85R	2.25
2SB 618	2.45
2SC 867A	3.25
2SC 1034	4.85
2SC 1061	1.15
2SC 1114	4.75
2SC 1124	.97
2SC 1316	3.20
2SC 1413A	3.95
2SC 1942	2.95
2SC 1969	1.95
2SC 2078	1.55
2SC 2335 (Kit)	7.55
2SD 588A	1.97
2SD 725	7.95

FIDELITY

TYPE	PRICE
Line U/P Tr. Models 14/16/20" (inc Mod. Board)	12.65

SANYO SPARES

TYPE	PRICE
5000 Pulley	5.95
5000 Reel Motor	8.55
5000 Pinch Roller	5.85
5000 Belt Kit	1.10
5300 Belt Kit	2.45

VIDEO BELT KITS

TYPE	PRICE
THORN 3V00-3V22	2.80
THORN 3V29	1.80
NAT PAN 2000	2.55
NAT PAN 3000	2.55
NAT PAN 7000	2.25
SHARP 8300	2.95
SHARP 9300	2.95
SONY C5/7	2.85
SONY C9 Belt Kit	4.50
TOSHIBA 8600 Belt Kit	2.35

LINE O/P TR.

DECCA 80	7.95
DECCA 100	8.50
ITT CVC 20	8.85
ITT CVC 25/30/32	8.95
ITT CVC 45	8.45
PHILIPS G8	8.75
PHILIPS G11	13.50
PHILIPS KT3	9.95
PHILIPS K30	16.50
RBM T20A	10.35
THORN 1615	12.35
THORN 1690/1	9.65

THORN/SONY

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

SUNDRIES

G8 Ttansductor	2.25
G11 E/W Coil	1.65
G11 Lin Coil	1.80
G11 Bridge Coil	1.35
G11 EHT Lead	2.25
THORN On/Off SW	1.00
TX10 Focus Unit	8.95
VCR Pilot Bulb	70

VALVES

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

E.H.T. TRAYS

DECCA 80	7.20
DECCA 100	7.35
ITT CVC 20/30	6.85
PHILIPS G8-550	7.90
PHILIPS KT3	7.95
RBM T20/T22A	7.35
THORN 8500/8800	7.60
THORN 9000	8.70
Universal	5.95

DIODES

TYPE	PRICE
BY127	.10
BY133	.15
BY164	.40
BY179	.65
BY210/800	.30
BY223	1.25
BY227M	.23
BY229/600	.87
BY298/400	.24
BY299/800	1.15
BYX10	.20
BYX55/600	.30
SKE4F2/06	.80
SKE5F3/10	1.45
W005	.55
1N4001-7	.07
1N5401-8	.16

SONY SPARES

C5/C7 Rewind Kit	4.65
C6 Rewind Kit	3.70
C5/C6/C7 V/Head	38.95
C5/C7 Ack Head	23.50
C5/C7 DC Motor	29.95
C6 Reel Motor	13.55
C6 MH2 Reel Motor	21.50
C5 Serv. Manual	7.85
C6 Serv. Manual	7.85
C7 Serv. Manual	7.85
C9 Serv. Manaul	7.85
KV1400UB Manual	7.85
KV1810UB Manual	7.85

(post & packing on manuals .95)

TV ELECTROLYTICS

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

PUSH BUTTONS/NEW TUNERS

DECCA/ITT 6 way	8.50
PHILIPS G8 S/L	14.90
PYE-G11 P/B	8.50
HITACHI 4 way	8.95
ITT CVC5 7 Button	10.40
ITT CVC8/9	12.80
1043/05	8.95
U321	8.75
U322	7.40
U411	12.50

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

ORDERING

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

NIKKO ELECTRONICS

JAPANESE COMPONENT SPECIALISTS

THE SOURCE FOR ELECTRONIC COMPONENTS

Electronics Components Distributors (Import & Export)

- I.C.s
  - EPROM
  - RAM
  - TTL
  - LINEAR
- TRANSISTORS
- DC MOTORS
- TAPE PLAYER HEADS
- VIDEO HEADS (Genuine Replacement Parts)
- AUDIO & VIDEO ROLLERS & BELTS
- VIDEO MOTORS

STOCKISTS OF:
Sony–Sanyo–Sharp–Toshiba–Matsushita–Fujitsu–SGS–Ikejiri–Mabuchi–Rhom–Mitsubishi–JVC–Thomson–NEC–National–Motorola–Mullard–Plessey–Sanken–Texas Instruments

TRADE ONLY

164 WEST BARNES LANE, NEW MALDEN, SURREY KT3 6LR, ENGLAND
☎ 01-949 2954 Telex: 914040 NIKKO

MAKE YOUR INTERESTS PAY!!

Train at home for one of these Career Opportunities

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

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

Name: ______________________

Address: ______________________

P. Code ______________________

ICS International Correspondence Schools, Dept. EGS96, 312/314 High St., Sutton, Surrey SM1 1PR. Tel: 01-643 9568 or 041-221 2926 (both 24 hours).

BARCLAYCARD VISA

EAST CORNWALL COMPONENTS

Access

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

★ ★ ★ ★ ★ ★ ★ ★ ★ ★

ORYX PORTASOL PORTABLE GAS SOLDERING IRON

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

★ ★ ★ ★ ★ ★ ★ ★ ★ ★

CERAMIC KIT 50 VOLT
125 CAPACITORS
5 EACH VALUE
£4.75

SEPTEMBER SPECIAL OFFER

ANTEX XS 25W SOLDERING IRON

NORMALLY £6.20

ONLY £4.99

WITH ORDERS OF £10.00 and over

SONY T.V. & VIDEO SPARES

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

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

ZENER DIODES

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

*Only available while stocks last

ZENER DIODE KIT 400 M/W
55 ZENER DIODES
5 EACH VALUE
£3.50

CHART RECORDER SPECIAL

Brand new 3 channel pen recorders complete with charts. Full spec. upon request. Price **£40 + £16 p&p + VAT.**

RESISTORS – CARBON FILM 5%

1/4W 1R0 to 10M (E12 Range)	2p each. 15p/10. 75p/100
1/2W 2R2 to 10M (E24 Range)	2p each. 15p/10. 75p/100
1W 10R to 2M2 (E12 Range)	7p each. 65p/10. 6.00/100
2W 10R to 2M2 (E6 Range)	8p each. 70p/10. 6.00/100

RESISTOR KITS – each value individually packed

1/4W pack 10 each value E12 – 10R to 1M 610 pieces	5.75
1/4W pack 5 each value E12 – 10R to 1M 305 pieces	3.35
1/2W pack 10 each value E12 – 2R2 to 2M2 730 pieces	7.95
1/2W pack 5 each value E12 – 2R2 to 2M2 365 pieces	4.75
1W pack 5 each value E12 – 2R2 to 1M 353 pieces	15.25
2W pack 5 each value E6 – 10R to 2M2 317 pieces	18.50

RESISTORS – WIREWOUND. Generally 5%

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

REPLACEMENT TV MAINS DROPPERS

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

Plus Many More. Please enquire.

FUSES Prices per 10

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

SOLDERING SECTION

Soldering Station complete with 30W or 40W Iron (state which)	74.95
XS25 W Iron kit/complete with steel & plug attached	11.00
CS 18W, as above	10.90
Antex 15W iron	5.75
Antex 18W iron	5.95
Antex 25W iron	6.20
Antex elements	3.20
Antex bits	0.99
Antex stands	2.20
Soldersucker	4.50
Spare nozzles for Soldersucker	0.65

SERVICE AIDS

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

BOOKS

EQUIVALENT BOOKS

DIODES VOLUME 1	£9.95
DIODES VOLUME 2	£9.75
Both volumes	£18.70
I.C. CMOS	£7.50
I.C. TTL	£7.55
I.C. LIN VOLUME 1	£5.95
I.C. LIN VOLUME 2	£5.99
Both volumes	£9.99
THYRISTORS A to Z	£4.90
TRANSISTORS A to Z	£4.90
TRANSISTORS 2N-3N	£5.10
Both volumes	£9.99

UNIVERSAL BATTERY CHARGER

To charge AA, C, D and PP3 Ni-Cads
Price £4.50

Rechargeable Batteries

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

Full range of Battery Holders

TELEPHONE SPECIAL

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

12V RECHARGEABLE UNIT

A bank of 10 D type Ni-Cads encapsulated in a black plastic box complete with inlet and outlet sockets (XLR type) and fuse holder. This giving 12V from a very neat and tidy unit. Approx. 245×75×75mm.
£5.99 + £1.85 P&P + 15% VAT

H.V. DISC CERAMICS

1KV 1.5nf	.18
8KV 56, 100, 120, 150, 180pf	.30

MULTISECTION ELECTROLYTICS

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

INTEGRATED CIRCUITS. (£) EACH

709	0.35
741	0.25
747	0.70
AN214Q	3.80
AN240P	3.42
BTT6218	1.98
CA301AT	0.80
CA358	0.66
CA801CM	1.20
CA3020	2.10
CA3065	1.60
CA3080E	0.68
CA3140	0.45
HA1366W	1.59
LA4422	3.20
LC7131	4.90
LC7137	5.40
LM324N	0.48
LM380N8-P	1.15
LM380N14-P	1.80
LM1011N	3.20
LM1458N	0.98
LM3900N	0.85
M51513L	3.18
M51515L	3.18
MC1307P	1.99
MC1327P	1.50
MC1330P	1.60
ML23213	2.10
ML23713	2.30
NE555	0.25
SAA1025	4.00
SN76226DN	1.70
SN76227N	
STK015	6.20
TA7146P	4.60
TA7203P	2.76
TA7204P	1.50
TA7205AP	1.30
TA7222P	2.32
TAA550	0.50
TAA611A12	3.50
TAD100	2.90
TDA120A	0.80
AS/S/SB/T/U	0.80
TDA120B	1.30
SA/SQ/UQ	1.30
TBA520	1.50
TBA530	1.20
TBA540	1.64
TDA560C	1.50
TDA800	0.80
TBA810S	1.20
TBA950/2A	3.05
TCA270SA	4.02
TDA1003A	5.50
TDA1004*	4.95
TDA1006A	2.45
TDA1035S	4.50
TDA1170S	1.99
TDA1352A	1.80
TDA2002	1.80
TDA2020	4.00
TDA2030	1.90
TDA2140	2.90
TDA2160	2.50
TDA2522	2.75
TDA2530	2.20
TDA2532	2.80
TDA2560	3.20
TDA2561	4.65
UPC57562	1.48
UPC741G	0.92
UPC1156H	2.75
UPC1182H	2.75
UPC1218H	1.80
UPC1370C2	2.50
UPC2002H	2.78

74LS

74LS00	0.24
74LS01	0.24
74LS02	0.24
74LS03	0.24
74LS04	0.24
74LS05	0.24
74LS08	0.24
74LS09	0.24
74LS10	0.24
74LS11	0.24
74LS12	0.24
74LS13	0.33
74LS14	0.48
74LS15	0.24
74LS19	0.44
74LS20	0.24
74LS21	0.24
74LS22	0.24
74LS24	0.28
74LS26	0.24
74LS27	0.24
74LS28	0.24
74LS30	0.24
74LS32	0.24
74LS33	0.24
74LS37	0.24
74LS38	0.24
74LS40	0.24
74LS42	0.50
74LS47	0.79
74LS48	0.85
74LS51	0.24
74LS55	0.24
74LS73	0.30
74LS74	0.33
74LS75	0.44
74LS76	0.38
74LS83	0.88
74LS85	0.82
74LS86	0.35
74LS90	0.48
74LS91	0.90
74LS92	0.54
74LS93	0.54
74LS95	0.60
74LS96	1.20
74LS107	0.40
74LS109	0.44
74LS112	0.44
74LS113	0.40
74LS114	0.39
74LS122	0.68
74LS123	1.00
74LS124	1.15
74LS126	0.50
74LS132	0.60
74LS135	0.26
74LS136	0.42
74LS138	0.44
74LS139	0.58
74LS145	0.93
74LS147	1.64
74LS148	1.28
74LS151	0.70
74LS153	0.70
74LS155	0.55
74LS157	0.45
74LS158	0.58
74LS160	0.62
74LS161	0.68
74LS162	0.70
74LS163	0.68
74LS164	0.74
74LS165	1.10
74LS166	1.50
74LS168	1.48
74LS170	1.40
74LS173	0.98
74LS174	0.75
74LS175	0.70
74LS190	0.82
74LS192	0.98
74LS193	0.98
74LS194	0.75
74LS195	0.74
74LS196	0.84
74LS197	0.96
74LS221	0.85
74LS240	0.80
74LS241	0.80
74LS242	0.94
74LS243	0.94
74LS244	0.80
74LS245	1.20
74LS247	1.00
74LS251	0.75
74LS257	0.73
74LS258	0.75
74LS259	1.20
74LS266	0.55
74LS237	1.20
74LS279	0.70
74LS283	0.80
74LS353	1.10
74LS365	0.50
74LS366	0.50
74LS367	0.50
74LS368	0.50
74LS373	1.00
74LS374	1.00
74LS375	0.70

CMOS

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

ALL PRICES SUBJECT TO CHANGE WITHOUT NOTICE

VALVES

Enquiries are welcomed for any other valve not listed here.

Type	Price (£)
AZ31	4.50
AZ41	1.98
DAF96	1.00
DF96	0.75
DK96	2.65
DM71	2.95
DY86/87	0.66
DY802	0.95
CV850	2.50
CV4015	2.80
E180F	6.50
EABC80	0.98
EAF42	1.50
EB91	1.30
EBC41	2.00
EBF80	0.75
ECC81	1.00
ECC82	0.90
ECC83	1.00
ECC84	0.80
ECC85	0.95
ECC86	2.80
ECC88	1.25
ECC189	0.85
ECF80	1.20
ECF82	0.85
ECF83	1.90
ECF86	1.70
ECH35	3.75
ECH81	1.40
ECH84	1.50
ECL85	0.75
ECL86	1.75
EF80	0.75
EF86	1.80
EF91	2.00
EF95	1.68
EF183	0.90
EF184	1.00
EH90	0.98
EL34	3.25
EL36	1.96
EL81	6.95
EL84	1.00
EL85	4.75
EL86	0.90
EL509	7.85
EL519	7.95
EM80	0.85
EM84	1.75
EM87	2.55
EY51	0.90
EY86/87	0.65
EY88	0.75
EY500A	2.50
EZ41	2.80
EZ81	0.80
GY501	1.40
GZ32	1.20
KT66(G.E.C.)	18.00
KT77	11.50

KT88(G.E.C.)	19.00
PC88	1.40
PC92	3.00
PC900	1.40
PCC88	0.80
PCC89	0.75
PCC189	0.85
PCF80	0.95
PCF82	0.95
PCF84	0.75
PCF86	1.25
PCF87	0.50
PCF200	1.95
PCF201	1.95
PCF800	1.20
PCF801	1.05
PCF802	1.05
PCF805	1.60
PCF806	1.20
PCF808	1.60
PCL82	1.00
PCL83	2.50
PCL84	1.00
PCL86	0.90
PCL88	2.50
PCL805	1.05
PD500	2.90
PFL200	1.85
PL33	1.50
PL36	1.75
PL82	0.75
PL95	2.00
PL504	1.40
PL508	2.70
PL519/509	5.25
PL802	5.50
PY81/800	1.10
PY82	1.75
PY88	0.80
PY500A	2.20
PY801	0.68
UABC80	0.85
UAF42	1.25
UBC41	3.00
UBC81	1.50
UCC85	0.75
UCF80	1.20
UCH42	2.50
UCH81	2.00
UCL82	1.80
UCL83	1.80
UF41	1.25
UF89	2.50
UL84	1.25
UY85	1.15
2D21	1.60
6AT6	1.25
6AV6	1.50
6C4	1.00
6GH8A	1.20
6J5GT	2.50
6K7G	2.00
6K8G	2.75
6KD6	6.50
12AU6	2.00
30FL2	1.70
30FL12	1.60

TRANSISTORS – DIODES

Type	Price (£)
AC127	0.28
AC128	0.30
AC128K	0.34
AC141	0.58
AC141K	0.38
AC142	0.56
AC142K	0.38
AC151	0.45
AC152	0.45
AC153	0.57
AC153K	0.46
AC176	0.30
AC176K	0.38
AC187	0.28
AC187K	0.38
AC188	0.28
AC188K	0.38
ACY22	1.50
AD142	0.88
AD143	1.10
AD149	0.72
AD161/162	1.20
AD162	0.52
AF114	1.20
AF115	2.10
AF116	2.10
AF121	0.56
AF124	0.42
AF125	0.58
AF126	0.58
AF127	0.38
AF139	0.40
AF178	2.28
AF239	0.50
AF279S	1.40
AL100	5.40
AL102	4.40
ASY80	5.20
ASZ17	2.00
AU110	2.80
AY102	4.40
840C200	1.03
BA110	0.68
BA115	0.14
BA121	0.40
BA129	0.38
BA148	0.16
BA155	0.12
BA157	0.28
BB105B	0.30
BB105G	0.48
BB110B	0.42
BC107	0.10
A or B	0.12
BC108	0.10
A,B or C	0.13
BC109	0.10
A,B or C	0.14
BC115	0.12
BC116	0.12
BC117	0.22

Type	Price (£)
BC118	0.16
BC119	0.28
BC125	14
BC140	0.27
BC141	0.24
BC142	0.24
BC143	0.26
BC147	0.18
BC147B	0.14
BC148	0.10
BC148B	0.12
BC149	0.10
BC149C	0.14
BC157	0.10
BC158	0.12
BC159	0.12
B/C	0.14
BC160	0.30
BC161	0.30
BC168B	0.20
BC169C	0.12
BC170A/B/C	0.16
BC171A/B	0.10
BC172/B/C	0.12
BC177/A/B/C	0.24
BC182/A/B/C	0.10
BC182L	0.12
LA LO LC	0.10
BC183/A/B/C	0.10
BC183L	0.10
LA LB LC	0.10
BC184	0.10
A B CL LC LB	0.10
BC207	0.15
BC212/A/B/C	0.10
BC212L	0.09
LA LB	0.10
BC213/A/B/C	0.10
BC213L	0.10
LA LB LC	0.10
BC237	0.11
BC238	0.12
BC251/A/B	0.14
BC262	0.20
A B	0.28
BC301	0.30
BC302	0.30
BC303	0.30
BC307A	0.18
BC317A	0.12
BC323	0.90
BC327	0.16
BC328	0.16
BC337	0.12
BC338	0.12
BC350A	0.24
BC351	0.16
BC440	0.36
BC441	0.40
BC461	0.58
BC478	0.24

Type	Price (£)
BC516	0.48
BC547	0.12
A or B	0.10
BC548	0.12
A B or C	0.10
BC549	0.10
A or B	0.10
BC550	0.10
A or B	0.10
BC557	0.10
BC558A	0.10
BCY70	0.16
BCZ10	3.21
BCZ11	2.60
BD124P	0.70
BD129	0.90
BD130Y	0.68
BD131	0.36
BD132	0.38
BD135	0.26
BD136	0.26
BD137	0.28
BD138	0.30
BD139	0.30
BD140	0.28
BD142	1.28
BD145	1.82
BD150A	0.72
BD160	1.58
BD165	0.45
BD183	0.70
BD201	0.52
BD202	0.57
BD204	0.50
BD222	0.80
BD225	0.40
BD232	0.45
BD234	0.30
BD235	0.30
BD236	0.38
BD237	0.38
BD410	0.76
BD434	0.58
BD438	0.58
BD439	0.85
BD441	1.00
BD507	1.05
BD520	1.20
BD687	0.88
BD707	0.88
BDX18	1.00
BDX32	1.48
BF115	0.32
BF117	0.50
BF119	0.82
BF120	0.38
BF125	0.42
BF127	0.41
BF154	0.14
BF157	0.46
BF160	0.23
BF167	0.32
BF177	0.42

Type	Price (£)
BF178	0.26
BF180	0.27
BF181	0.27
BF182	0.32
BF183	0.32
BF184	0.30
BF185	0.28
BF194A	0.15
BF195	0.12
BF224J	0.20
BF240	0.30
BF241	0.30
BF244A	0.30
BF257	0.22
BF258	0.26
BF259	0.30
BF262	0.34
BF263	0.38
BF270	0.30
BF271	0.28
BF273	0.22
BF274	0.34
BF294	0.46
BF336	0.32
BF337	0.28
BF338	0.28
BF355	0.37
BF371	0.27
BF450	0.38
BF457	0.36
BFR51	0.36
BFR61	0.32
BFR90	0.86
BFT41	0.68
BFT43	0.86
BFY50	0.22
BFY51	0.22
BFY52	0.22
BFY90	0.80
BFY90S	1.34
BR100	0.25
BR101	0.40
BR103	0.50
BR303	2.75
BRY39	0.50
BRY56	0.42
BSX20	0.30
BSY52	0.35
BSY95A	0.25
BT100A/02	0.90
BT101/300	2.75
BT101/500	3.25
BT102/300	3.60
BT106	1.15
BT116	1.20
BT119	3.30
BT138/600	1.30
BT151/560R	0.30
BTY79/400R	2.80
BU104	1.80
BU105	1.20
BU108	1.75
BU124AE	0.98

Type	Price (£)
BU126	1.40
BU133	1.90
BU204	1.30
BU205	1.30
BU206	1.50
BU208A	1.40
BU326S	1.75
BU407	1.10
BUX80	3.70
BUY20	2.75
BUY69A	2.60
BUY69B	1.98
BY100	0.80
BY103	0.50
BY122	0.60
BY126	0.10
BY127	0.08
BY133	0.06
BY135	0.35
BY164	0.45
BY179	0.56
BY182	0.80
BY184	0.38
BY187	0.65
BY189	6.75
BY198	0.64
BY199	0.72
BY206	0.14
BY207	0.16
BY210/400	0.21
BY210/600	0.24
BY210/800	0.28
BY227	0.22
BY228	0.46
BY238	0.65
BYX10	0.20
BYX36/150	0.40
BYX36/600	0.48
BYX48/300	0.70
BYX55/600	0.30
BYX71/600	1.18
C106D (400V)	0.48
E1222	0.30
E5024	0.30
MCR106/5	1.20
ME0413	0.70
ME6002	0.26
MEU21	0.62
MJ400	0.45
MJ2955	1.00
MJ3000	1.80
MJE340	0.46
MJE520	0.44
MJE2955	1.60
MJE3055	1.40
MPSA05	0.30
MPSA12	0.30
MPSL01	0.34
MPSU05	1.05
MPSU06	1.18
MR502	0.40
MR854	0.88
OA91	0.07

Type	Price (£)
ORP12	0.85
R2008B	1.20
R2010B	1.20
R2540	2.71
TIP30A	0.32
TIP31C	0.39
TIP32	0.35
TIP33A	0.55
TIP34A	0.70
TIP41C	0.42
TIP42	0.44
TIP47	0.42
TIP121	0.63
TIP2955	0.70
TIP3055	0.58
TIS88	0.50
TIS90	0.27
Y728	0.14
Y969	2.80
IN4001	0.04
IN4003	0.05
IN4004	0.05
IN4006/7	0.07
IN4148	0.04
IN5400	0.12
IN5402	0.13
IN5405	0.16
IN5406	0.17
IN5408	0.19
2N2122A	0.34
2N2222	0.30
2N2904A	0.48
2N2926G	0.14
2N3053	0.30
2N3054	0.60
2N3055	0.65
2N3703	0.10
2N3773	2.80
2SB337	1.80
2SC1098	0.84
2SC1172Y	1.70
2SC1173Y	0.88
2SC1279	0.50
2SC1306	0.92
2SC1413A	2.70
2AC1449	0.60
2SC1507	0.60
2SC1678	1.00
2SC1758	0.68
2SC1909	1.20
2SC1923	0.30
2SC1945	2.88
2SC21953	0.70
2SC1957	0.70
2SC1969	2.80
2SC2028	0.73
2SC2029	2.70
2SC2078	1.05
2SC2091	0.70
2SC2098	2.90
2SC2122A	3.20
2SC2314	0.80
2SC2335	1.50

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

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

TELEVISION

EDITOR

John A. Reddihough

Please note that the telephone numbers below are for contact with the advertisement departments only. Editorial enquiries should be sent to the editor at the address given on page 689.

ADVERTISEMENT MANAGER

David W.B. Tilleard
01-261 6671

SECRETARY

Janet Reeve
01-261 6671

CLASSIFIED ADVERTISEMENTS

Pat Bunce
01-261 5942

ADVERTISEMENT COPY AND MAKE-UP

Ron Scorey
01-261 6035

INFORMATION WANTED

Can anyone provide information on sources of spares/service data for the following: Soundmaster monochrome portables (distributed in Ireland), Trophy monochrome portables and Griffin Teleranger TV/monitors?

COVER PHOTO

That pretty but annonymous looking chassis on our front cover this month is the Fidelity ZX3000. See article on page 702.

Learning, coping and doing

Learning is something that many of us find tricky. But what exactly is learning? It depends of course on what one is learning about, or to do. Important that last distinction. There was a time when learning, in the sense of the formal acquisition of knowledge, was the province of a very small minority of the population, those who attended the universities. Yet everyone had to do a certain amount of learning in order to operate successfully in society, i.e. get by from day to day and do a job that brings in an income. For many learning consisted of the apprenticeship system – learning by doing, by acquiring skills passed on by those who already possessed them. The traditional apprenticeship system seems long dead, killed by the age of equal opportunity and education for all. It had two great disadvantages. It tended to lock people into a particular type of job for life, and it prevented anyone else from doing particular types of job if they wanted to. We live to this day with the legacy of demarcation disputes and skill shortages.

One thing that helped to kill off the apprenticeship system was the increasing technical content of many jobs. The more complicated a job becomes, the greater the need for formal instruction. The problem becomes more acute as the pace of technological change increases. Those who learnt their electronics in terms of the thermionic valve had to start all over again with the advent of solid-state electronics. This sort of thing led to talk of the need for continuous retraining throughout one's working life. The great question here is how well we've succeeded in going about this, and whether the formal processes of education have been effective.

These problems are particularly relevant in the field of electronics, and seem to me to bring out the fact that by and large people get on surprisingly well despite a lack of formal training. Just consider the servicing of consumer electronics equipment. There are still those who started off dealing with valved radio and audio equipment before graduating to TV sets. The dreaded complication of colour followed, and when one looked at the formal explanations of how it worked one shuddered. Yet most of us soon got the hang of it and the air of mystery evaporated. The same can be said of the change to solid-state technology. The latter has enabled great strides to be taken in increasing the sophistication of consumer electronics products – imagine a teletext decoder built of valves! So digital techniques, once confined to obscure books on computers, started to appear in the domestic telly. Did we all rush off to the local college to acquaint ourselves with this new subject? Not at all, and I suspect that many people were soon wielding their logic probes without giving too much thought to the matter.

Video added a whole new field of complications. New signal processing techniques coupled with a need to understand automatic control systems. Before long we were not only having to take servo systems in our stride but microcomputer control of functions as well. And if you decided to keep out of video you nevertheless found that the microcomputer chip was beginning to do its stuff in TVs as well. Is this all? Well microwave technology is now a part of the domestic TV scene as well with the advent of satellite TV transmissions. Yet somehow or other we're still coping!

If the educators had their way we'd all have to traipse back to their halls of learning to find out about these new technologies as they came along. In practice of course there simply isn't time for those in full-time employment to go off for weeks/months to follow a formal course – while the educators are in fact in the same boat! A nice irony here. It has often taken a long time for formal courses to catch up with advances in technology.

I often wonder how we've all managed to cope with this flood of innovation. The fact that we have seems to carry some sort of message for those in education: that the experienced person can pick up a surprising amount of knowledge without going through formal educational procedures. I'm not saying that one can acquire an in-depth understanding by a process of assimilation. Design knowledge and practical knowledge are different things. In past times one might have talked about theoretical and practical knowledge. But a concern with theory nowadays is something that takes us into the realms of research.

One of the great problems is the way in which information is presented. It's so easy to make things seem more complicated than they really are. Add to this the fact that what's new always seems to be a bit mysterious and you soon have a rather off-putting prospect. Yet quite often a simple analogy, a rather good diagram or a couple of brief sentences that manage to get to the heart of things will unlock a whole new range of understanding. The moral here seems to be that if we can find ways of putting things across simply life will be made a lot easier for us all. There are unfortunately always those who want to do the opposite. They like to cloak their knowledge in obscure terminology or simply to adopt terms that are singularly unhelpful to those who are uninformed. An example of this is when techniques or devices are called after their inventors rather than by what they actually do. By all means give credit to the great innovators, but it doesn't help the rest of us to perpetuate their names in this way. Surely the classic example of this sort of thing in recent times is the adoption of Hz instead of c/s, something that none of us can now avoid. It simply amounts to pulling the wool over people's eyes unnecessarily. Oh yes, you get rid of the /, which is very clever and efficient: but c/s is self-explanatory, Hz isn't. Avoid unnecessary confusion and we shall probably all manage to cope with new techniques as they come along. Without having to become apprentices, and without having to return to the classroom every couple of years.

Servicing the Fidelity ZX3000

David Botto

The ZX3000 chassis is used in many Fidelity colour TV sets including the CTV14S (later versions), the CTV20, the CTV2022, the CTV20R, the CTV2024, the CTV22, the CTV22R and the CTV2224. Several of these models incorporate remote control.

The Usual Symptoms

Whilst the chassis is generally reliable it does have one nasty tendency. It likes to go dead, blowing the expensive chopper transistor and fuse. After careful tests the service engineer fits a nice new BU426A transistor and a 1·6AT fuse. When he switches on he's rewarded with a good picture and prepares to refit the back. Then suddenly, after anything from five to thirty minutes, a loud bang is heard and to his dismay both the fuse and the chopper transistor have once more failed.

To make life more interesting, in all the chassis we've handled the components on the main PCB are not identified by letters or numbers. You'll now understand why Pete recently sat by his bench sadly contemplating a ZX3000 chassis together with a little heap of useless BU426A transistors and 1·6AT fuses.

The ZX3000 chassis uses a self-oscillating chopper power supply circuit based on the Siemens TDA4600 chip. Regulation is achieved by varying the mark-space ratio and frequency of the drive waveform provided by the TDA4600 chip. Follow the procedure outlined below and you'll find these sets straightforward to service. Many other chassis nowadays use the same basic power supply circuit, so you'll find this information of wide application – failures are usually due to the same causes.

Power Supply Circuitry

The power supply circuit, with a simplified block diagram of the TDA4600 chip, is shown in Fig. 1. The 240V a.c. mains supply is fed via a push on-off switch and fuse F1 to the mains filter coil T1. In remote control models a relay mounted on the mains switch provides remote switch off. In some sets the mains filter capacitor C81 is fitted across the output from T1 whilst in others it's designated C251 and is fitted across the input – the alternative arrangment is shown in Fig. 2. So far we've had no trouble due to the mains filtering components.

Bridge rectifier D3-6 develops, via the surge limiting resistor R80, about 350V d.c. across its reservoir capacitor C86. Note that if fuse F2 has been removed or has blown and the set is switched on then off it takes some time for C86 to discharge via R81. To avoid giving yourself a nasty shock, use a 2·2kΩ resistor to discharge C86 before handling the chassis.

The positive side of the power supply is connected via fuse F2 and the primary winding 12-14 of the chopper transformer T2 to the collector of the BU426A chopper transistor TR3. The emitter of TR3 is returned to the

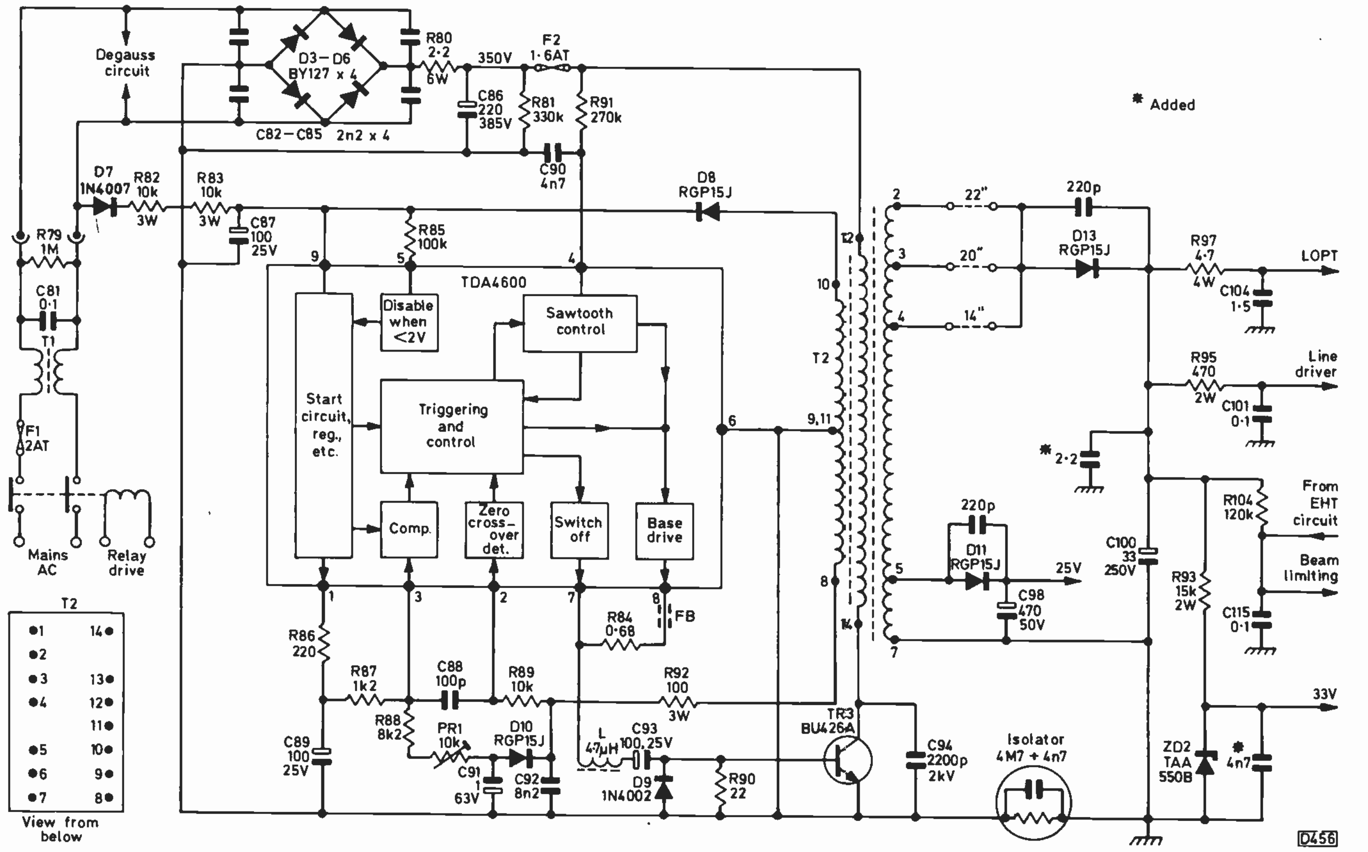


Fig. 1: Power supply circuitry used in the Fidelity ZX3000 chassis

negative side of the 350V supply. Notice that T2 isolates the rest of the set's circuitry from the a.c. mains supply. Since the power supply circuit itself is not isolated from the a.c. mains supply an isolated bench supply transformer should always be used when servicing the ZX3000 chassis. Notice too the special isolator units.

As soon as mains power is supplied and the set is switched on D7 charges C87 via R82 and R83. When the voltage at pin 9 of the TDA4600 i.c. reaches 4V with respect to pin 6 an internal reference voltage of 1·12V switches on within the chip's complex circuitry. More internal reference voltages then appear within the i.c., and as the voltage across C87 rises to 11·8V internal switching turns on an extremely accurate, temperature stabilised 4V supply which is used to power all the internal circuitry except for the chopper transistor's base drive amplifier. It's this stabilisation that makes the circuitry within the TDA4600 largely independent of mains input voltage variations over quite a wide range.

Resistor R91 is connected between the positive side of the 350V supply and pin 4 of the i.c. It charges C90 to produce a sawtooth voltage waveform at pin 4. This sawtooth is added to a switching waveform within the i.c. and appears at pin 8 as the drive waveform for the chopper transistor – the drive is via R84, choke L (L2 on some Fidelity circuits, L13 on others) and capacitor C93. As TR3 commences to switch on and off energy is generated in the chopper transformer's primary winding 12-14. The current induced in winding 11-10 charges C87 to 12V via D8, taking over from the start-up supply.

Feedback is obtained from winding 9-8 of the transformer. Pin 2 of the chip is linked to tag 8 of the transformer via R89 and R92: when the voltage at pin 2 falls to zero, corresponding to zero energy in the transformer, the cross-over detector tells the control circuitry within the i.c. to switch TR3 on again. D10 rectifies the voltage across tags 9-8, producing a voltage of some −22·6V across C91 for regulation purposes. This voltage is applied to pin 3 of the chip via R88 and the preset PR1. Pin 1 of the i.c. provides a reference voltage for the other end of the resistive chain R86/7/8/PR1. R86 with C89 form a delay circuit while C88 stabilises the frequency under excess and no-load conditions.

An excessive overload across the secondary windings 7-2 will reduce the voltage developed across winding 11-10 and thus the voltage at pin 9 of the i.c. When the voltage at pin 9 falls below 7·5V the drive to TR3 is removed. Normal load variations simply vary the voltage developed across winding 11-8 and thus across C91. This in turn varies TR3's switch-off time, via the internal control/triggering circuitry.

The h.t. rectifier D13 charges C100 from one of the three taps 2, 3, 4 on the transformer – the correct tapping for the c.r.t. size must be selected. The h.t. should be 112V for a 14in. tube, 119V for a 20in. tube and 150V for a 22in. tube. To set the voltage, turn down the brightness and contrast controls, connect a digital voltmeter across C100, then use a plastic tool to adjust PR1 for the correct voltage. Check the voltage after the set has been operating for half an hour.

R93 and ZD2 provide the 33V tuning supply. D11 and C98 provide a 25V supply for the sync/timebase generator chip IC4. Note that a major change occurred fairly early in the production of the ZX3000 chassis. In the early version the sync/timebase generator chip IC4 is a TDA8180 and the field output chip is a TDA2170 or TDA2270 (in this version the TDA4600 is referred to as IC7): in the later version IC4 is a TDA2578 and IC6 a TDA3651, the TDA4600 being referred to as IC8.

Tackling a Dead Set

So what to do when confronted with a "dead" ZX3000? Remove the back and examine the mains fuse F1. If it has failed with no signs of blackening the cause may simply be ageing. Fit a new fuse and if the set starts to work you're entitled to heave a sigh of relief. Let it run for several hours before returning it to the customer.

If F2 has failed however you'll almost certainly find that TR3 has zero resistance between all its connections. You'll now need to unslot the aerial socket from the chassis and take out the two little screws at the side and near the front of the PCB surround to withdraw the chassis. To get at the components you'll then have to take out the five screws that hold the circuit board to its frame.

The line output stage can be isolated by removing or disconnecting one end of R97. This enables the power

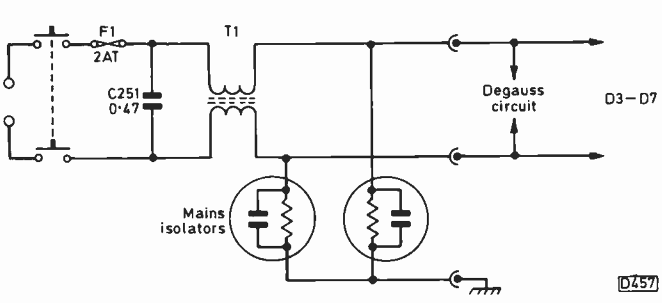


Fig. 2: Alternative mains filter arrangement.

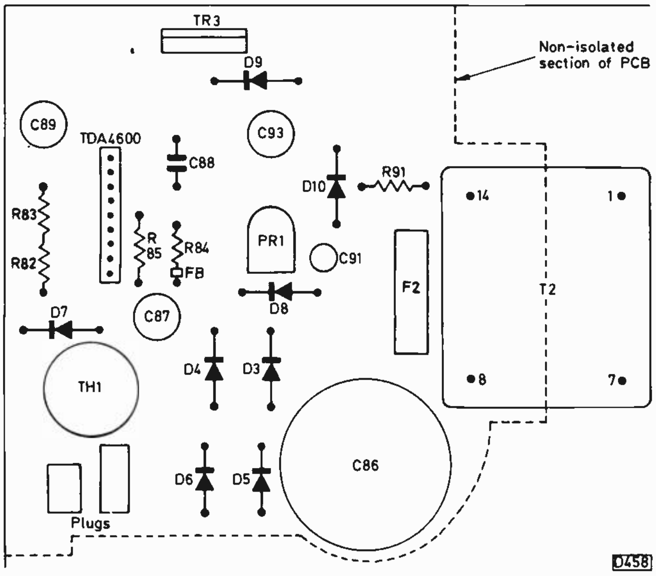
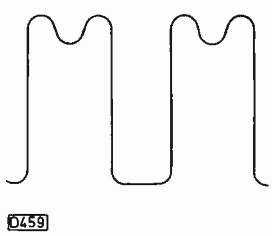


Fig. 3: Positions of the main components, and those referred to in the text, in the power supply. TH1 is the degaussing circuit thermistor.



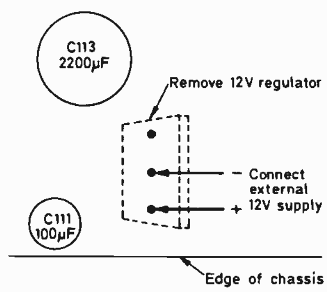


Fig. 4 (left): Waveform at the base of the chopper transistor TR3 with F2 removed from its holder.

Fig. 5 (right): Applying an external 12V supply when checking for line drive.

supply to be operated when there's an overload in the line output stage.

If TR3 and F2 have both blown, replace the following components – do this even if they appear to be in order when you check them (Fig. 3 shows their positions on the component side of the board). First R91 – strange things tend to happen to this resistor. Secondly C88 – if you've a capacitor checker to hand, check the value of the replacement before fitting it. Thirdly R85 – again check the value before fitting. You'll find it essential to replace these components or else you'll almost certainly end up with a pile of dud BU426As, as Pete did. Fit a new BU426A of course, but don't replace F2 for the moment.

Next carefully check D7, D8, D9 and D10. Then check R84 out of circuit, using a digital multimeter with low ohms compensation or allowing for the resistance of the meter leads.

Use your component tester or a capacitor tester to check C93, C87, C89 and C91. Finally measure the values of R82/3 to ensure that they are correct. If you've the slightest doubt, change them. You'll generally find however that R91, C88 and R85, which must all be replaced, are the cause of the trouble.

With F2 still out of circuit, connect your scope to the base of TR3 via a 10:1 probe, with the chassis clip to TR3's emitter. Connect the set to the mains via a variac or tapped transformer, switch on and increase the supply voltage slowly. As the voltage is increased you should see the hefty waveform shown in Fig. 4. Note that this is not the waveform you'll see when the set is working normally. Though you might tend to suspect the TDA4600 when faced with a dead set we've yet to have one fail.

Disconnect the set from the mains supply, discharge C86 and replace F2. Check the BU508 line output transistor TR5 with your component tester, then refit R97. Connect a digital voltmeter across C100.

Reconnect the set to the mains supply via the variac or tapped transformer and gradually increase the input. You should now obtain both picture and sound. If you've been tempted to omit replacement of the components we've mentioned, just turning the TV set up on the variac to see what happens, you might well get the picture and sound accompanied by a loud whistle from T2, indicating that the power supply is working off frequency. This will be followed by the usual loud bang from F2.

Line Drive Checks

If removal of R97 proves that the fault is not in the power supply (it almost always is), check the BU508 line output transistor TR5 and the BY228 efficiency diode D16. Also make sure that 25V is present at the cathode of D11 (incidentally there are two 25V lines in this chassis, the other one being derived from the line output transformer via D18).

To check for line drive, first carefully desolder and remove the MC7812 12V regulator, with R97 still disconnected. Connect a mains-isolated, regulated 12V supply as shown in Fig. 5. Switch the set on and check once more for 25V across C98. Connect the scope's 10:1 probe to the base of TR5 to see whether the base drive waveform is present. If not, move the probe to the collector of the BF460 line driver transistor TR4. This transistor can fail. If necessary go on to check for drive at the base of TR4. This comes from pin 7 of IC4 if it's a TDA8180 or pin 11 if it's a TDA2578. You'll easily see which i.c. you've got – the TDA8180 has 24 pins while the TDA2578 has 18. In addition with the TDA8180 there's no line hold control while with the TDA2578 the 5V regulator, transistor TR1 and the ceramic resonator are omitted. The test procedure for line drive is identical whichever type of chip is used.

Where a TDA8180 is used, make sure that the 5V regulator supplying pin 24 is in order. The two types of i.c. used in position IC4 seldom fail, so don't suspect them until all else has been checked.

If there is line drive at the base of TR5 the next step is to check the rectifier diodes fed from windings on the line output transformer – D17, D18 and D19, all type RGP15J. It's easy to check for an overload elsewhere in the circuitry by removing D17 and D18 in turn, with the mains switched off first of course.

Because the line output transformer is of the diode-split type we anticipated problems when we first started handling the ZX3000 chassis. But to date we've not had one failure. As mentioned before, when you've got a dead ZX3000 you'll usually find that the fault is in the power supply rather than the line timebase.

Protective Varnish

In conclusion, when the repairs have been completed spray a little circuit varnish on the connections you've soldered. With this particular chassis, be sure to leave the varnish to dry for at least an hour before switching the set on again.

June's Daughter

Les Lawry-Johns

You may recall me telling you a while back about a frustrating call on June, when her dog Piddler pinned me to the floor and was about to tear my throat out just before he recognised me. Well, her daughter got a relative to bring her set down to me and carry it in for her. It was a large 26in. ITT set fitted with the CVC5 chassis. Yes, an oldie – but in good condition. The report was that the picture went off but the sound stayed on.

I switched it on and when it had warmed up my neon glowed when brought near the PL509 line output valve. So the line output stage was active, but there was no sign of a raster – or sound for that matter. I tested this and that and when I checked the voltages in the sound i.f. stages dance music blared out.

"There you are" said June's daughter.

"That's radio music" I growled.

The same music came through when I was checking the final vision i.f. transistor and this suggested to me that the fault was in this stage. Now most of you know how difficult a fault in this section can be. I switched off and cold checked the BF123 transistor (T17). I couldn't get any readings from base to emitter or base to collector but I wasn't sure where I was in the confined space. So I reasoned (?) with myself. If the BF123 was open-circuit, I could hold a BF197 across its contacts as a check. Switch on again and allow the set to warm up. Sort out a BF197 and hold it in position, base to base etc. True TV sound burst out and a picture appeared on the screen.

"There it is" screamed June's daughter.

This scared me (women's voices do) and I withdrew the BF197. The sound and vision continued and I gave a sickly smile.

"Aren't you clever?" said June's daughter.

"Aren't I?" I agreed, wondering what the hell had happened. Tap the vision i.f. stage and move it about a bit. The vision and sound continued whatever I did. Pull the aerial out and switch off.

"We'll put the back on and pretend it's finished. Then we'll switch it on again to surprise it. That's what we'll do." And that's what we did. The picture was now grainy and horrible though the sound was o.k.

"Bloody tuner's up the creek" I bawled. "It wasn't a minute ago." So off came the back cover and I moved the tuner about a bit. A lovely picture came on then went all grainy again.

I removed the covers and laid the tuner on its side. Resoldering the r.f. amplifier transistor's base and emitter connections did the trick. After that it wouldn't go grainy again. We put the rear cover back and tried again. It was still all right. So they took it away, after I had warned them that the sound and vision could fail again at any time as I didn't trust it. The set hasn't been back so I suppose it's still all right. But what brought the BF123 to life – if indeed it was faulty? Perhaps it's me that's faulty? I can imagine E.T. chuckling away down there in Sussex. "Yes, it's you who's faulty Les!" Well I know I'm silly but the inspector of taxes had my books last year and couldn't fault them: there's not many can say that! And I did check the soldered edge connectors, so there.

You'd think the way I natter on that I don't have any real troubles. No so. Take the Thorn 9000 that came in the other day for example. I put a new tripler in it last week and this week it came back with the report that it was "no go – probably the switch". It wasn't the switch of course and there was plenty of h.t. at the collector of the R2540 Syclops transistor. I moved over to the line driver transistor and found that there was only 12V or so at its collector instead of around 150V. The same voltage readings were obtained at its base and emitter. Like a fool I dallied around the subpanel for a while, finding wrong voltages all over the place, also aware that I'd had this trouble before and had solved the matter in minutes. At last I listened to the voice in my head. It kept saying "thick film unit".

I got one off the shelf and fitted it, telling myself that it wasn't going to help matters. When I switched on again the e.h.t. rustled up. I knew it was going to be the thick film unit all along of course. It's just that I like to give myself a bit of exercise every now and again.

The Family Dawe

I've mentioned the brothers Jack and Oven Dawe before. I've just discovered that there's another. Ray. I couldn't believe it. All I can say is that their parents must certainly have had a sense of humour.

Ray said he had a set that didn't like odd numbers. We asked him what it was. It turned out to be a Ferguson set fitted with the TX10 chassis, and it wouldn't select channel one – or three or five etc. "You've a duff chip" I told him, hoping I was right.

He brought the set in and sure enough a new SAA5012 remote control receiver/decoder chip restored normal channel selection. Peace was thus restored in Ray's household. He'd altered the selectors so that 2 gave BBC-1, 4 gave BBC-2, 6 gave ITV etc. but his wife had said that interferring with the set would bring bad luck. She was right.

After we'd replaced the chip and reselected the programmes the set worked for one day then gave up. He brought it back and we investigated. I lowered the rear, i.f. panel and the set behaved itself, showing a nice picture and producing nice sound. I raised the panel and it lapsed into sullen silence. Feeling a bit annoyed I lowered the panel again and everything was all right. Inspection showed that the cable loom was subject to pressure from the i.f. panel when it was raised and that the insulation had punctured. Only a slight movement was required to put the cableform out of risk. I seem to remember having had this one before, but such is the state of my deplorable memory that I can't recall when it was. The set now functioned correctly however and Ray had to face his wife . . . "I told you so" she said.

This and That

Stan from SEME had popped in to take an order. He also wanted to know if I'd seen Ray Ling the Chinese fence. Daft, isn't he? Shortly after he'd gone a nice couple popped in to say hallo. They were from Blackpool and being in the area had decided to run Les to ground – they're regular readers. Thanks for calling, Chris and Jill. Hope to see you again sometime. Also hope you weren't too disappointed. I did get that set done. Can't remember which one it was, but I was in a bit of a dither over it for a while.

Teletopics

BUOYANT FIRST QUARTER

CTV deliveries to the trade during the first quarter, at 865,000, increased by 12·3 per cent compared to the same period in 1985. The upsurge was mainly in small-screen sets, where deliveries rose from 349,000 to 459,000. This in turn led to a significant increase in imports, mainly from Japan. Deliveries of large-screen sets fell from 421,000 to 406,000, while deliveries of teletext-equipped sets remained much the same at 147,000. A fifth of the large-screen sets were fitted with FS tubes. VCR deliveries increased by 30 per cent to 381,000 while camcorder deliveries rose by 300 per cent to 15,000. In other sectors of the trade CD player deliveries rose by over 400 per cent while home computer deliveries decreased by 83,000. A good year is being predicted for the video/TV trade. Deliveries of CTVs are expected to increase to around 3·8 million while VCR deliveries should be around 1·8 million.

HQ VHS MACHINES

VHS VCR manufacturers are adding "HQ" machines to their ranges – you'll find the initials HQ (high quality) somewhere on the front panel with most recent releases. HQ is an industry-agreed picture enhancement system: some of the techniques used were described in Steve Beeching's series on VCR developments earlier this year. Three basic techniques add to the improved quality picture. First, increased h.f. pre-emphasis gives improved definition in areas of the picture where the contrast ratio is high. Improved videotape characteristics have helped in this respect, enabling the recorded f.m. range to be extended to 5·8MHz. Secondly, detail enhancement in low-contrast ratio areas of the picutre is achieved by using improved picture sharpening techniques – low-level h.f. signal components are filtered out, boosted then added back. The third technique involves the use of a delay line to provide noise reduction. Note that there is complete compatibility between HQ and non-HQ machines.

Ferguson's latest range of VCRs, Models 3V55, 3V59 and 3V53, are all of the HQ type. In addition these models all incorporate infra-red remote control with timer setting via the remote control system. The 3V55 has a four-event, fourteen-day timer and a suggested retail price of £379. Model 3V59 adds two-speed operation at £479 while Model 3V53 adds hi-fi sound at £699.

BUSINESS NEWS

Problems with its Inmos semiconductor subsidiary held back profits at Thorn EMI in the year to March 31st 1986. Ferguson has been restored to profitable tading however, following a restructuring and cost-reduction programme, while the retail and rental business did particularly well, with a £97·6 million profit on sales of £885·3 million compared to a profit of £86·6 million on sales of £831·9 million.

Japan's largest consumer electrical/electronics products manufacturer Matsushita (Panasonic) has reported a 26 per cent fall in net earnings for the half year ended May 1986, the first setback for eleven years. A fall in total sales of eight per cent is attributed largely to the high value of the yen – sales of video equipment, including TV sets and VCRs, fell by 18 per cent. Matsushita comment that the situation is "fluid", making it difficult to predict the outcome for the full year.

Fidelity, now part of Caparo Industries, increased sales by approximately 70 per cent during the latest half year. Two new manufacturing lines have been added to the Acton factory and there are plans for a new plant which is expected to be located in the Midlands.

Goodmans Loudspeakers Ltd. has dropped the Saba franchise less than a year after taking over distribution in the UK following the closure of the European Electronics Corporation. Goodmans will be fulfilling servicing obligations on sets supplied but details of long-term arrangements for Saba products are awaited.

VIDEO SCENE

Model VR6467 is the first in a new range of "slimline" VHS machines from Philips – it's described as a "basic" model, with a three-event timer, auto-off override to permit use as a tuner and infra-red remote control. A novel feature of the re-engineered mechanical deck is the use of the U-wrap technique when threading up – this has hitherto been seen only on Beta models. The new range will run parallel with the current series for some time to give a choice of presentations.

In another development Philips has decided to shelve the introduction of 8mm video equipment for the time being, adopting instead the VHS-C camcorder format. The VKR6830 camcorder to be introduced this autumn will be manufactured for Philips by JVC – it's basically the JVC GRC7. The suggested retail price is expected to be under £1,300.

A manufacturing deal on tape deck mechanisms has been signed between Grundig and Matsushita. Grundig will manufacture items such as head drums for Matsushita's W. German subsidiary and will in turn sell Matsushita assembled machines.

A playback only VHS machine, Model VI910, has been announced by Samsung. The front-loading machine, which incorporates picture search and freeze frame, will sell for just under £200.

Canon intends to start selling a video still camera in Japan and the USA later this year. Pictures, with NTSC encoding, are recorded on a reusable magnetic disc. The complete equipment range will include a playback unit to enable the pictures to be viewed on a TV set, a colour printer, and a transceiver to transmit and recieve image information over telephone lines. The magnetic disc stores fifty pictures and the camera, which seems to be intended mainly for press and commercial users, can operate at up to ten frames per second. Sound can also be recorded.

The RCA CED video disc system has come to a final end with the announcement that disc manufacture at RCA's Indianapolis plant has ceased. Player production by RCA ended in April 1984 – the system was launched in early 1981.

SATELLITE TVRO EQUIPMENT

The latest issue of the British Amateur Television Club's magazine *CQ-TV* (no. 135) contains a TVRO receiver project using the modules mentioned in this column last month. The Astec AT1020 and AT3010 tuner and i.f./demodulator modules are partnered by a single-chip intercarrier sound demodulator and a PCB is available from BATC Members' Services. Membership of the BATC costs £5 annually – application forms can be obtained by sending a stamped addressed envelope to Dave Lawton, Grenehurst, Pinewood Road, High

Wycombe, Bucks HP12 4DD. Since membership is payable annually on January 1st the charge for each remaining quarter on application is £1·25.

STS (Satellite Technology Systems Ltd., Satellite House, Blackwarth Road, Bristol BS5 8AU) have introduced a low-noise 10·95-11·7GHz LNB priced at £125. Gallium-arsenide f.e.t. technology is used, giving a noise level of 2·3dB at 25°C and a gain in excess of 50dB – this specification is said to be comfortably exceeded in practice. The local oscillator is of the dielectric resonator type, giving high stability regardless of temperature. A WR75 input is provided and the N type output connector can easily be waterproofed – the unit itself is hermetically sealed for all-weather operation.

Two complete satellite TVRO packages have been introduced by Comet Radio. These will initially be availble at the Hull, Leeds, Norwich and Rochester stores. The system giving single-satellite coverage costs £890 while the multi-satellite system is priced at £1,190 – the price includes installation, a year's parts and labour guarantee and a dish licence.

TV/VCR SPARES

Willow Vale Electronics Ltd., 11 Arkwright Road, Reading, Berks RG2 0LU (0734 876 444) has been appointed sole Grundig parts distributor in the UK – Willow Vale now stock the complete range of genuine Grundig replacement spares for distribution to non-Grundig account dealers. Grundig dealers can order either direct from Grundig or from Willow Vale. While replacement modules are available from stock the original module must be returned for examination before an exchange panel/module is issued. Willow Vale have issued new lists of Fidelity spares and Thorn VCR spares available from them – also spares for Philips, Thomson and Sharp microwave ovens.

Tech-Semco, who provide spares for variuos makes of TV sets and other consumer electronics products equipment (see the April issue Spares Guide), have moved to Precision Centre, Heather Park Drive, Wembley HA8 1SU (01-902 8832). The accounts department remains in Brixton but orders should be sent to the above address.

Philips Service (604 Purley Way, Croydon CR9 4DR) has issued an Approved Service Dealer Directory. Following the policy change mentioned in this column last May, Philips has now set up a network of Approved Service Dealers throughout the UK to provide local spares and repair services for Philips and Pye consumer electronic products.

Spares for Commodore microcomputers are now being handled by HRS Electronics Ltd., Electron House, Great Barr Street, Birmingham B9 4BB (021-771 2525).

Thorn have introduced the Newlife range of reprocessed upper head drum assemblies for a wide range of popular VHS machines. The old assembly, in good condition, should be carefully packed to avoid damage and returned to a distributor or direct to Thorn EMI Colour Tubes Ltd., Factory B, Pallion Industrial Estate, St. Luke's Road, Sunderland SR4 6SR. The reprocessed drums have new heads and carry a twelve month guarantee covering normal domestic use.

PORTABLE TELETEXT RECEIVER

A battery-operated, portable teletext-only receiver with liquid-crystal display, called the Intercepter, is to be introduced by a new company called Telebeam International. Distribution will be through dealers and the price is likely to be about £200.

RS GO MAIL ORDER

RS have set up a subsidiary, Electromail, PO Box 33, Corby, Northants NN17 9EL (telephone 0536 204 555) to provide a mail order service for RS products. Priced RS catalogues are issued every four months – for the latest 600-page catalogue send £2·50 to the above address.

BBC STARTS DIGITAL STEREO TV SOUND EXPERIMENT

The BBC started limited experimental engineering tests of digital stereo TV sound on July 18th from the Crystal Palace BBC-2 transmitter and its associated relays. The first programme to be transmitted in these tests was "The First Night of the Proms", which was broadcast live from the Albert Hall. The aim of the tests is to enable staff to gain operational experience and allow manufacturers to build and test prototype stereo TV sound decoders. The normal sound channel is not affected by these tests, which will be liable to interruptions. Details of the standard were given in this column last May. Briefly the digital stereo sound signal is transmitted by quadrature phase-shift keying modulation of an r.f. carrier placed 6·552MHz above the vision carrier, at a data rate of 728kbit/sec. The system, developed by the BBC, underwent initial trials in 1983-4 and is the subject of a joint BBC/IBA specification that is under consideration by the Department of Trade and Industry as a potential UK standard.

CITIZEN INTRODUCE LCD TV SET

Citizen Watch (UK) Ltd., CP House, 97-107 Uxbridge Road, London W5 5TP have announced the official introduction of their Model 06TA pocket monochrome TV receiver with liquid crystal display in the UK. The price is £99·95. Brief technical details were given in an article in our June issue. The 2.5in. screen now has black matrixing to improve the contrast. Standard accessories include an earphone (there's also a built in speaker), soft case and four AAA (R03) batteries.

AERIAL RIGGERS COURSE

One-week intensive instructional courses for those wishing to operate their own aerial erection services are being run by R.B. Mannion, Badcual House, Badcaul, Dundonnell, Garve, Ross-Shire, Scotland IV23 2QY. The courses involve both theoretical and practical, hands-on instruction, covering all aspects of television and radio reception. Robert Mannion worked for the IBA until 1984 on surveying, planning and testing u.h.f. TV relay systems.

ADCOLA REWORK STATION

Adcola's new 777 soldering station is a portable unit that incorporates its own internal vacuum source when operating direct from a 220/240V, 100W 50Hz supply. Both the desoldering and soldering tools are thermostatically controlled, with the desoldering tool on a set/read device coupled to a LED display. A standard 444 Adcola soldering tool with integral electronic control is used. The desoldering tool has heating of the tip throughout its length to reduce the possibility of tip blocking during normal desoldering operations. Replacement tips cost less than £1. A range of four tips is supplied with each desoldering station. The versatility of the station is enhanced by a hot-air blow. The station, complete with operating instructions and a comprehensive spares and tool kit, is priced at under £500. For further details apply to Adcola Products Ltd., Adcola House, Gauden Road, London SW4 6LH (01-622 0291).

Letters

DECCA 80 CHASSIS

One of these sets would trip after being on for nearly two hours. Strangely the mains fuse F1 didn't always blow, and when the set cooled down again it worked perfectly. The cause of the fault was eventually traced to the 25V shunt regulator circuit which stabilises the supply to the audio amplifier chip. The 24V zener diode D307 was faulty, the driver transistor Tr303 (BC157) had exceptionally high gain and suspected leakage, and R372 (150Ω) in its base circuit was discoloured though of the correct value. Replacing these items restored normal operation.
K.J Treeby,
St. Judes, Plymouth.

SONY MODEL KV1340UB

A couple of points on this set. First no sound with the picture blanked out over one side of the raster and the h.t. smoothing resistor R617 burnt was found to be due to the associated smoothing capacitor C605 (4·7μF, 160V). Secondly on several of these sets we've had in the EBC markings for the error detector transistor Q605 on the power supply board PR have been marked incorrectly. If you can't set the h.t. for 110V after replacing this transistor, check that the transistor has been connected correctly. It's an easy mistake to make.
Roy Birchinshaw,
Sprowston, Norwich.

ELECTRIC MOTORS

With reference to Mike Phelan's article on electric motors in your last issue, particularly Table 1 on page 654, I'd like to point out that most commutator motors are not universal. Shunt-wound, compound-wound and permanent-magnet types will not run on a.c. The reason for this is that if the current flowing in the armature is reversed the direction of the magnetic field must also be reversed to keep the shaft torque the same. This is plainly not possible with a permanent-magnet type. It is also impractical with a shunt-wound motor (field and armature in parallel). Because of the different field and armature winding inductances the respective currents wouldn't be in phase and the motor torque would reverse fifty times a second. Even if the field and armature windings were connected in series to ensure that the current flowing in each was the same the motor still wouldn't run on a.c. – unless the iron circuit in the field winding was laminated, as in a power drill. Imagine trying to reverse the field in the solid casing and polepieces of a car starter motor at 50Hz: the eddy current losses would swallow up most of the energy.

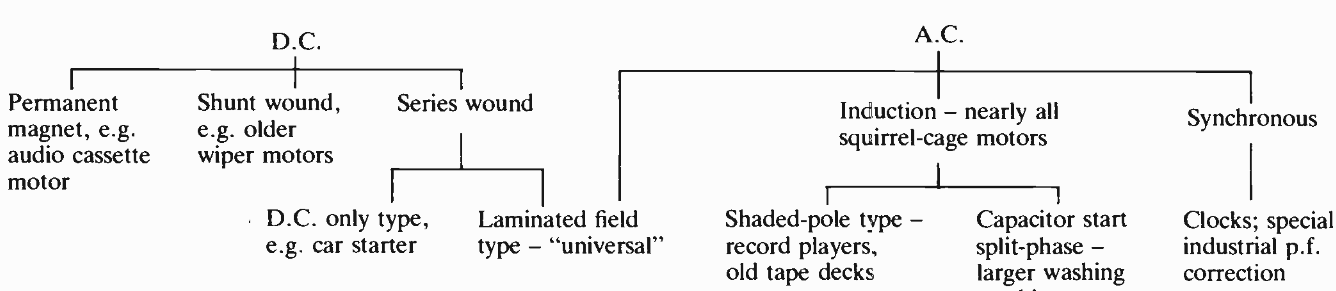
So only the series-wound type with laminated cores is universal, the other commutator type motors running on d.c. only. Table 1 provides a more accurate motor type "tree".
Ian Poskitt,
St. Ives, Huntingdon.

PHILIPS G8 CHASSIS

The two recent articles on the Philips G8 chassis (May and July 1985) show the benefit gained by large-scale refurbishing of a single type of chassis – stock faults are quickly brought to light while obscure ones get a better chance of being detected. The results reported in those articles closely follow our own experience of these sets. The chassis is basically reliable: not as good as a modern set, but good enough to warrant time and money being spent on them to increase their life span. Minor irritations such as the red goo in coil L005 on the decoder panel, the red goo at both ends of the blue lateral convergence coil and the varnish in the line output stage storage equalising coil are well known – as of course is the infamous line output transformer which Philips have done very little to improve.

The elimination of potential dry-joints, from which all panels suffer, greatly improves the reliability of the chassis. It is our recommendation that a soldering iron is applied to the following points, whether the joints appear to be satisfactory or otherwise.
(1) On the power panel, the four tags on the dropper, the three tags on the board associated with the input inductor (round type only) and the thermistor (R1362) in the degaussing circuit.
(2) On the chroma panel, the contrast potentiometer terminations, including the earth shield, the three RGB output transistors and their collector load resistors, and both ends of the luminance delay line.
(3) On the signals panel, the two BD131 audio output transistors, the 12V zener diode D166, the resistors in series with the 45V and 25V inputs (R189, R190, R200 and R221) and R143 (33kΩ) which feeds the TAA550 tuning voltage stabiliser.
(4) On the timebase panel R516 (10kΩ) which feeds the 18V zener diode, R533 (15Ω) in series with the field output stage, the field driver transistor's load resistor R457 (1·2kΩ), and R483 (15Ω) in the transductor circuit – also the transductor's terminations.
(5) On the line output panel, the trigger amplifier transistor's load resistor R515 (8·2kΩ), the damping resistor

Table 1: Types of electric motor.



R521 (4·7kΩ) in the line driver stage, and *all* the tracks and terminations on the upper drive panel, associated with the line driver transformer's secondary windings. After the resoldering, check across the two 10Ω damping resistors R527 and R529 with a low-reading ohmmeter. The reading should be around 1Ω: a higher reading indicates a high-resistance track.

The line output stage equalising coil repair described in the July aricle was excellent and adds to our own method of coil replacement by using the plastic formers from the rear convergence panel and rewinding, fitting centre spacers as necessary.

Buzzing inductors can generally be silenced by force fitting one or two rawlplugs – preferably not in front of the customer.

Slight bottom cramping is usually due to open-circuit field windings on the transductor – this adds the 15Ω damping resistor as a series element.

Attempts to remove the teletext lines by adjusting the field output stage bias present R463 are not always successful as bottom cramping can occur before the lines disappear. Several methods of increasing the field flyback time exist. Our favourite one was devised by John McKenna of Barrhead, Renfrewshire – replace C481 (0·47μF) in the raster correction circuit with a high-value electrolytic (greater than 1,000μF, 64V wkg.). The Rank A823 chassis also benefits from this modification.

A buzzing noise on high contrast scenes turned out to be due to the degaussing shield vibrating. It is permanently silenced by fitting plastic inserts between the shield and the c.r.t. glass, around the e.h.t. connector.

The greatest improvement to the reliability of this chassis comes from removing diode D544 on the line output panel. This disconnects the beam limiting circuit. The modification has saved countless hours of service calls to deal with intermittent brightness faults. The G11 chassis (non-teletext versions) also benefits from such treatment – remove transistors T4085/6 – and it's thought that other chassis may be "improved" by similar modifications. Engineers who subscribe to this view are asked to form a club to be known as RIBALD – Removal of Inadequate Beam Limiting Devices. It's proposed to nominate L.L.-J. as president. Will the proposer please make himself/herself known?

Mike Bragg,
Elliott Rentals, Paisley, Scotland.

Servicing Sinclair Microcomputers

Part 5

Ken Taylor

Previous treatment of the Spectrum in this series has related specifically to the issue 3 and 3B versions. There has however been continuous development of the machine since its introduction in 1982. The range now extends from the initial issue 1 version to issue 6A, covering a total of eight models with six PCB changes. It's time we looked at some of these variants, starting with the earlier models.

The issue 1 and 2 versions have a lot in common. They both have the early zigzag shaped heatsink, and both have small trimmer capacitors and preset potentiometers for setting up the colour generator circuits. The issue 2 board layout is shown in Fig. 8. The issue 1 differs only in the design of the original 32K extension memory, which isn't assembled on the main board as with all later versions. Instead, it's built on a plug-in board that carries the memory i.c.s and the decoders and multiplexers. This daughter board plugs into two DIL sockets at the rear of the main board and extends right across from the modulator to the coil. To accommodate this, the CPU and the multiplexer chips IC3/4 are moved towards the front of the main board along with the ULA and ROM chips, leaving a clear space into which the extension memory board fits. If this space isn't filled the machine isn't worth very much, since the extension is no longer available and without it the majority of the commercial programs cannot be used.

Another distinctive feature you will find on some issue 1 boards is the "spider". Due to a timing error in the 5C102 ULA chip it was necessary to fit an extra 74LS00 i.c. Because this was added retrospectively there wasn't room for it on the board, so the i.c. had to be mounted on its own small board suspended above the main board by the connecting wires. When the later type 5C112 ULA was introduced the spider was no longer required. The initial issue 2 board used the same 5C112 ULA but a further modification was fitted: this was the addition of TR6 which replaced the previous diode/resistor network – see Fig. 9. As you can see from Fig. 8, TR6 is mounted across the top of the CPU i.c. Later versions of the issue 2 board have the current 6C001 ULA chip: this necessitated some resistance changes which are detailed in (4) of the issue 2 modification instructions.

The following modifications should be added whenever a Spectrum is dismantled for servicing. First, issue 1 versions.

Issue 1 Modifications

(1) When National 4116 RAM i.c.s are fitted, remove R57 (330Ω) – connected to pin 28 of IC2 – and fit a 1kΩ resistor between the $\overline{CAS}$ line and the 12V rail and another 1kΩ resistor between the $\overline{RAS}$ line and the 12V rail. These resistors are best fitted on the underside of one of the memory chips IC6-13. C54 (at pin 28 of IC2) can also be removed – but it must be left in circuit when the 4116 RAMs are of NEC manufacture.

(2) When a type 5C102 ULA is fitted, add a 100pF capacitor between the $\overline{RAS}$ line and chassis.

(3) C46 (1μF electrolytic) should be replaced with a high-temperature capacitor as it's mounted beneath the heatsink.

(4) Axial capacitors should be fitted in place of all the disc ceramic capacitors. The following capacitors *must* be replaced: C41 (ROM pin 14 to pin 28) and C49 (between the collector and emitter of TR4) – these capacitors are both 47nF.

(5) If there's insufficient colour difference between white and yellow, fit a 47kΩ resistor between pin 13 of IC14 (LM1889) and chassis.

(6) To improve the reliability of the voltage generator the circuit should be modified to correspond with Fig. 13. A minimum would be to change the value of R60 and fit a 4·7μF electrolytic (C74) between the emitter and base of

TR5. See the notes on this section of the circuit in Part 6 next month.
(7) Finally, if you want to use the Spectrum to operate a Z80 PIO, or if you find that some machine code software doesn't run satisfactorily, check that the following modifications have been made.
(a) Change TR3's base circuit as shown in Fig. 10, i.e. replace D14 with C67, change R24 to 1kΩ and add the pull-up resistor R73.
(b) Change R27 from 680Ω to 470Ω or shunt it with a 1·5kΩ resistor (ULA pin 33 to CPU pin 20).

Issue 2 Modifications

Now to issue 2 boards. Like the modifications given for the issue 1 version these should be made whenever possible. Fig. 8 shows the positions of the components.
(1) Replace all disc ceramic capacitors with axial ones. Especially change C41 and C49 (47nF) – as with issue 1 boards – and change C43 (100nF) in the voltage generator circuit. This, together with modification (3) below, will update the circuit almost to issue 3 standard.
(2) To improve the colour, change R48 to 2·2kΩ, R49 to 8·2kΩ, R50 to 4·7kΩ, R72 to 10kΩ and C65 to 22μF. These components are all associated with the luminance/chrominance drives to TR1 and TR2 (see Fig. 11).
(3) Carry out the same modifications as those listed under (6) and (7) for issue 1 boards.
(4) The only currently available ULA is type 6C001. When this is used to replace an earlier type the following modifications should be made: change R47 to 1kΩ, R49 to 10kΩ and R56 and R63 to 470Ω.
(5) There's no need to change the speaker circuit from that shown in Fig. 5 to that shown in Fig. 11. The modification is very simple however if increased sound output is required.

Servicing Aspects

From the servicing point of view the advice given for issue 3 versions applies in general to issue 1 and 2 versions. There's one exception. There are four presets (TC1, TC2, VR1 and VR2) that may need setting up if any changes have been made. Their positions are shown in Fig. 8 and their functions are as follows.

TC1 sets the frequency of the 14MHz crystal that controls all the computer timing, including the 50Hz field sync signal. You might think that this would provide an easy means of setting up this control, but in many cases the range of adjustment is too small to enable the 50 Hz to be locked. The control is used only to alter the frequency slightly, to eliminate any objectionable colour patterning on the screen.

TC2 sets the frequency of the colour subcarrier oscillator and unlike TC1 Sinclair advise precise adjustment using a frequency counter. I've personally had no problems with the setting of this control but if a check is required it should be possible to compare the results with the frequency obtained from a TV set locked to a transmitter.

VR1 and VR2 are the only controls that may present difficulties. They affect the phasing of the colour-difference signals and are interactive in their effect on the display. Take particular care when dealing with issue 1 models because although the controls are in the same positions and are marked as shown in Fig. 8 the connec-

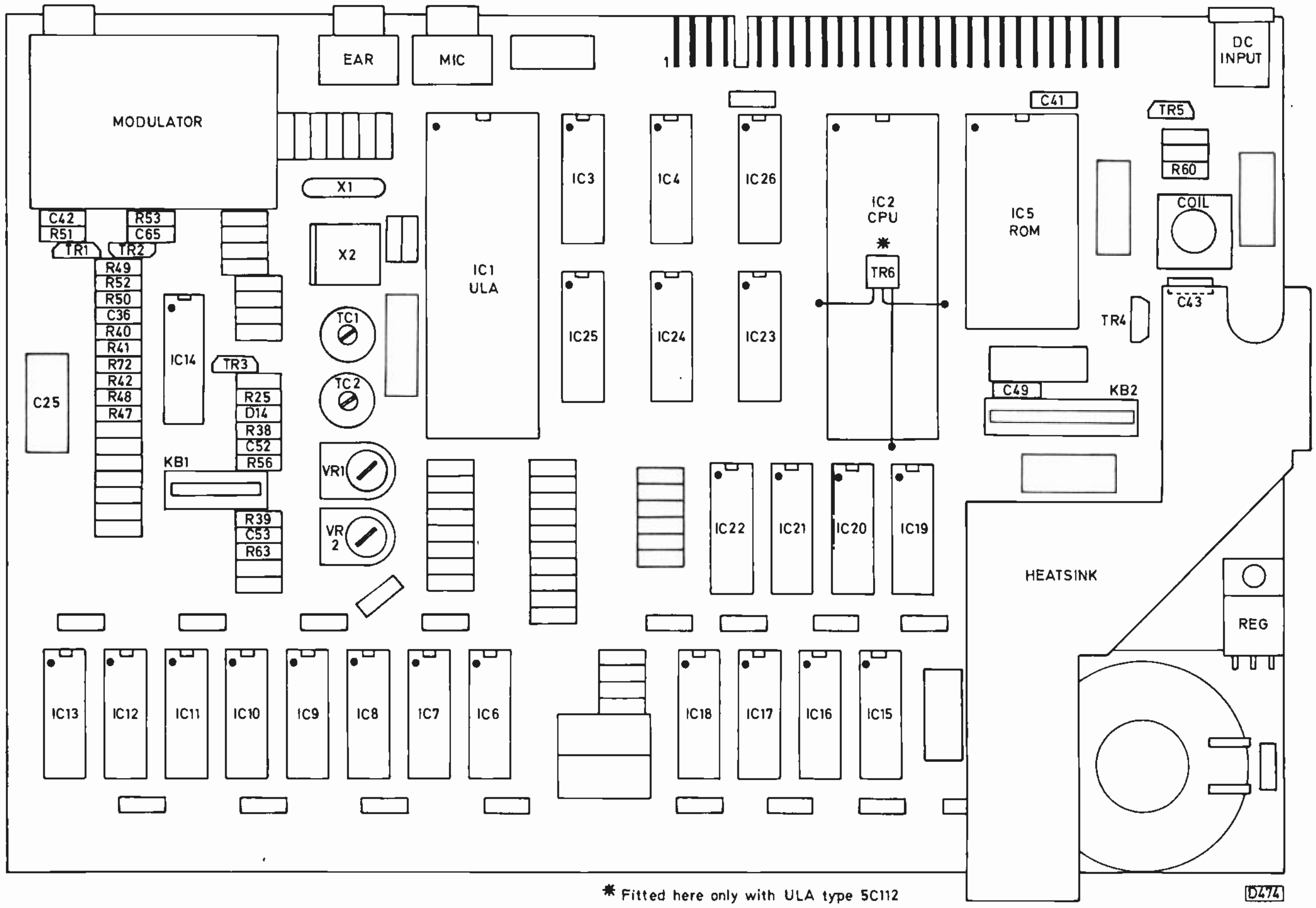


Fig. 8: Layout of the issue 2 board.

tions between them and IC14 are reversed.

A colour display is necessary for setting and checking these controls. The following short program will display colour bars, enabling the effect of any changes to be seen across the colour spectrum. It's advisable to save this program to make it easier to load when the top case and keyboard are lifted to reach the presets.

```
10 FOR N = 0 TO 7
20 FOR M = 0 TO 3
30 PAPER N : PRINT "    ";
40 NEXT M
50 NEXT N
60 GOTO 10
```

This will display the Spectrum colours corresponding to keys 0 to 7, i.e. black, blue, red, magenta, green, cyan, yellow and white.

If there's no colour on the screen when this program is entered and run, check the TV set's tuning and colour controls. If there's still no colour the controls will have to be set up. The procedure suggested by Sinclair is as follows.

(1) Switch on and initialise the computer. Do not enter a program.

(2) Using TC2, set the colour subcarrier frequency to 4·433619MHz ± 50Hz.

(3) Using VR1, set the voltage at pin 4 of IC14 to 50mV +0mV/−5mV relative to pin 3.

(4) Using VR2, set the voltage at pin 2 of IC14 to −50mV +5mV/−50mV relative to pin 3.

These settings are designed so that pins 2 and 4 will be at zero with respect to pin 3 when the computer is at its operating temperature. In the factory however they set pin 4 to 130mV ± 20mV and pin 2 to −75mV ± 20mV, so you can take your choice which values to use.

Personally I prefer the following method of setting these controls. It may seem very complex at first sight but it's actually quite simple. A word of explanation. Those of you who are long in the tooth – and short of hair – may remember ion traps. These could be set in a few seconds but it took you twice as long even to read the Mullard instructions. This procedure is similar. As the settings aren't critical – about the same as the average hold control – getting the colour correct is easier than reading the instructions. So here they are:

(1) Load the program above and run it.

(2) Assume that the subcarrier frequency is o.k. and set VR1/2 to mid-travel.

(3) Slowly sweep VR1 until colour is displayed. If no colour shows during the full travel of VR1, move VR2 slightly and try again.

(4) Keep moving VR2 in steps of about 20° to 30°, sweeping VR1 slowly back and forth until colour has been obtained, or the whole range of both potentiometers has been covered.

(5) If no colour can be obtained at any settings, mark the position of the vanes of TC2 and move it approximately 30°. Repeat (3) and (4) above. At worst it should take only about four-five repeats to get some indication of colour.

(6) When some colour is displayed, move the presets one at a time until the full eight colour bars are present, in their correct colours. Finally, find the optimum position for each adjustment, going over TC2, VR1 and VR2 at least twice.

The colour controls should now be set up correctly and the bars displayed in their correct colours. Check by switching channels on the TV set and making sure that the colours lock without any delay. When all is well set TC1 as described below.

If you still have a problem there could be a fault in IC14, the associated circuitry or the signals from the ULA. The colour-difference signals can be checked either at pins 17 and 18 of the edge connector (underside) or at VR1 and VR2. Examination of the signals with and without the colour display running will show if the ULA is o.k. Check the oscillator and its frequency at pin 17 of IC14 – use a high-impedance probe when checking the frequency.

Finally, when a satisfactory colour display has been obtained put in a program giving a screenfull of characters in red ink with a background of green paper and adjust TC1 for minimum patterning. Some early machines have a hole in the bottom of the case to enable this adjustment to be carried out with the computer fully assembled.

Next month we'll deal with the 4A, 4B, 5 and 6A versions.

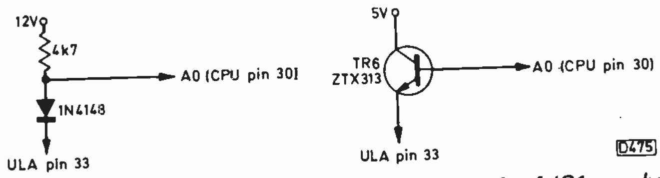


Fig. 9: Modifications associated with pin 33 of IC1: early version left, later version right.

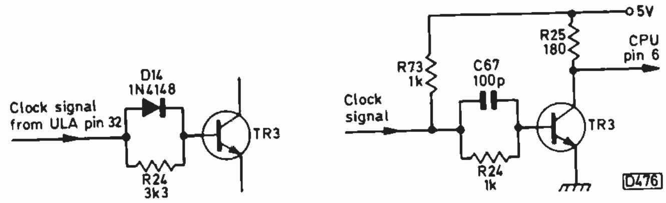


Fig. 10: Modified clock circuit. It's essential to modify the circuit to that shown on the right whenever the earlier version is found.

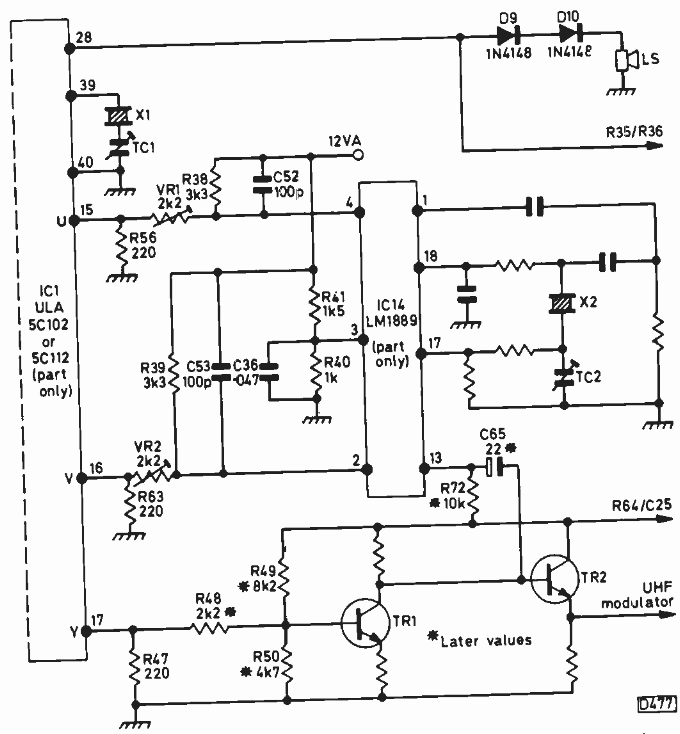


Fig. 11: Circuit variations around IC1/IC14 in earlier versions – compare with Figs. 1 and 5.

Satellite TVRO Installation

Part 2

Harold Peters

Before briefly surveying the market scene here's a quick run down on the basics of satellite TV – something we should perhaps have done first, but then you were so keen to get the dish up and working that aerial installation took priority. It's hard to believe that with the technology now well past the development stage and in a stable state there was only Russia's Gorizont four years ago – and before that nothing to speak of. Previous articles in *Television* have possibly been a little ahead of their time and assumed some basic background knowledge. This time we'll assume that you prefer to start from scratch.

Orbits

If you throw a ball in the air it takes an elliptical course and lands some distance away. At one point it is neither going up nor coming down, the force you gave it being equal and opposite to the pull of gravity. If only we could keep it there it would hover and we could bounce signals off it. Sadly air resistance joins with the effect of gravity and down it comes. The harder you throw it the farther away it lands and the wider the ellipse it traces until – with the aid of a rocket – you propel it so hard that the ellipse is greater than the earth's circumference and it "falls off the end", circling the globe.

Its elliptical path will be farthest from earth (the apogee) round the other side and nearest (the perigee) when it comes back over the launch site some ninety minutes later. Unfortunately the earth has spun round on its axis by 22·5° (360 ÷ 16) during this time, so the launch site misses the satellite completely. It's not much good then for bouncing signals off.

Suppose that while it is at its apogee you can boost its velocity. It could either leave the earth's influence altogether or, if you get it just right, it will go into a larger orbit farther out, one in which it circles the earth exactly once every twenty four hours. Position this orbit directly above the equator and an observer there, looking up, would see the satellite apparently motionless in the same place in the sky – because its angular velocity is the same as that of the earth. This geostationary or synchronous orbit is at 22,300 miles above the equator and is sometimes known as the Clarke orbit – since Arthur C. Clarke first suggested its possibilities in a letter to *Wireless World* back in 1945.

Satellites

The satellites in this orbit are used primarily for communications, including TV, and share a common basic design. A series of solar panels capable of collecting about 1·5kW/m^2 are attached to the main, cylindrical body of the satellite. These panels are arranged to turn and point towards the sun as the earth rotates. Dishes, some steerable and others fixed, pick up signals from the earth. Others retransmit the signals back down again. A "receive-transmit" pair is called a transponder and in the case of the Eutelsat birds and others the uplink from earth uses frequencies at around 14GHz while the downlink frequencies are at around 11GHz. The transponder simply converts the frequency of the signal it receives before beaming it back.

Satellites are kept on station by small gas jets that correct any positional errors. The more you have to use the jets the shorter the satellite's useful life. When you consider that the accuracy needed to keep within 0·1° drift per year is 70 feet radius (in 22,300 miles) and that any ovality of orbit must be less than 23 miles for a diurnal variation of less than 0·1° the drifts are remarkably small. With their near-equatorial launch sites France and the USA are luckier than Russia. The Russian satellites, launched from somewhere in the steppes, come on to geostationary orbit from the side, so most of them "wobble" a bit more than the others: with the foresight for which their engineers are noted however this wobble is arranged to give maximum e.r.p. over their own territory at peak viewing times.

Owing to the tilt of the earth's axis the satellites see the sun for 24 hours of the day for most of the year. During the equinoxes however the earth comes between the sun and the Clarke belt at midnight, shutting off the solar power supply. To keep the weight down the batteries provided are sufficient to keep only the telemetry and other essential beacons going. In practical terms this means that to avoid losing programmes before midnight the satellite should be placed in a longitude at least 11°W of the intended area of reception. At their peak these eclipses last for 72 minutes: they reduce to zero 22 days on either side of the equinoxes. Eutelsat-1 is unfortunately placed in this respect. At 13°E its solar power supply fails at 9·56 p.m. GMT during the equinoxes – we've already had complaints from people deprived of signals before midnight!

Footprints

The beam from a satellite can be wide (an omnibeam or Eurobeam) and of low power or concentrated in the form of a high-powered "spot". An example of the latter is the Eutelsat-1 west spot shown in Fig. 1. The graph of the area with adequate field strength is called the "footprint", the centre point aimed at is called the boresight – for Eutelsat-1 this is in the North Sea, off Cleethorpes – while the concentration of signal required to bring this about is the beamwidth, which is about 1·5° in this example. Beamwidth is determined by the satellite's dishes – the wider their diameter the smaller the beamwidth – and, as the diameter is limited by how big a dish you can get on to the launch vehicle without folding, on the launching system itself.

Signals

Terrestrial TV signals are picked up by rods and measured in terms of "microvolts per metre"; decibels are generally read in voltage terms (6dB down = half strength) and ratios are expressed as "signal-to-noise". With a dish for satellite reception the sensitivity is given in terms of watts per square metre (W/m^2), decibels are used in wattage terms (3dB down is half power), and the ratio

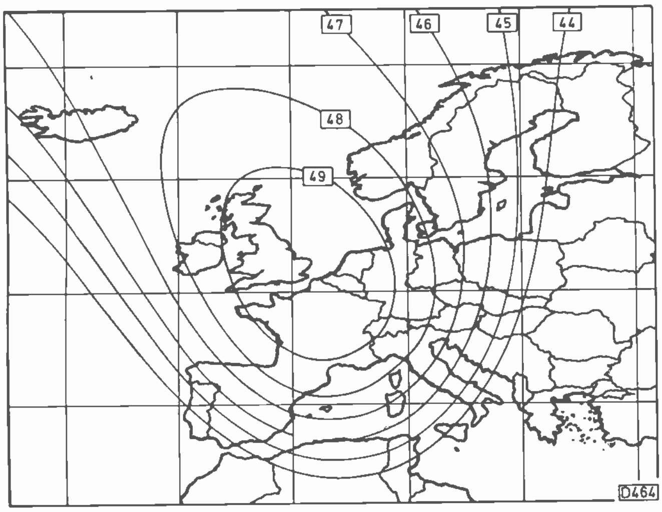


Fig. 1: Footprint for Eutelstat-1 – dBW contours.

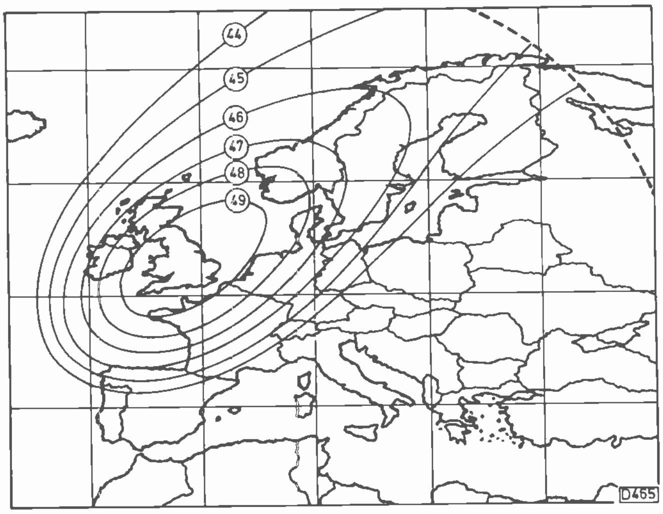


Fig. 2: Intelstat VA F11 footprint. For half transponder use, e.g. Premiere and Screen Sport, reduce by 3dB.

usually quoted is "carrier-to-noise". At first you tend to try to relate the old to the new, but you soon get used to the new terminology. In addition bitter experience soon teaches you that in satellite work one dB can make all the difference between no picture and a picture with no snow. So when you're told that a heavy rainstorm will drop the signal by a mere 1dB, rest assured that your viewer will most certainly notice the difference. But we digress . . .

Since less power is required to resolve a clean signal with f.m., in all transponders in current use the vision carrier is frequency modulated. In addition all the transponders use medium-power travelling-wave tubes (TWTs) as the output devices. Maximum frequency deviation corresponds to the maximum modulation depth with a.m., and represents the excursion from peak white to the sync tip. The brighter the picture the further the deviation from the nominal carrier frequency. The modulation, or picture content, is the rate at which the deviation changes from the nominal carrier frequency to maximum deviation, and because the sidebands are a product of the two the bandwidth required for an f.m. satellite TV channel is about six times that required for an a.m. terrestrial TV channel.

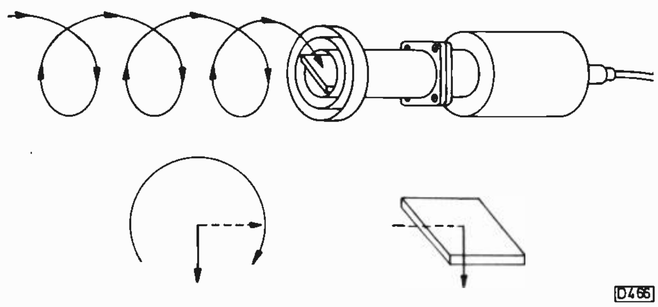


Fig. 3: Depolarising a circularly-polarised signal – the C band method for Gorizont. A PTFE wedge at 45° bends the horizontal component of the signal through 90°, adding it to the vertical component to increase the gain by 3dB.

A typical Eutelsat transponder channel has a bandwidth of 36MHz, with a deviation of 28MHz from black to white. Bandwidth limitation is possible by transmitting only one sideband. So you can get two programmes for the price of one by separately modulating each half of the transponder's bandwidth. A good example of this is the use by Screen Sport and Premiere/Children's Channel of two common half transponders on Intelsat VA F11. It is for this reason that a larger dish is generally required for receiving these programmes than their Eutelsat counterparts. Although the power flux density, or field strength, is about the same for both satellites, half transponder use effectively reduces the received signal by 3dB.

Polarisation

Additional frequency sharing is made possible by polarising the outputs from the transponders. Music Box and Sky share a common channel with slightly offset carriers: the Music Box signal is vertically polarised however while Sky is horizontally polarised. If you've adjusted your LNB correctly the unwanted channel will be cancelled out. Don't expect the LNB to be at exactly right angles to the ground for this condition. Unless the satellite is due south of you the polarisation will appear to be at a small angle.

The forthcoming DBS transmissions will use circular polarisation. Signals radiated in this way rotate, like a rifle bullet, as they travel from one point to another, and as far as your dish is concerned can be broken down into horizontal and vertical components. So an ordinary LNB will pick up circular polarisation whichever way round it's mounted. To prevent this and get 3dB more gain a "depolariser" consisting of a diagonal wedge of material of high dielectric strength, such as PTFE, is inserted in the mouth of the feedhorn (see Fig. 3). Once the depolariser has been optimised for the reception of right-hand circularly polarised signals all left-hand circularly polarised signals will be cancelled out and vice versa. Experience of circular polarisation can be gained from the Russian Gorizont C-band transmissions – still going strong at just below 4GHz, where everything is much easier to adjust.

Dispersal

Energy dispersal is provided on all transmissions by "wobbling" the carrier either side of its mean. Unless this wobble is filtered out after detection the picture will have an unbearable field flicker. Again Gorizont provides a practical exception: its dispersal is very slow, with quite a massive swing that cannot easily be filtered out after detection – it's best dealt with by adjusting the time-constant of the i.f./a.f.c. loop. Energy dispersal is used to minimise interference to terrestrial microwave links.

TV Systems

Despite the agreement to use C-MAC as the European satellite TV transmitting standard only the Norwegian NRK channel on Eutelsat-2 uses it at the moment. Most of the other transponders use the terrestrial system of the area aimed at. Thus France and Russia use SECAM, the rest PAL. All with 625 lines. This includes Ted Turner's Cable News Network (CNN) which is converted before being uplinked.

Sky is scrambled but at the moment the rest of the channels are clear. Some may follow the US practice of introducing scrambling once sufficient non-paying viewers are hooked on their offerings. A prerequisite for this will be the availability of a cheap, reliable scrambling system. Those in use today stem from military applications and are expensive to produce.

The accompanying sound signal is transmitted on an intercarrier in the 6·65MHz region – all the channels that began by using the sound-in-sync system have now changed to this method. This permits stereo and/or multilingual transmission to be added. For stereo the Wegener system is commonly used, with a mono signal at 6·6MHz, stereo left at 7·02MHz and stereo right at 7·2MHz. Europa TV (Eutelsat-1 at 11·17GHz with horizontal polarisation) intends to be multilingual, with English at 6·65MHz, Dutch at 7·02MHz, Portuguese at 7·2MHz, German at 7·38MHz and Italian at 7·56MHz.

If you experience sibilance on any channel this means that it uses a different de-emphasis time-constant from the standard 50μsec. Many receivers are now fitted with programmable variations for both de-emphasis and the sound intercarrier frequency. Failing this, suitable equalisation should be applied after detection. Gorizont, as ever, differs. The intercarrier is at 7MHz and companding is applied, using a 12kHz pilot tone to provide the variable correction after detection and amplification of the signal. You can still listen to the uncorrected sound but it's pretty terrible.

So much then for the basics. We shall delve into the "nitty-gritty" next month when we go into greater detail. Meanwhile we'll take a look at the market place.

Who Sells What

Because things tend to happen fast in the satellite TV field we can say only that the following brief review of who sells what was correct at the time of going to press.

Initially most packages available could be directed at only one satellite and if you needed signals of both polarities two LNBs were required, together with some switching at the set end. Then NEC introduced a double LNB assembly in which the two local oscillators are offset so that channels with horizontal and vertical polarisation can be multiplexed and sent to the receiver via a single coaxial cable. The latest thing is the polarotor, which is cheaper than an extra LNB: it either rotates the LNB through 90° or rotates a polarising element in front of the LNB. Almost all packages can now be supplied with motorized azimuth control to move the dish from Eutelsat to Intelsat. This is especially useful if you want to beam in on satellites lying between the two popular ones. The next step will be to extend the LNB ranges into the DBS spectrum, some 0-500MHz higher than the 11MHz band – and to provide C-MAC decoders.

Prices in the following notes are suggested retail ones and do not specify whether installation is included. Most equipment is guaranteed for twelve months and the basic packages assume a cable run of 20-30m. Longer runs would call for a larger dish or the use of in-line amplifiers. Fixed mounts are those with "Az-El" adjustment.

Armstrong Electronics Ltd., 4/9 Blessington Court, Dublin 7, Ireland. Distributors of satellite TV receiver systems, aerials and electronic equipment. Recently announced a range of spun aluminium dishes available in sizes from 1·5m to 4m, with polar or fixed mounts and the facility to fit a motor or hand crank. Matching NEC feedhorns and Houston Tracker motors are available.

Avcom, 500 Southlake Boulevard, Richmond, Virginia 23236, USA. Their portable spectrum analyser type PSA35 was mentioned as a useful item in Part 1. A companion sweep generator, type MSG1750, sweeps from 950-1,750MHz. Other equipment and a full range of accessories are available.

Beltronics, Kembrey Park Industrial Estate, Swindon, Wilts. Cheapest TVRO package around £1,250. Choice of 1·2m or 1·5m dish with polar mount and polarotor or two LNBs. Aerial actuator extra.

Connexions Satellite Systems Ltd., 125 East Barnet Road, New Barnet, Herts EN4 8RF. Cheapest package £895 with 1·2m offset dish, polar mount, polarotor and CX2460 receiver. For about another £300 you can have the CX2460R remote control receiver and an aerial actuator with indoor control.

Euro-Sat, 107 Cross Street, Sale, Cheshire. Range of dishes from 1m to 3m with stand and feed support.

Ferguson. Thorn EMI Ferguson Ltd., Cambridge House, Great Cambridge Road, Enfield, Middx EN1 1UL. Home satellite system package ES01 is available at around £1,495. Includes a 1·5m dish with polar mount (1·2m or 1·8m dishes are also available), polarotor, LNB, satellite receiver with IR remote control. Aerial actuator is extra.

Greenwich Satellite Ltd., 62-64 Beresford Street, London SE18 6BG. Master UK distributor of NEC equipment. A full range of systems is available starting at £1,056 for a 1·5m dish, polar mount, LNB and receiver. Larger dishes, actuators and remote control are available as extras. A unique feature is the double-stacked LNB assembly.

Grundig International Ltd., Mill Road, Rugby, Warwickshire CV21 1PR. For £1,750 Grundig offer the STR200 receiver (see review in June issue), a 1·5m pressed aluminium dish with polar mount and twin LNBs.

Handic/Victor, Unit 1, Valley Centre, Gordon Road, High Wycombe HP13 6EQ. The basic package, at around £1,000, includes an Italian 1·5m dish with a rim extension available as an extra, plus Japanese electronics. Handic claim that the outfit can be assembled on a DIY basis in thirty minutes.

Harrison Electronics, Century Way, March, Cambridgeshire PE15 8QW. Stockists of 4, 11 and 12GHz equipment including dishes, LNBs, receivers etc.

ITT Consumer Products (UK) Ltd., Paycocke Road, Basildon, Essex SS14 3DR. Around £1,200 buys you a 1·4m square offset dish, 96 channel receiver with IR remote control, an LNB, polar mount and polarotor.

Kesh Electronics Ltd., Main Street, Kesh, Fermanagh, NI. Supplies 0·9m to 2·8m dishes and complete systems for 4, 11 and 12GHz.

Luxor (UK) Ltd., 87-89 Farnham Road, Slough, Berks SL1 4UL. See Salora.

Maspro-Denkoh, 76 Shoe Lane, London SE4A 3JB. Package consists of a 1·2m offset dish with polar mount, LNB and Japanese receiver for £1,500. Polarotor and aerial actuator available as extras.

Megasat Ltd., 5 St. Pancras Commercial Centre, 63 Pratt Street, London NW1 0BY. Pioneers in the TVRO field. Now supply to the trade only. Can assemble packages from a wide selection of dishes, LNBs, receivers and ancillary gear. An integrated package is available comprising a 1·8m dish with polar mount, polarotor, 1·8dB LNB and receiver.

NEC. NEC Business Systems (Europe) Ltd., 36 Oval Road, London NW1 7EA. See Greenwich Satellite Ltd.

Network Satellite Systems Ltd., Unit 7-8, Newburnbridge Industrial Estate, Hartlepool, Cleveland. Full band package available for about £800.

North East Satellite Systems, Cropton, Pickering, North Yorkshire YO18 8HL. Supply a range of dishes in sizes 1·6m, 1·8m, 2·2m, 2·4m, 2·6m and 2·7m. Also ancillary equipment and complete packages.

Orbitel. Harvetti Ltd., 16-20 Cumberland Street South, Dublin 2. Can supply a basic package comprising 1·8m dish, fixed mount, LNB and receiver for about £800. A fully motorised version costs around £1,200. Other options available.

Precision Antennas, Masons Road, Stratford-upon-Avon, Warwickshire CV37 9NU. Supplies 1·5m, 1·8m and 2·2m dishes with polar mounts and feedhorns. Optional items include a wall-mounting polar mount and special configurations to suit roof mounted steelwork.

Rohde and Schwarz UK Ltd., Roebuck Road, Chessington, Surrey KT9 1LP. Suppliers of professional testgear of high quality, intended for manufacturers and cable companies, including the SFSZ satellite i.f. test transmitter which covers 50-1,750MHz and is capable of being modulated with video at up to 8MHz bandwidth.

Salora (UK) Ltd., Techno Trading Estate, Swindon, Wilts SN2 6EZ. Has available a full range of domestic TVROs including TV sets with built-in satellite TV receiving capability and full remote control of channel, polarity and satellite. Basic package available at around £1,000. Similar equipment included in both the **Salora** and **Luxor** ranges. Policy is to permit upgrading of equipment by retrofitting of extras.

Sat-Tel. Space Communications (Sat-Tel) Ltd., 9 Edgemead Close, Round Spinney, Northampton, NN3 4RG. Basic package consists of a 1·8m solid or perforated dish with polar mount, an LNB and STR1 receiver. Polarotors and aerial actuators are available for upgrading. Latest dish is a 1·4m square offset type.

SATVRN. Satellite TV Antenna Systems Ltd., 10 Market Square, Staines, Middx. Packages start at around £855. Three dishes are available: 1·2m offset, 1·5m and 1·8m, with polar mounts and optional polarotors and actuators. The SATVRN TDM1210 receiver can be converted to full remote control. Currently supplies packages to Thorn EMI Ferguson. DDT Maintenance Ltd., 58-64 Northfield Road, King's Norton, Birmingham B30 1JH provides a full installation and maintenance service.

STS. Satellite Technology Systems Ltd., Satellite House, Blackwarth Road, Bristol BS5 8AU. Basic package (STS300 series system) consists of a 1·2m offset dish with polar mount, an LNB and SSR7700 receiver for around £1,000. A polarotor is available as an optional extra. The STS600 system for hotels etc. can feed over 200 separate TV sets. Official UK agents for Japanese Satcom Receivers. Has dealer training centre at Bristol headquarters.

The Toshiba V5470B Fault-finding guide

John Coombes

The Toshiba V5470B is a piano-key operated Betamax VCR that was on sale during 1980-81. It was of advanced design for its time, with digital capstan and drum servos and three motors, one for direct drum drive. Features include a seven-day, three-event timer; microcomputer memory tuning; freeze frame in colour with the noise bar shunted off screen; picture search with colour; a programme quick selection facility; playback speed continuously variable between normal and double speed; and wired remote control. The machine was also sold as the Bush BV6900. The following notes summarise common problems.

(1) No results: Check the mains fuse F801 (500mA delay type). If it's blown check the mains filter capacitor C801 (0·1μF) which sometimes goes short-circuit.

(2) No results with the standby light on: Check fuse F802 (3·15A delay type) for being open-circuit. If it has blown check the double diodes D801 (S5151) and D802 (S5151R) in the 17V supply for shorts. If necessary go on to check F803 (1A delay type) in the 24V supply. Check rectifier diodes D804/5/6/7 (all 1S1885) if F803 is short-circuit. Note that the regulated 12·4V and 12V lines are derived from the 17V supply while the regulated 16·5V line is derived from the 24V supply.

(3) No results, ejected tape loose: Check for a broken guide pulley belt.

(4) No functions operational: Check that the 12V supply is present. If so check that 7·5V is present at test point TP511 (there should be a 15V p-p squarewave here) on servo board PW2110. If this voltage is missing remove plug P507 on the board. If a short is present at this plug check whether the stop solenoid microswitch S681 is faulty – this switch can also cause intermittent deck shutdown.

(5) Keys release: First check the plugs/sockets on servo board PW2110. Try removing plug P903 on pause board PW2113: if the drum motor doesn't operate suspect IC501 (TM4216P) on the servo board. Alternatively the capstan motor may fail to operate: again check IC501. If the tape doesn't move check the drive belts, the play idler reel assembly and the tape path and upper cylinder.

Key release with the capstan and drum motors running too fast again means a check on IC501 and if necessary C964 (0·01μF) on drum drive board PW2115 – this capacitor can go short-circuit. For key release with slight drum rotation check the drum drive transistor Q961 (2SD235Y) on panel PW2115.

(6) Play key jumps up intermittently: Usually caused by a badly worn play idler which can damage or break the tape. If the complaint is tape creasing check and if necessary replace the play idler. If the problem is caught early and the play idler is not worn it may be possible to do a service as follows. Separate the clutch assembly and remove any dust from the felt pads, then clean the plastic face plates with alcohol. Check the rubber tyre and if shiny rotate it on a small piece of wet/dry then clean with cloth and alcohol. Refit, replace play belt and check that the play torque is 80-120g/cm.

(7) Record key releases intermittently on a timer recording: Check that the modification on servo board PW2110 has been carried out – R619 should be 330kΩ, not 150kΩ.

(8) No eject: If it is displaced, reseat the wheel that guides the loading ring. Check the rewind key. If stiff to operate it may be necessary to remove the mechanism to clean out thick hardened grease that prevents free movement. After reassembly the problem should be cleared.

(9) Tape loading problems: Check the adjustment of the loading drive assembly. Too close tolerance will mean excessive tape tension or no loading/unloading. Excessive tolerance means loose loading ring movement with poor performance.

(10) Tape will not run: Check for a faulty loading end switch. If incorrectly set, follow procedure in manual.

(11) No play after rewind: Check whether R581 (1kΩ) on board PW2110 is open-circuit, then the stop microswitch which may be shorting.

(12) No or poor rewind: Check whether the tape is very tight. If an L750 cassette is poor on rewind check the rewind idler assembly. Replace the complete unit if the tyre is worn. Cleaning and lubrication may be all that's required if the tape is just running slow. Check that the reel brake is not sticking. If so free it and ensure that it's clean. Check that the supply reel and the fast forward/rewind belt are clean – replace the belt if it's elongated. If all these points are in order, suspect a badly worn upper drum. As a temporary measure, or to prove the point, clean it with a metal polish – this is a temporary measure only!

(13) Tripping on rewind: Check whether the tape is too tight, causing premature tripping. If necessary set up the rewind oscillator control R652 as specified in the manual.

(14) Autostop solenoid inoperative: If the plunger doesn't move freely in the solenoid housing, grease lightly. If necessary set up the solenoid position. Note that it will not release when the tape is at the end or reaches the counter memory point. It may not release when tape slack is detected or with no head rotation due to tape sticking.

(15) Monkey chatter on cue/review: Suspect IC601 (CX141) on servo board PW2110.

(16) Tape damage: A faulty pinch roller or play idler – see (6) – can be responsible for creased or broken tapes. In addition to incorrect tape path adjustment misalignment of the upper drum can cause tape damage. Failure of the slack sensor to operate will result in tangled or looped tape. Replace or set up the switch alignment as in the manual.

(17) Wow/flutter on sound: First check that the tape spools and pulleys are clean. Then suspect a faulty capstan motor. If the voltage at pin 1 of IC503 on panel PW2110 varies when the capstan motor is slowed down this usually indicates that the servo circuitry is working normally. Before replacing the motor (there may be noise bands in addition to wow/flutter) check the play idler and ensure that the capstan flywheel is free, clean and lubricated. If the capstan motor has to be replaced, check the tape speed and ensure that the correct capstan motor pulley is fitted – the larger the pulley the higher the speed and vice versa. The capstan motor can also be responsible for lateral picture instability, though the usual symptom is wow/flutter on sound.

(18) Bent verticals: Ensure that the back tension is set up correctly. If so, suspect the drum motor.

(19) High-pitched howling: This fault may be intermittent. Check that the capstan flywheel shaft is clean and slightly lubricated.

(20) Video troubles: The most common fault is loss of output from one head. The cause could be build up of dust in the gap. Clean with a cleaner stick and alcohol. The fault may show up only with the machine's own recordings, playback of prerecorded tapes being all right. If there's a cotton-wool effect across the screen with a picture in the background suspect that one of the heads is open-circuit. Streaking across the picture is another symptom caused by a faulty head.

There are other causes of an incorrect f.m. waveform, i.e. excessive noise on the picture. Check the alignment of the tape path, also the upper drum for excessive wear or misadjustment. The record/playback switch S101 can cause intermittent noise and picture breakup if it's dirty, misadjusted or worn. If the outputs from the two heads differ when playing back a recording check the adjustment of R152/3/4/5 on board PW2108. If this doesn't do the trick the drum dihedral adjustment may be incorrect. This is a complicated adjustment – it's simpler to replace the drum. For a good picture with no wow or flutter on sound, eccentricity alignment to a setting of less than three microns must be undertaken when a new drum is fitted.

If there is no recorded video, check IC401 (TA7637P) on board PW2109 by replacement. If there's no output from Q404/5 check whether C419 (0·022μF) is leaky.

For smeary playback check IC402 (TA7636P) on board PW2109 by replacement.

(21) Colour drop-out on cue/review: Check crystal X961 on drum drive board PW2115 – it can go off frequency.

(22) Interference on sound: This can be caused by a faulty drum motor. Make sure that the noise suppression components L961 and C962 (0·01μF) on drum drive board PW2115 are in order.

(23) Poor stills/vertical bouncing on cue/review: Suspect absence of the VD pulses from ICH01 (TC4528P) on speed control logic board PW2117.

(24) No frame advance: First ensure that the frame selector switch S982 on switch board PW2116 is operating correctly. Then check ICH03 (TC4528BP) on board PW2117 by replacement.

(25) Still frame slipping: Check that the frame correction control RH51 on board PW2117 is not set too high. Slightly adjust the screw to set the noise band at the bottom of the screen.

(26) Timer not alight: Check clock bulbs for open-circuits. This can occur when the machine is unplugged from the mains supply for the first time in a few years.

(27) Programme timer i.c. faults: The symptoms caused by IC861 (TC5038P) on board PW2112 can be many and varied – digits not illuminated, days not changing on programme setting or inoperative on second programme, and incorrect time settings. The timer may fail to latch, switching off from the mains for a few minutes after which the timer will reset.

(28) No channel lights, one channel only alight or stuck on BBC-1: Check ICA01 (TC9002AP) on selector board PW2106 by replacement.

(29) Memory button inoperative – will not lock channel: Check the TMM841P memory chip ICC01 on board PW2106 by replacement.

(30) Tuning drift: Several items on selector board PW2106 can cause this problem. The most likely cause however is the tuner unit itself – check by replacement. ICA01 (TC9002AP), ICC01 (TMM841P) and/or ICC02 (TA7619AP) on board PW2106 can all cause the trouble when warm or intermittently from cold. The other item you might need to check, again by replacement, is the 33V tuning supply stabiliser DE01 (μPC574JC).

The Development of Colour Tubes

Part 4: Behind the Colour Screen

Eugene Trundle

Just behind the tube's faceplate is the point where it all happens! The rear of the glass surface is coated with dots or stripes of phosphor materials that glow when bombarded by the electron beams. Phosphor brightness is proportional to the beam current and the accelerating voltage (e.h.t.).

Phosphors

A wide range of phosphor colours is available, but for colour tubes the three phosphors used – classified X in Europe, P22 (Jedec) in the USA and B22 in Japan – have very specific coloured light emission characteristics that are based on the EBU chromaticity co-ordinates – see Fig. 39. All the colours within the solid triangle can be reproduced on the screen – this compares well with the range of colour pigments, dyes and inks available. Monitor tubes are sometimes provided with a lighter blue phosphor (sky blue) whose desaturated colour gives much more legible alphanumeric displays while still offering a usuable hue for graphics displays. Purer colour phosphors have been developed since the EBU co-ordinates were finalised: these are also shown in Fig. 39 (enhanced red and green).

What the co-ordinates defining the colour triangle don't show is the purity (spectral bandwidth) of each phosphor. The spectral/energy emission characteristic for a typical modern tube is shown in Fig. 40. It can be seen that red has the narrowest bandwidth and lowest efficiency. To produce a standard colour-temperature white raster (Illuminant D6500) a typical anode current contribution by the red gun is 42 per cent, with the green and blue guns contributing 35 and 23 per cent respectively. When you recall that white light consists of 30 per cent red, 59 per cent green and 11 per cent blue you get an idea of the relative phosphor efficiencies. Other factors (many of them!) being equal, picture brightness depends largely on the chromaticity and efficiency of the green phosphor. Since the earliest colour tubes there has been a fifteenfold increase in white brightness due to phosphor improvements. Many phosphor materials have been used over the years: the current favourites (in Europe, America and Japan) seem to be yttrium/oxysulphide/europium (rare earth) for red, zinc sulphide/silver for blue and zinc sulphide/copper/aluminium for green.

With early in-line gun tubes the RGB phosphor stripes were laid on the screen continuously, i.e. with no gap between them – see Fig. 41(a). To provide some beam landing tolerance to take account of mask expansion, imperfect setting up and stray magnetic fields the mask slots were made narrower than the stripe width. For a domestic tube this resulted in a beam landing tolerance of about 60 microns at the centre of the screen and 140 microns at the edges. This approach is called a positive-tolerance system. The alternative approach shown in Fig. 41(b) is the negative-tolerance system where the mask slots are wider than the phosphor stripes, which now have a "guard-band" between them. In this case the beams slightly overlap their intended phosphor stripes. Apart from the advantage of making black matrixing possible (we'll come to this in a minute) the negative-tolerance screen produces a crisper picture due to the absence of "spread" and light scattering across the now sharply defined phosphor glow areas. The dimensions given in Fig. 41(b) relate to the Videocolour A66-FS10 tube.

Improving the Contrast

Achieving a high contrast TV picture is largely a battle to reduce the reflection of ambient light from dark (unenergised) sections of the screen. The first step taken to improve matters was the black matrixed screen, in which the spaces between the phosphor dots or stripes are filled with a light absorbing black pigment (usually based on carbon or graphite) to reduce screen reflectivity. The phosphor material itself is very light in colour however, and it was not long before dyes were added to the phosphors, making each absorb incident light other than

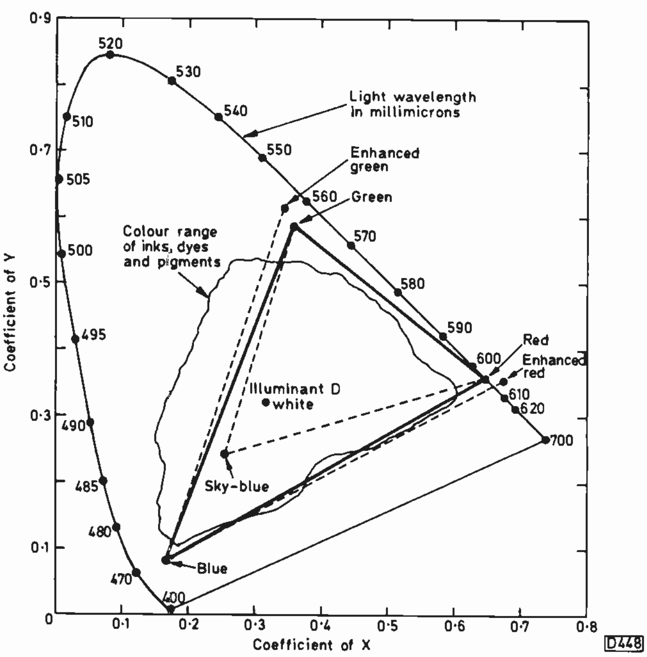


Fig. 39: The CIE chromaticity diagram.

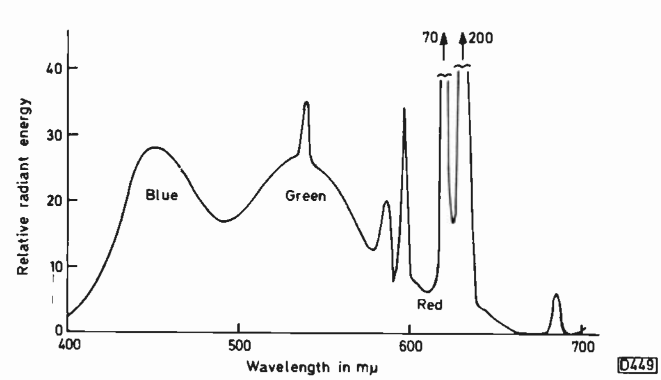


Fig. 40: Spectral emission and relative efficiencies of the phosphors. Although red peaks far higher than the others its very narrow emission band makes it the least efficient of the three.

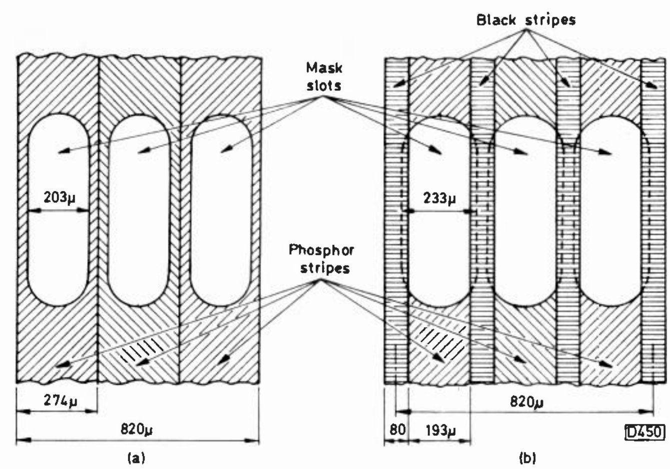


Fig. 41: Positive-tolerance screen-mask system (a) compared with a negative-tolerance system (b) for use with a black matrixed screen.

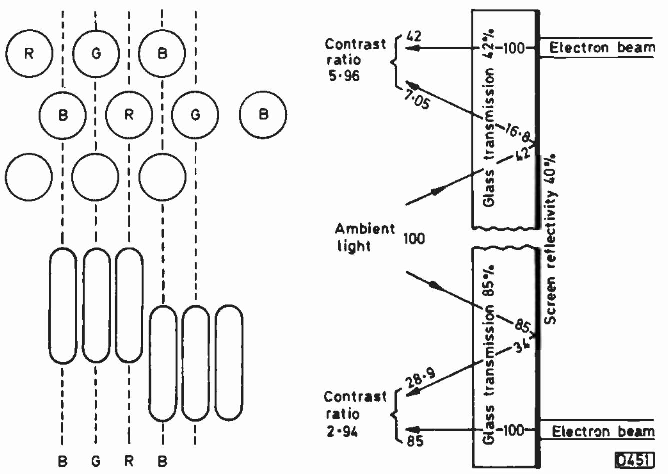


Fig. 42 (left): To achieve a comparable number of vertical picture lines the dot pitch of an in-line gun tube must be much finer than with a delta-gun tube.

Fig. 43 (right): Effect of two widely different faceplate glass densities on the contrast ratio. Ideally we need to change the filter density to suit the ambient lighting conditions – a separate glass filter introduces multiple light reflections however.

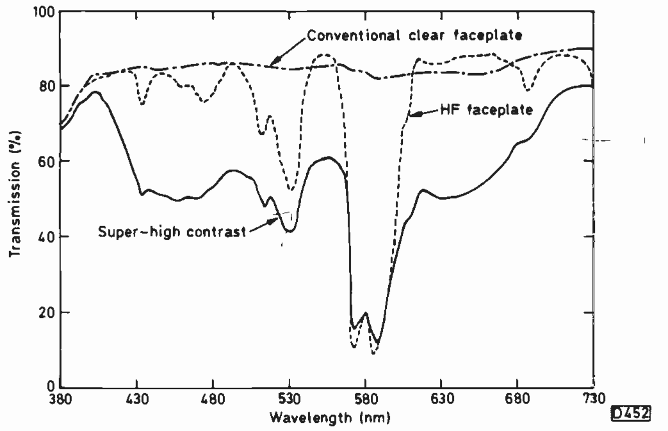


Fig. 44: Light transmission characteristic of a selective filter faceplate.

that of its own colour. These are called pigmented phosphors, and can be recognised by the RGB coloured appearance of the phosphor pattern on the face of an unenergised tube. The use of pigmented phosphors and black matrixing can reduce the reflectivity of the tube face by as much as 30 per cent without sacrificing brightness. This advantage can be used to improve either the brightness or contrast depending on the faceplate glass light transmission characteristic, as we shall see.

The rear surface of the phosphor is aluminised, the conventional practice for many years now, to reflect the phosphor light forwards, to equalise the charge over the whole screen area and to form an ion barrier. The gun side of the aluminising layer is often sprayed black, as mentioned last month in connection with mask heatsinking.

Stripe Pitch

With tubes intended for domestic TV use the phosphor stripe pitch is 0·8mm for screens above 50cm diagonal and about 0·6mm for smaller screen sizes. Individual phosphor stripes are typically 0·19mm wide in a large-screen, matrixed tube. Since no picture element can be smaller than the width of a stripe triplet, the structure of the screen and mask is a limiting factor for the tube's resolution. A standard 66cm stripe tube is capable of resolving about 350 lines, a 51cm tube about 270 lines and a 37cm type about 250 lines. These figures allow for a pixel to cover *two* stripe triplets, for easy viewing and to avoid spurious effects.

High resolution tubes with the stripe pitch down to 0·31mm are available at high price to give 370 lines with a 37cm screen and 550 lines with a 50cm screen, again allowing two triplets per pixel. They are expensive not only because of the precision of the screen and mask but also because of the special gun and yoke required to produce a suitably small spot size and matching convergence performance.

Delta-gun tubes give better definition for a given triad spacing – see Fig. 42. One 50cm delta-gun tube on the market has a dot pitch of 0·2mm, offering a 1,680 dot count across its width: sticking to our two-dot per pixel criterion, this gives a resolution of 840 lines. It must be interesting to converge!

Faceplate Glass Characteristics

The faceplate glass characteristics have an important bearing on picture tube performance. In effect the glass panel acts as a neutral-density filter, having grey glass with a light transmission characteristic that can vary, depending on tube design, between 40 and 85 per cent.

The basic idea of the tinted faceplate, which inevitably reduces picture brightness, is to reduce the screen's reflectivity and thus increase the contrast. Use of glass with a low light transmission characteristic helps because reflected light has to pass through the glass twice while the light emitted by the phosphors passes through only once. Thus if the glass light transmission characteristic is 50 per cent a fourfold reduction in reflected light is achieved for a halving of the available light from the phosphors.

The tendency in Europe seems to be to use a high light transmission glass for maximum light output (it seems, especially from their factory "granny-button" settings, that our German and Dutch cousins watch TV in a very subdued light). The USA and Japan on the other hand have generally opted for a better contrast ratio using low light transmission glass. Fig. 43 shows the effect of two different glass densities on the contrast ratio for a modern screen with black matrix infill and pigmented phosphors.

Mitsubishi go a step beyond the neutral-density filter principle with their Blue Diamond tubes. Into the faceplate glass mix go the rare-earth element neodymium oxide plus colourants, giving selective light transmission properties. These faceplates provide increased attenuation at wavelengths around 580nm (see Fig. 44), offering enhanced contrast where the ambient light level is high.

Also relevant to the faceplate is the question of reflections from the outer polished surface. The mirror effect of this surface will show an image of the room, the viewers and particularly any light sources. For domestic use the flat type screen (FST) has advantages because of its narrower capture angle. With monitor tubes, especially those used to display small alphanumerical characters, various treatments are available to break up the outer glass surface so as to diffuse reflections. All except the most expensive tend to impair the definition however, so careful design and control are required. The two most common treatments are chemical etching and silica coating. Fig. 45 shows the effect of the latter treatment on a half-coated screen by Mitsubishi.

Glass Envelope

The primary purposes of the glass envelope are to contain the vacuum essential for the tube's operation and to provide a flat viewing screen. There are many secondary functions. One is to provide the e.h.t. reservoir capacitor, whose plates consist of the conductive graphite coatings on the inner and outer surfaces of the bowl: with a large tube the capacitance value can be 2,200pF.

To reduce the energy released from this store in the event of a flashover, and just as important the *rate* of energy release, the inner graphite coating in present-day tubes is made resistive. The addition of iron oxide to the coating increases its resistivity and gives it a characteristic reddish colour. The effect is that of having a resistor of about 400Ω value in the path of any flashover current to any gun electrode. This technique reduces the likely flashover current from around 700A peak to approximately 60A while the rate of current build up is reduced by a factor of ten. The result is a great decrease in the amount of transient energy reaching the low-voltage circuits of the receiver, and less risk to the increasingly sensitive chips nowadays being used.

The protection functions of the envelope are twofold.

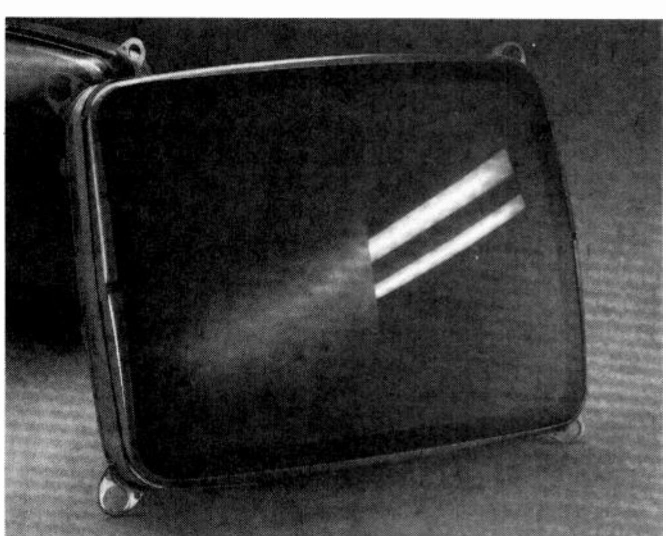


Fig. 45: Surface treatment of the faceplate diffuses light reflections from the tube's faceplate.

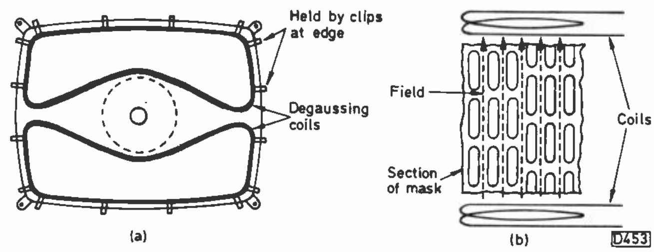


Fig. 46: The degaussing coil position for an in-line gun tube is shown at (a); the resultant degaussing field in the mask is shown at (b).

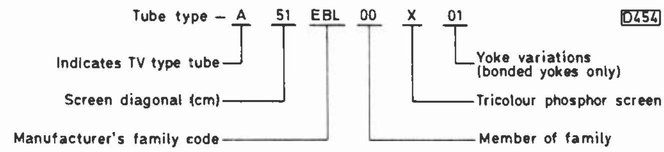


Fig. 47: Current tube type numbering system.

Strontium carbonate is included in the glass mix to provide an X-ray radiation barrier – the production of X-rays increases according to the twentieth power of the e.h.t. voltage. At specified e.h.t. voltages and currents the radiation from any accessible part of a working tube does not exceed the international standard of 0·5mR/hour: at the faceplate it's in practice usually less than 0·1mR/hour. The envelope must also protect viewers from the effects of implosion. The faceplate of current (FST) tubes is around 12·5mm thick at the centre and thicker towards the edges. The stress of atmospheric pressure on the faceplate is conveyed to the rimband where it's contained in the band's tension.

The envelope is made in two parts, the neck/bowl and the screen. These two components are heat-sealed together at a late stage in manufacture. The tube is then pumped to a hard vacuum and sealed at a glass pinch at the rear end. To absorb any further gases, particularly those liberated from the gun, mask, etc. during the life of the tube, a getter material (usually based on barium) is used. It's packed into a trough at the end of a spring attached to the front of the gun assembly, to tuck it well out of the way in the tube's bowl. After tube evacuation it's fired by means of a local r.f. heater to activate it.

Internal Degaussing Shield

In modern tubes the degaussing shield is incorporated within the bowl. This magnetic shield prevents ambient magnetic fields upsetting the beam landing. Any flux it acquires itself is neutralised by the action of the degaussing coils which are mounted on the tube's bowl and also demagnetise the shadowmask and rimband. The coils are fed with a decaying burst of 50Hz a.c. at switch on. With in-line gun tubes there's infinite vertical landing reserve, so it's necessary to generate only a vertical field to correct for the stray fields which would deflect the beams horizontally. This is achieved by the coil configuration shown in Fig. 46(a) which, because of the continuity of the mask material in the direction of the degaussing field (Fig. 46(b)), requires fewer ampere-turns than the degaussing coils for a delta-gun tube. An h.f. bypass capacitor shunts the degaussing coils to prevent currents induced from the line scan coils causing beam mislanding.

Tube Nomenclature

For many years tube size has been specified in inches (more recently centimetres), the quoted figure referring to the overall diagonal measurement across the glass screen. This was somewhat misleading, and all tube makers have now agreed to adopt the Worldwide Type Designation System. With this the *visible* picture diagonal is quoted in centimetres. Fig. 47 explains a typical c.r.t. type number using this system.

The FS tube types – tubemakers are very rapidly converting to FST production – have the following common sizes: 22cm (9in.), 36cm (14in.), 41cm (16in.), 51cm (21in.), 59cm (24in.), and 66cm (27in.). Where these figures correspond to the old Pro-Electron classification system the picture area with the new types is greater. The new 51V tubes have 6·2 per cent greater picture area than the old 22in. types and the new 66V tubes 9·5 per cent more picture area than the original 26in./66cm types. Hence the claim – made more in the USA than here – for 28in. as the largest consumer tube size.

Definition Enhancement

There are two ways in which the scanning spot in a colour tube can be manipulated to give an apparent improvement in picture sharpness. Both have been used in Sony receivers under the name Turbo Trinitron. The first uses a split focus electrode to which differential pulses at instants of black/white or white/black transitions in the video waveform are fed. The pulses are obtained from the luminance signal by filtering. This is followed by differentiation, amplification, phase splitting and then application to the focus electrodes via two separate output stages. The effect of this arrangement is to "flatten" the scanning spot momentarily into a narrow ellipse, thus enhancing the vertical edge of the picture feature.

A similar drive system is used with the later velocity-modulation enhancement system. Here however the "edge pulse", derived as above, is fed to a little class B push-pull output stage whose load is the VM yoke – a few turns of wire on a plastic former mounted on the tube neck. The field produced by this winding opposes that produced by the line deflection coils. Its effect is thus not on the size of the spot but on its scanning velocity. Imagine a white-to-dark transition. If we momentarily slow the spot down before the edge, then momentarily speed it up afterwards, we shall emphasise the edge by brightening it – the increased spot dwell-time gives greater brightness at that point. This is followed by a black edge, produced by the subsequent spurt put on by the spot to catch up its correct position along the line. The system works with black-to-white transitions as well, with none of the "phase" penalties of electrical enhancement circuits. In fact it works very well indeed, especially with teletext and computer displays: plugging the VM yoke in and out gives a convincing "before and after" demonstration.

Next Month – Beam-indexed Tubes

Next month we'll take a look at the beam-indexed colour tube: several versions of this type of tube have been introduced recently for various special purposes.

CORRECTION

We apologise for an error that got into Mr. Pearson's letter about sound problems with the Grundig Model 6010 (page 576, July issue). "NS transductor" should have read "ultrasonic transducer". This is connected via a phono connector to the TD (remote) panel.

next month in

TELEVISION

FREE GIFT!!

A simple aid to chip removal will be provided free with the October issue of *Television*. Be sure not to miss your copy!

● SERVICING THE JVC HR7300

David Botto provides servicing notes on these popular machines. In general the information applies also to the HR7200 and the Ferguson 3V29 and 3V30.

● BATTERY-OPERATED CRT TESTER

A portable tester which gives a quick indication of tube emission is a boon when buying second-hand CTVs "off the pile". This design by Nick Laidlaw uses a Thorn 3500 series e.h.t. transformer to generate some 350V for test purposes. It can be used to test both delta and PIL type tubes and is powered by a 6V lead-acid battery.

● BEAM-INDEXED COLOUR TUBES

A striped screen and a single gun, with the input switched in RGB sequence – that's the beam-indexed colour tube. This type of tube has been talked about for many years: it's now being used for certain special applications. Eugene Trundle looks at these new tubes in the concluding instalment of his current series.

● SERVICING THE FERGUSON 3787

Large numbers of these well-made 14in. colour portables are still in use. Their thyristor line output stage and power control circuitry confuses some, but the sets are well worth attention. Colin Boggis provides guidance on circuit operation and common faults.

PLUS ALL THE REGULAR FEATURES

ORDER YOUR COPY ON THE FORM BELOW:

TO ....
(Name of Newsagent)

Please reserve/deliver the October issue of TELEVISION (£1·20), on sale September 17th, and continue every month until further notice.

NAME ....

ADDRESS ....

....

....

ECONOMIC DEVICES, PO BOX 228, TELFORD TF2 8QP

15/80H	3.30
15/85R	3.30
16039	0.79
16181	1.04
16182	1.04
16334	0.98
16335	0.94
16446	0.98
16600	1.38
16802	1.27
17052	5.61
17053	5.61
17074	9.30
17089	5.35
17127	3.51
17376	1.58
17523	1.32
17524	1.32
1N4001	0.06
1N4002	0.06
1N4003	0.06
1N4004	0.06
1N4005	0.08
1N4006	0.08
1N4007	0.07
1N4148	0.04
1N4448	0.05
1N5401	0.14
1N5402	0.15
1N5403	0.16
1N5404	0.15
1N5408	0.35
1N914	0.04
IR3403	5.00
1S1555	0.20
1S44	0.10
1S5012A	0.81
1S921	0.10
2N1303	0.38
2N2219A	0.40
2N2222	0.38
2N2646	0.80
2N2904	0.36
2N2905	0.43
2N2906	0.38
2N2926	0.15
2N3053	0.27
2N3054	0.99
2N3055	0.61
2N3442	1.56
2N3702	0.14
2N3703	0.14
2N3705	0.16
2N3706	0.14
2N3707	0.16
2N3711	0.11
2N3771	2.04
2N3772	1.71
2N3773	2.29
2N3819	0.42
2N3823	1.17
2N3904	0.62
2N3908	0.62
2N4101	1.33
2N4240	3.30
2N4444	1.73
2N5293	0.50
2N5294	0.50
2N5296	0.49
2N5297	0.50
2N5298	0.61
2N5771	1.18
2N6109	1.58
2N6130	0.72
2N6133	1.25
2N6180	0.95
2N6292	1.65
2N696	0.43
2N698	0.43
2SA1006	1.50
2SA1011	1.65
2SA1015	0.49
2SA1012	1.25
2SA1020Y	0.86
2SA1027R	0.45
2SA473	0.75
2SA766S	4.95
2SC1173Y	1.25
2SC1474	1.25
2SC1509	1.35
2SD1391RL	3.95
2SA1095	4.10
2SA1103	6.55
2SA329	0.40
2SA351	1.17
2SA489	1.17
2SA490	2.25
2SA493	2.25
2SA562	0.57
2SA564	0.58
2SA614	4.88
2SA628	1.14
2SA639S	1.50
2SA659	0.49
2SA673	1.27
2SA684	1.61
2SA697	0.82
2SA699	1.75
2SA715	0.95
2SA747	8.26
2SA748	1.36
2SA817	0.65
2SA818	1.82
2SA835	2.50
2SA836	0.89
2SA844	0.35
2SA872	0.70
2SA884	2.15
2SA937R	0.97
2SA940	1.81
2SA940-2	2.14
2SA950	0.72
2SA951	1.26
2SA966-Y	1.16
2SA999	1.36
2SB774	1.15
2SB185	1.13
2SB375	3.87
2SB400	0.40
2SB405	1.03
2SB407	3.24
2SB449B	6.98
2SB511	2.50
2SB54	1.39
2SB546	3.75
2SB56	2.80
2SB618A	2.22
2SB631	3.25
2SB643	0.61
2SB669	3.67
2SB681	3.96
2SB695	1.98
2SB75	1.04
2SB774	0.72
2SB819	0.89
2SC1034	6.75
2SC1050	5.06
2SC1096	1.16
2SC1104	3.98
2SC1106	4.54
2SC1114	6.75
2SC1116	4.95
2SC1124	1.26
2SC1129	0.34
2SC1131	0.50
2SC1158	3.33
2SC1162	1.05
2SC1172	2.22
2SC1195	3.26
2SC1212A	1.97
2SC1213	0.89
2SC1226	1.46
2SC1293	0.90
2SC1306	1.98
2SC1316	4.10
2SC1317	0.87
2SC1364	0.49
2SC1383	1.20
2SC1391	2.45
2SC1398	0.94
2SC1413A	3.05
2SC1446	1.25
2SC1447	2.07
2SC1475	0.37
2SC1505	1.00
2SC1514	1.41
2SC1573Q	1.25
2SC1578	8.74
2SC1583	1.17
2SC1617	3.89
2SC675	1.41
2SC1678	1.98
2SC1741	1.25
2SC1810	1.70
2SC1815	0.66
2SC1826	0.65
2SC1829	2.22
2SC1875	5.19
2SC1881K	2.98
2SC1893	3.02
2SC1906	0.98
2SC1921	1.37
2SC1923	1.07
2SC1929	2.25
2SC1942	5.70
2SC1945	4.53
2SC1959	0.45
2SC1957	1.09
2SC1953	1.93
2SC1962	1.93
2SC1969	3.10
2SC1983	8.35
2SC1985	1.55
2SC2009	0.34
2SC2029	2.33
2SC2028	2.11
2SC2063	0.99
2SC2078	2.39
2SC2073	1.54
2SC2085-Q	1.40
2SC2091	1.30
2SC2141	1.86
2SC2166	1.98
2SC2216	0.69
2SC2233	2.20
2SC2236	1.65
2SC2278	1.14
2SC2314	2.17
2SC2335-KI	10.41
2SC2551	1.26
2SC2565	3.36
2SC2570	1.85
2SC2577	1.75
2SC2578	6.75
2SC2671	1.99
2SC2826	2.07
2SC288A	1.85
2SC3153	5.26
2SC372	1.40
2SC373	1.16
2SC383	1.33
2SC388	0.50
2SC394V	0.81
2SC403C	0.39
2SC41	2.19
2SC458	0.39
2SC495	0.92
2SC515A	2.85
2SC535	0.79
2SC536	0.41
2SC537	0.54
2SC605L	1.16
2SC620	1.46
2SC643A	1.54
2SC668	0.67
2SC681	4.40
2SC682	1.88
2SC684	1.65
2SC693	0.63
2SC710	0.69
2SC711A	0.50
2SC717	1.28
2SC734	1.43
2SC761-Y	0.95
2SC783	3.98
2SC790Y	1.64
2SC828	0.28
2SC867A	3.05
2SC876	0.96
2SC930	0.54
2SC935	4.13
2SC936	8.66
2SC940	4.68
2SD1128	2.90
2SD1138	0.99
2SD1273	1.25
2SD1453	0.75
2SD152K	2.64
2SD198	3.87
2SD234	0.49
2SD235	0.60
2SD24	2.29
2SD257	2.94
2SD292	2.59
2SD313	2.59
2SD325D	1.95
2SD348	16.13
2SD350	5.20
2SD350A	2.80
2SD353	7.50
2SD389	2.41
2SD401	2.55
2SD414	1.98
2SD471	2.13
2SD560	2.95
2SD588A	2.36
2SD600	3.25
2SD601R	0.65
2SD613	1.03
2SD621	12.85
2SD636	0.55
2SD639-R	0.85
2SD655	0.98
2SD657	2.85
2SD661A	0.80
2SD731	2.45
2SD773	0.33
2SD811	5.54
2SD823	1.98
2SD837	1.56
2SD841	3.65
2SD856	2.25
2SD857Q	1.84
2SD882	1.50
2SD894	1.50
2SD898	5.45
2SK105H	2.15
2SK152	2.95
2SK34	0.76
2SK41	1.07
2SK79	2.98
40408	0.50
40594	1.53
40636	1.43
4EX581	0.80
741	0.30
7805-T022	0.63
7806	0.73
7808	0.85
7812-T022	1.16
7815	0.64
7818	0.92
7824	0.64
7905	0.80
9368	10.70
AA133	0.12
AC133	0.12
AC123K	0.43
AC127	0.27
AC128	0.34
AC138	0.24
AC141	0.29
AC142K	0.44
AC151	0.28
AC176	0.30
AC179	0.28
AC183	0.72
AC187	0.39
AC187K	0.43
AC188	0.25
AC188-01	0.49
AC188K	0.43
AC193K	0.65
AC194K	0.65
AD140	1.06
AD143	1.25
AD145	1.60
AD161	0.56
AD162	0.45
AD262	1.25
AF114	2.47
AF115	1.24
AF118	1.20
AF127	0.50
AF139	0.53
AF178	1.45
AF179	0.55
AF180	0.55
AF181	0.53
AF186	0.53
AF239	0.43
AF279	0.88
AL113	1.36
AN115	3.98
AN155	1.89
AN206	2.58
AN208	3.55
AN210	2.28
AN211	3.25
AN214Q	2.75
AN231	14.65
AN234	5.92
AN236	3.78
AN239	6.95
AN240P	1.52
AN241	1.71
AN245	4.49
AN253	2.97
AN260	3.85
AN262	1.98
AN272	7.92
AN281	6.65
AN295	5.52
AN301	5.55
AN302	3.99
AN303	4.39
AN305	9.47
AN315	2.46
AN316	5.53
AN318	6.27
AN320	5.47
AN321	2.25
AN322	5.85
AN331	4.59
AN337	5.37
AN340P	1.17
AN355	5.98
AN362	1.75
AN370	3.95
AN5010	5.70
AN5111	2.92
AN5120N	4.50
AN5132	4.39
AN5250	3.98
AN5435	3.08
AN5610	7.43
AN5612	4.12
AN5613	3.80
AN5630	3.95
AN5701N	1.66
AN6250	2.95
AN6300	7.00
AN6310	8.74
AN6320N	4.28
AN6340	15.18
AN6341	2.40
AN6342	1.61
AN6363	16.00
AN6371	9.24
AN6387	7.95
AN6531	1.95
AN6551	1.35
AN6552	0.68
AN6610	2.40
AN6677	6.60
AN7111	1.45
AN7114E	5.94
AN7115	2.55
AN7120	4.65
AN7145	2.80
AN7146	4.35
AN7151	2.26
AN7156	2.85
AN7158	6.75
AN7218	1.64
AN7223	4.25
AU107	3.50
AU110	2.25
AU113	5.25
AY105K	2.08
AY106	1.09
BA524	8.21
B250	2.65
B40	1.55
BA130	0.14
BA1310	1.98
BA1320	1.38
BA1322	3.95
BA1330	2.75
BA145	0.19
BA148	0.33
BA154	0.40
BA155	0.12
BA156	0.05
BA159	0.15
BA182	0.24
BA222	1.66
BA302	1.24
BA311	1.32
BA312	0.97
BA313	0.76
BA317	0.08
BA318	0.09
BA328	4.77
BA333	1.37
BA335	6.27
BA5102A	3.78
BA511	2.92
BA514	2.20
BA521	2.52
BA524	8.94
BA526	7.98
BA527	2.98
BA532	1.56
BA536	2.95
BA6209	4.75
BA656	8.99
BA7100	10.85
BA841A	16.72
BA843	3.96
BA854	5.76
BAV18	0.21
BAV19	0.11
BAV20	0.31
BAV21	0.34
BAW62	0.19
BAX12	0.44
BAX13	0.11
BAX16	0.11
BC107	0.13
BC107A	0.11
BC107B	0.18
BC108	0.15
BC108B	0.15
BC109	0.12
BC109B	0.15
BC109C	0.12
BC113	0.14
BC119	0.36
BC126	0.20
BC132	0.14
BC135	0.14
BC137	0.18
BC138	0.34
BC139	0.28
BC140	0.45
BC141	0.34
BC142	0.34
BC143	0.33
BC147	0.08
BC148A	0.10
BC148B	0.13
BC148C	0.11
BC149	0.11
BC149B	0.13
BC153	0.14
BC154	0.14
BC159	0.36
BC160	0.40
BC161	0.28
BC168	0.36
BC169C	0.16
BC170	0.16
BC171	0.11
BC172	0.13
BC172B	0.27
BC173	0.17
BC174B	0.27
BC177	0.20
BC178	0.26
BC179	0.26
BC182	0.09
BC182L	0.10
BC182LB	0.14
BC183L	0.11
BC183LB	0.26
BC184	0.13
BC184L	0.14
BC184LB	0.26
BC186	0.27
BC187	0.28
BC204	0.16
BC207	0.14
BC212	0.11
BC212B	0.26
BC213L	0.10
BC213LB	0.15
BC214	0.10
BC214LB	0.26
BC225	0.40
BC237	0.10
BC237BJ	0.12
BC238	0.10
BC238A	0.13
BC238B	0.13
BC239	0.12
BC239B	0.25
BC251A	0.12
BC294	0.50
BC300	0.35
BC301	0.45
BC302	0.53
BC303	1.04
BC307	0.18
BC307A	0.14
BC308	0.18
BC308A	0.11
BC309	0.17
BC317A	0.13
BC327	0.15
BC328	0.11
BC337	0.09
BC338	0.34
BC368	0.24
BC440	1.09
BC441	0.44
BC454	0.36
BC460	0.42
BC461	0.47
BC462	1.15
BC463	0.64
BC477	0.37
BC478	0.32
BC479	0.41
BC532	0.28
BC546	0.17
BC547	0.10
BC548	0.10
BC549	0.10
BC550	0.40
BC556	0.16
BC557	0.10
BC558	0.10
BC559	0.10
BC559B	0.11
BC560C	0.14
BC635	0.36
BC636	0.42
BC637	0.24
BC639	0.20
BC640	0.24
BC879	0.39
BC880	0.31
BCX34	0.40
BCY70	0.30
BCY71	0.21
BCY72	0.20
BD115	0.46
BD116	0.70
BD124	1.31
BD124P+KIT	0.69
BD131	0.42
BD132	0.42
BD133	0.53
BD135	0.36
BD136	0.26
BD137	0.36
BD138	0.46
BD139	0.34
BD140	0.37
BD144	1.70
BD150	1.25
BD157	0.67
BD160	1.60
BD163	0.71
BD165	0.62
BD166	0.42
BD168	0.73
BD175	0.60
BD179	0.49
BD181	0.99
BD182	0.99
BD183	0.99
BD184	1.21
BD187	0.53
BD189	0.69
BD190	0.69
BD201	0.53
BD202	0.60
BD203	0.50
BD204	0.59
BD207	1.79
BD208	1.23
BD222	0.49
BD225	0.49
BD228	0.63
BD229	1.05
BD232	0.50
BD234	0.42
BD237	0.47
BD238	0.39
BD239	0.45
BD240	0.37
BD241	0.39
BD242	0.39
BD243A	0.37
BD243C	0.79
BD244	0.51
BD244C	0.79
BD245C	0.99
BD246C	0.89
BD253	1.05
BD278A	0.80
BD317	2.60
BD318	2.85
BD375	0.42
BD380	0.76
BD410	0.52
BD433	0.47
BD434	0.49
BD435	0.49
BD436	0.60
BD437	0.49
BD438	0.40
BD441	1.42
BD442	0.66
BD509	1.42
BD510	1.07
BD519	1.50
BD529	1.32
BD530	1.18
BD533	0.67
BD534	0.53
BD535	0.79
BD536	0.61
BD537	0.74
BD538	1.45
BD544B	0.83
BD598	1.25
BD677	0.53
BD679	0.57
BD680	0.76
BD681	1.48
BD696	2.47
BD699	3.49
BD700	3.70
BD707	1.06
BD709	1.12
BD710	0.80
BD809	0.85
BD810	0.69
BD879	0.74
BD880	0.79
BD895	2.31
BD899	2.48
BD901	0.79
BD902	0.84
BDW83C	1.56
BDW84C	1.56
BDX32	1.75
BDX53A	4.93
BDX53B	3.35
BDX54B	2.16
BDX62A	2.15
BDX63A	1.96
BDY20	1.21
BDY81	1.18
BF115	0.40
BF117	0.66
BF118	0.67
BF121	0.25
BF123	0.21
BF127	0.13
BF137	0.29
BF153	0.58
BF154	0.26
BF157	0.33
BF158	0.18
BF159	0.18
BF160	0.31
BF167	0.38
BF173	0.34
BF177	0.35
BF178	0.40
BF179	0.36
BF180	0.36
BF181	0.32
BF182	0.34
BF183	0.39
BF184	0.43
BF185	0.39
BF194	0.14
BF195	0.14
BF196	0.17
BF197	0.16
BF198	0.17
BF199	0.17
BF200	0.37
BF218	0.36
BF224	0.17
BF237	0.65
BF240	0.17
BF241	0.17
BF245	0.50
BF245A	0.45
BF245B	0.49
BF246A	2.52
BF255	0.20
BF256	0.28
BF256LB	0.42
BF256LC	0.42
BF257	0.34
BF258	0.36
BF259	0.34
BF262	0.57
BF263	0.57
BF271	0.34
BF273	0.20
BF274	0.20
BF324	0.35
BF336	0.33
BF337	0.40
BF338	0.44
BF355	0.49
BF362	0.66
BF363	0.60
BF371	0.50
BF391	0.25
BF417	0.84
BF418	1.87
BF422	0.29
BF423	0.52
BF450	0.35
BF451	0.29
BF457	0.41
BF458	0.39
BF459	0.52
BF460	1.56
BF469	0.31
BF470	0.55
BF471	0.31
BF472	0.33
BF479	0.61
BF480	1.38
BF491	1.99
BF495	0.64
BF506	0.43
BF509	0.41
BF523	0.24
BF532	0.45
BF596	0.18
BF597	0.27
BF694	0.22
BF757	0.59
BF759	0.47
BF761	1.05
BF762	0.75
BF869	0.65
BF870	0.30
BF959	0.42
BF960	0.69
BF970	0.69
BFR39	0.44
BFR61	0.50
BFR62	0.50
BFR79	0.29
BFR81	1.65
BFR86	1.08
BFR89	1.63
BFR90A	1.30
BFT42	0.43
BFT43	0.43
BFT84	0.40
BFW10	0.60
BFX29	0.34
BFX84	0.37
BFX85	0.41
BFX86	0.36
BFX87	0.55
BFX88	0.34
BFX89	0.44
BFY50	0.32
BFY51	0.50
BFY52	0.27
BFY79	0.49
BFY90	0.61
BLY49	2.20
BR00	0.22
BR01	0.75
BR03	0.75
BR03	1.26
BRC116	0.67
BRC300	2.01
BRC5296	0.77
BRC6109	0.83
BRC82	1.08
BRC83	2.19
BRC84	2.08
BRX44	0.60
BRX49	0.53
BRY39	0.69
BSS38	0.87
BSTBD140G	5.25
BSTC0246	7.25
BSTC0233	7.25
BSTCC0143	3.07
BSTD1043	2.85
BSV57B	3.49
BSW68	0.60
BSX19	1.29
BSX20	0.34
BSY52	0.50
BSY79	0.51
BT100A	1.61
BT106	1.55
BT108	1.45
BT119	1.76
BT120	2.17
BT121	2.48
BT123	1.98
TBA970	3.06
BT151-800R	1.15
BTT6018	2.42
BTT8124	4.89
BU106	2.48
BU108	1.50
BU109	2.65
BU110	5.69
BU111Y	4.16
BU125	2.48
BU126	1.55
BU137	9.25
BU205	1.08
BU206	1.27
BU207	1.65
BU208	1.12
BU208/02	1.97
BU208A	1.12
BU208D	1.95
BU209	1.93
BU226	2.95
BU326	2.00
BU326A	2.20
BU326S	2.20
BU406	1.49
BU406D	1.79
BU407	0.82
BU407D	1.09
BU412	9.15
BU426A	1.67
BU500	1.95
BU508A	1.89
BU536	1.68
BU608	2.65
BU705	3.07
BU806	1.79
BU807	0.80
BU826A	2.15
BUW84	1.39
BUX84	1.00
BUX85	1.10
BUY69A	2.04
BY126	0.14
BY127	0.13
BY133	0.11
BY164	0.47
BY176	0.52
BY179	0.75
BY182	1.05
BY184	0.47
BY187	0.77
BY189	1.79
BY198	1.62
BY201/2	1.50
BY203/20	0.59
BY207	0.22
BY208	0.46
BY210-400	0.18
BY210-600	0.27
BY210-800	0.34
BY218	1.64
BY223	1.23
BY224-600	1.88
BY225-100	1.13
BY226	0.25
BY227	0.49
BY228	0.60
BY229-1000	1.12
BY229-600	0.92
BY255	0.69
BY295-600	1.03
BY298	0.20
BY299	0.60
BY407	0.84
BY409	1.49
BY448	0.69
BY713	1.10
BYW19/1000	1.36
BYW56	0.34
BYX10	0.29
BYX55-600	0.19
BYX71-600	1.25
BYX71-350	0.72
BYX94	0.16
BYY56	1.20
BZY93C30	1.86
BZY88 RANGE	0.10
BZX61 RANGE	0.18
BZX79 RANGE	0.10
C106D	0.46
C106M	0.76
C1129	0.58
CA3046	2.35
CA3089	0.83
CA3090AQ	3.25
CA3094	2.20
CA3131EM	3.12
CBF16848N-071	1.56
CD4001	0.38
CD4002	0.27
CD4008	1.35
CD4011	0.29
CD4012	0.24
CD4013	0.47
CD4016	0.46
CD4017	0.82
CD4020	1.23
CD4021	0.39
CD4023	0.28
CD4025	0.64
CD4028	0.84
CD4040B	0.85
CD4047	1.06
CD4049	0.46
CD4052	0.75
CD4066	0.38
CD4069	0.29
CD4070	0.66
CD4081	0.35
CD4093	0.72
CD4511	1.10
CD4528	2.04
CD4556	3.47
CR02AM-8	1.55
CV12E	3.07
CX095D	3.14
CX104	9.64
CX108	11.48
CX109	7.86
CX130	8.76
CX134	11.04
CX136	11.49
CX139	11.83
CX157	4.84
CX158	4.10
CX177	6.75
CX187	5.26
CX755	12.95
CX885A	6.85
DEC1	2.20
DEC2	2.20
DS3486N	4.33
DS3487N	4.33
E1222	0.40
E5024	0.28
E5386	0.25
E9003	0.46
E9005	0.50
ESM310BP	4.15
FND500	5.78
GC374	1.65
GD243	4.95
GF758	0.84
GH3F	1.82
HA11215	5.06
HA11211	2.53
HA11225	4.29
HA11226	8.71
HA11229	2.88
HA11235	3.48
HA11124	5.25
HA11244	2.82
HA11251	4.47
HA1125	4.29
HA1137W	2.87
HA1138	5.03
HA11414	5.65
HA1144	7.87
HA1156	1.16
HA1160	4.78
HA1166	5.25
HA1166X	5.36
HA1167	5.36
HA11706	9.50
HA11705	8.00
HA11703	9.56
HA11701	9.56
HA11710	9.50
HA11713	8.13
HA11711	9.00
HA11715	8.13
HA11714	8.56
HA11716	13.10
HA11725	18.26
HA11725MP	16.00
HA117555P	6.23
HA11781	29.48
HA1180	5.15
HA1196	7.43
HA13001	6.25
HA1306	2.26
HA1338	7.50
HA1339	2.33
HA13402	7.87
HA13342	2.65
HA13365	4.02
HA1366WR	1.86
HA1367	4.32
HA1368R	2.45
HA1368	1.90
HA1370	3.71

IF YOU DON'T SEE IT LISTED ASK FOR QUOTE. GIVE MAKE MODEL LOCATION. REMEMBER TO ADD 0.60p POST & HANDLING. ADD 15% VAT TO TOTAL

TEL 0902 712083 TELEX 338490

HA1374	4.80
HA1377	4.98
HA1389R	2.05
HA1389	2.39
HA1392	3.90
HA1394	3.95
HA1397	3.76
HA1398	3.98
HA1406	2.07
HA1452	1.63
HBF4030AF	2.48
HD14538	2.07
HD38702-A2	7.45
HD38750A53	8.95
HD38750A-7	7.25
HD38800A50	14.09
HD44801A05	18.25
HEF4001BP	0.67
HISH1010	8.59
HISH1004	6.00
HISH1002	9.50
HM6231	9.81
HM6232	8.89
HM6251	5.70
HM7103	2.46
HM9032	3.22
HM9012	3.22
HM9015	3.24
HT4207	17.16
HT4208	18.25
IN5401	0.11
IR2403	4.25
IR2C05	4.25
IR3P06	2.25
IR3P08	4.95
IR94558	6.25
IS751	2.85
ITT425	0.18
IZ0003GE	5.37
IZ0020GE	5.93
K174YP	3.46
KA2101	2.92
KC581C	6.32
KC582C	3.97
KC583C	5.54
L200CV	1.69
LA1201	1.02
LA1210	1.56
LA1230	2.87
LA1320	2.87
LA1352	1.75
LA1357N	11.07
LA1363	7.25
LA1364	3.02
LA1365J	3.44
LA1385	1.94
LA1387	7.60
LA3155	1.25
LA3301	1.65
LA3350	1.43
LA3361	1.25
LA3365	3.98
LA3390	4.25
LA4030P	4.20
LA4031P	3.20
LA4032P	2.35
LA4100	1.25
LA4101	1.30
LA4102	2.81
LA4112	1.56
LA4125	2.25
LA4138	3.45
LA4140	1.15
LA4192	4.29
LA4220	1.62
LA4250	6.75
LA4400	3.92
LA4420	1.72
LA4422	1.72
LA4430	1.56
LA4440	4.95
LA4445	7.25
LA4460	2.32
LA4461	2.95
LA4505	6.56
LA5112N	2.65
LA7020	7.33
LA7025	8.05
LA7027	9.35
LA7040	9.20
LA7042	4.25
LA7800	2.65
LA7801	4.15
LB1274	3.08
LC7800	9.20
LD3120	1.13
LD3150	2.25
LM1017N	4.29
LM1877	10.92
LM224	1.75
LM2808	6.25
LM2877	5.25
LM317CKC	1.38
LM324N	0.75
LM339N	0.80
LM340K	11.85
LM342P	1.62
LM342P	1.62
LM342P	1.62
LM348N	2.15
LM380N	2.80
LM384N01	3.25
LM567CN	1.71
LM6402/011	10.23
LM6402A093	10.15
LM748	1.82
LM8360	3.87
LM8361	3.57
LR2612	11.95

LR3419	9.37
LR3471	9.37
LU1141	7.27
LU52012	5.95
LU52011	4.95
LU03112	12.37
M193	12.75
M21C	1.00
M23C	0.83
M293	9.15
M51102L	6.35
M5115P	5.24
M51203L	3.15
M51231P	3.04
M5134-9341	4.13
M51353P	5.25
M51381P	4.50
M51393AP	7.78
M51394P	11.97
M5142P	5.49
M5144P	4.25
M51513L	2.55
M51515BL	3.23
M51517L	3.71
M5192	2.20
M5194AP	5.74
M5231L	1.95
M53274P	1.33
M54532P	2.15
M54544L	4.75
M58478P	6.75
M58485P	10.74
MA06	1.07
MA8001	0.82
MA8003	1.16
MB3705	1.98
MB3712	1.85
MB3713	1.69
MB3730	3.25
MC13002	3.55
MC1310P	2.25
MC1327P	1.33
MC1330P	1.69
MC1350P	1.61
MC1351P	3.96
MC1352P	2.50
MC1357P	2.15
MC1358P	1.55
MC14001	2.40
MC14013	0.41
MC14493P	3.44
MC14494P	2.15
MC14497	3.65
MC14510BAL	3.75
MC14511BCP	1.10
MC14528BCP	2.70
MC1712	3.88
MC5192	13.50
MC7724CP	3.49
MC7818C	2.18
MCR100/7	1.65
MCR106-5/6	0.95
MCR220/7	2.28
ME0402	0.17
ME0404/2	0.47
ME0411	0.28
ME6002	0.26
ME6102	0.28
ME8001	0.34
ME0411	0.75
MJ2501	3.30
MJ3001	1.75
MJ481	1.53
MJ802	5.45
MJE2955	1.89
MJE3055	1.65
MJE340	0.49
MJE520	0.49
ML231	3.33
ML232B	2.15
ML237B	2.51
ML238	5.77
ML923	3.30
ML926	3.98
MM5314N	4.02
MM5316N	4.25
MM5318N	3.11
MM5369N	2.01
MM5387AA/N	6.20
MM5841N	6.64
MN1400VL	9.96
MN1405	9.52
MN1435VX	11.48
MN6016A	20.56
MP1192	5.07
MP2794	4.00
MP2812	5.07
MP8512	1.57
MPC596	2.13
MPF256C	0.60
MPS6570	0.48
MPSA42	0.65
MPSA56	0.27
MPSA92	0.49
MPSU05	0.86
MPSU10	1.56
MPSU56	0.64
MPSU60	1.98
MR818	0.33
MR854	0.72
MR914	1.20
MSM5816RS	17.35
MSM5840H	9.25
MVS460-02	0.61
NE542	2.50
NE545B	4.86
NE555	0.38
NE556	0.95

NE565N	1.33
NE645BN	3.35
NP1106	5.61
OA202	0.11
OA47	0.14
OA91	0.09
OA95	0.12
OC28	2.95
OC29	2.15
OC36	1.28
OC44	0.35
OC45	0.18
OC72	0.44
OC75	0.44
ON236	1.06
ON782	1.98
OT121	1.45
PT6042	2.45
PT8504	4.98
R1038	2.19
R1039	2.19
R2008B	1.33
R2009	1.98
R2010B	1.33
R2029	1.33
R2030	1.33
R2257	3.71
R2265	1.49
R2305	1.18
R2322	0.59
R2323	0.76
R2354A	2.01
R2354B	2.01
R2443	0.88
R2461	1.50
R2540	2.31
R2540X	3.30
R2615	0.67
RCA16029	2.01
RCA16600	1.38
RCA16802	1.08
RCA17074	6.60
RCA17376	1.58
RCA17524	0.83
RCA17523	0.83
RCA2060	2.00
RGP01-15	0.70
RGP10	0.50
RGP30M	0.59
RT402	1.58
RT905A	2.38
S1299	5.74
S175	31.48
S2062D	2.07
S2800D	5.54
S2802	3.47
S2818	4.05
S3702S	6.15
S40W	10.89
S6080B	8.80
SA8063	5.17
SAA1006	1.75
SAA1020	4.76
SAA1025	4.40
SAA1024	2.81
SAA1075	6.25
SAA1121	5.14
SAA1124	3.25
SAA1130	4.99
SAA1174	7.77
SAA1250	4.25
SAA1251	9.85
SAA11351	4.95
SAA3027P	10.03
SAA5000	2.95
SAA5010	5.39
SAA5012	5.20
SAA5020	5.78
SAA5030	8.25
SAA5050	7.74
SAB1009B	5.98
SAB3011	7.34
SAB3013	5.61
SAB3021	7.90
SAB3024	6.36
SAB3209	5.82
SAB3210	3.49
SAF1032P	6.50
SAF1039	3.35
SAS5010	8.39
SAS560S	2.26
SAS560T	5.42
SAS570T	5.42
SAS570S	2.61
SAS580	2.85
SAS6600	1.33
SAS660	2.97
SAS6700	1.33
SAS670	3.96
SAS6710	1.33
SBA750	1.61
SC84203	19.35
SC9504P	1.95
SDA2006	18.95
SDA2112/2	12.85
SG264A	5.26
SG613	8.75
SG629	8.27
SG6533	10.31
SI-1020H	10.89
SI-1125HD	17.63
SI1125H	7.50
SI1225HD	17.73
SI1630HD	17.85
SI6900	12.00
SKE1/02	1.85
SKE2F1/04	1.39
SKE2G3/04	1.05
SKE4F1/06	0.73

SKE4F2/08	1.24
SKE4F2/06	0.85
SKE4F2/10	1.24
SKE4G2/02	0.96
SKE5F3/10	1.60
SKS1/10	2.15
SL1310	3.14
SL1430T	1.98
SL414	3.69
SL432A	3.44
SL439	2.48
SL471	4.78
SL480	3.98
SL490	2.37
SL901B	8.32
SL918A	6.98
SN16861ANO	4.95
SN16862AN	2.98
SN16966N	10.25
SN29717N	7.19
SN29716N	3.66
SN29715N	6.04
SN29722	11.95
SN29723AN	7.65
SN29764AN	1.38
SN29767	4.98
SN29770BN	4.24
SN29772BN	4.91
SN29771BN	5.26
SN29791	1.67
SN29798N	5.56
SN2709	0.44
SN7400N	0.34
SN7401N	0.36
SN7402N	0.65
SN7404N	0.24
SN7408N	0.27
SN7410N	0.27
SN74121	1.60
SN7413N	0.37
SN74141N	2.65
SN74151AN	1.51
SN74154N	1.27
SN74190	2.00
SN7420N	0.34
SN7430	0.49
SN7440N	0.27
SN7472	1.54
SN7474N	0.44
SN7490AN	0.93
SN74LS26N	0.53
SN76001N	1.65
SN76013ND	2.48
SN76023N	5.15
SN76023ND	3.96
SN76033N	4.15
SN76110N	0.90
SN76115AN	1.61
SN76131	1.92
SN76227N	1.33
SN76226DN	1.98
SN76228N	3.27
SN76242	8.95
SN76243	5.23
SN76396	2.90
SN76533N	2.47
SN76532N	2.95
SN76545	4.87
SN76546N	3.47
SN76549	2.59
SN76570	3.08
SN76611	2.59
SN76620	2.59
SN76660N	2.48
SN76666N	1.41
SN76708	4.86
SN76709N	13.50
SN76707N	5.11
SN76705N	1.34
SN76730	5.36
SN76810N	0.60
SN76832N	3.25
SN94041	5.54
SN94042	4.35
SP8385	0.55
SPS5384	1.98
ST1702L	0.99
STA401	6.76
STA441C	2.75
STA471C	7.56
STK0029	5.54
STK0039	5.35
STK0040	12.00
STK0050	7.67
STK0080	9.16
STK011	3.96
STK013	9.25
STK014	9.80
STK015	7.75
STK016	6.94
STK022	5.25
STK025	12.50
STK031	12.95
STK040	9.40
STK043	13.44
STK054	7.13
STK058	18.25
STK077	7.67
STK078	8.52
STK080	16.50
STK082	11.86
STK086	13.59
STK1039	5.75
STK2110	7.33
STK2145	16.25
STK2230	7.70
STK2240	14.40
STK2250	18.95

STK3042	11.05
STK3044	5.75
STK4019	4.50
STK430	11.75
STK433	4.95
STK4332	8.25
STK435	5.94
STK4352	12.25
STK436	7.21
STK437	7.80
STK4372	3.85
STK439	8.31
STK441	11.28
STK443	10.29
STK457	13.45
STK460	14.83
STK461	9.68
STK463	11.53
STK466	11.77
STK4833	16.95
STK501	6.32
STK502	5.74
STK5314	9.48
STK5730	3.95
STK7216	12.67
STK772	6.95
STR1096	4.50
STR4090	11.98
STR440	7.85
STR441	6.50
STR451	4.95
STR453	8.16
STR454	7.50
STR6020	8.31
T6029V	5.75
T6035V	0.73
T6036	0.67
T6037	2.11
T6044V	0.97
T6045	1.20
T6049	1.45
T6052V	0.87
T6058	0.59
T6059	0.65
T9003V	1.25
T9005V	2.38
T9011V	0.49
T9013V	7.96
T9014V	2.60
T9016	1.02
T9019W	1.98
T9034V	1.38
T9035V	2.33
T9051	7.45
T9054V	1.15
T9057V	0.70
T9062V	0.49
T9064	1.51
TA6002	4.35
TA7027	4.80
TA7050	1.74
TA7051	1.74
TA7054	2.55
TA7060AP	0.71
TA7061AP	1.27
TA7069	3.13
TA7070P	1.83
TA7072P	2.57
TA7073P	5.86
TA7074P	1.98
TA7076P	7.80
TA7089P	3.10
TA7092P	8.65
TA7093P	3.99
TA7102P	5.88
TA7108P	1.61
TA7109	3.71
TA7122B/P	0.92
TA7124P	2.34
TA7129P	1.50
TA7130P	1.27
TA7136AP	1.27
TA7137P	0.98
TA7141AP	3.87
TA7146	2.50
TA7146P	4.23
TA7148P	1.67
TA7149P	3.26
TA7152P	1.72
TA7153P	7.47
TA7161P	5.45
TA7162P	3.25
TA7169	9.54
TA7172P	1.41
TA7176P	2.48
TA7193AP	6.67
TA7193P	5.50
TA7201P	2.71
TA7203P	2.18
TA7204P	2.16
TA7205P	1.38
TA7206P	6.35
TA7207P	3.34
TA7208P	2.15
TA7210P	3.58
TA7214P	3.63
TA7215P	2.58
TA7217AP	1.45
TA7222	1.95
TA7226	3.57
TA7227P	2.81
TA7229P	4.45
TA7230P	4.98
TA7232P	6.60
TA7233P	5.32
TA7240AP	7.83
TA7245P	7.50
TA7270	7.50
TA7310P	2.15

TA7312P	2.45
TA7313AP	1.50
TA7314	5.94
TA7323P	3.15
TA7325P	1.15
TA7339P	1.35
TA7340P	5.06
TA7607AP	13.90
TA7609	3.28
TA7611AP	4.80
TA7616P	5.25
TA7622AP	8.94
TA7628P	5.98
TA7629P	7.50
TA7630P	2.98
TA7640AP	1.55
TA7672P	2.25
TA7676P	2.81
TA7726P	10.25
TAA320A	1.27
TAA350A	6.45
TAA570	1.74
TAA621AX1	2.65
TAA621A12	2.14
TAA661B	2.62
TAA691	8.58
TAA700	3.75
TAA930	4.87
TAA970	2.83
TAA110	2.52
TAG232-600	0.73
TAG626-600	1.06
TBA120AS	1.24
TBA120SB	1.05
TBA120T	0.95
TBA120U	2.50
TBA120A	1.05
TBA1440	2.03
TBA1441	1.62
TBA1440G	5.20
TBA1441	1.75
TBA240A	3.99
TBA395	1.10
TBA395Q	1.10
TBA396	0.80
TBA400	2.39
TBA440P	2.45
TBA480Q	1.30
TBA500P	6.58
TBA510	2.11
TBA520	1.84
TBA520Q	1.68
TBA530	1.30
TBA530	1.30
TBA540	1.15
TBA540Q	1.15
TBA560C	1.40
TBA560CQ	1.60
TBA570Q	1.60
TBA570A	1.71
TBA641A12	4.13
TBA641B72	3.03
TBA651	1.76
TBA673	2.60
TBA700	1.85
TBA720	1.55
TBA730	3.55
TBA750Q	2.90
TBA760	1.71
TBA800	1.08
TBA810S	1.61
TBA810T	1.50
TBA810AS	1.00
TBA820	1.52
TBA820M	0.82
TBA890	2.50
TBA920	1.89
TBA920Q	2.31
TBA940	1.87
TBA950	1.84
TBA970	3.56
TBA990	1.82
TBA990Q	1.68
TC4001BP	3.25
TC4011BP	3.50
TC4013BP	3.75
TC4016BP	3.15
TC4053BP	4.34
TC4069	1.52
TC4071BP	2.76
TC4081BP	3.25
TC40H000	1.98
TC4514BP	4.15
TC9002BP	11.95
TCA270Q	1.71
TCA270S	2.15
TCA270SQ	1.65
TCA290A	2.39
TCA420A	2.16
TCA440	2.25
TCA530	2.24
TCA640	7.36
TCA650	2.04
TCA660B	3.30
TCA730	3.81
TCA750	2.25
TCA800Q	6.95
TCA830S	2.38
TCA890	5.44
TCA900	2.04
TCA910	1.65
TCA940	1.80
TCA940E	2.93
TCE330	3.89
TCEP100Q	10.25
TCEP100	9.61
TD3406AP	3.98
TD3F800R	3.92
TD3F900H	4.16

TD62105P	2.50
TD62104P	2.50
TD62706P	4.50
TDA1001B	2.31
TDA1003A	2.25
TDA1005A	2.22
TDA1006A	2.11
TDA1010AF	4.25
TDA1011	2.98
TDA1010	1.15
TDA1011A	3.25
TDA1028	2.45
TDA1034B	2.42
TDA1035S	2.95
TDA1035T	2.55
TDA1037	1.98
TDA1037D	2.05
TDA1044	2.62
TDA1047	4.10
TDA1059B	0.98
TDA1054M	1.21
TDA1060	2.60
TDA1082	3.25
TDA1151	1.22
TDA1170S	2.25
TDA1190	2.11
TDA1190Z	3.96
TDA1200	1.50
TDA1235	3.88
TDA1236	4.30
TDA1270	4.85
TDA1327A	1.33
TDA1412	1.05
TDA1420	2.55
TDA1440	3.45
TDA1470	3.16
TDA1470P	4.25
TDA1506	7.45
TDA1510	5.90
TDA1512	2.98
TDA1515	16.60
TDA1559	3.15
TDA1670	4.48
TDA1770	6.85
TDA1905	1.76
TDA1908	2.87
TDA1940	1.95
TDA1950	4.75
TDA2005	5.08
TDA2006	1.55
TDA2004	2.27
TDA2002	0.90
TDA2003	1.75
TDA2010	1.85
TDA2020	2.77
TDA2030	1.99
TDA2140	1.59
TDA2150	6.20
TDA2151	2.07
TDA2160	4.01
TDA2161	1.85
TDA2170	3.45
TDA2190	4.95
TDA2270	4.65
TDA2510	7.85
TDA2520	2.37
TDA2522	3.46
TDA2524	4.50
TDA2521	3.71
TDA2525	3.90
TDA2532	2.50
TDA2530	2.70
TDA2541	2.48
TDA2540	2.15
TDA2545Q	5.94
TDA2560	2.17
TDA2575A	0.50
TDA2571AQ	3.60
TDA2576A	2.85
TDA2571A	3.66
TDA2578A	4.55
TDA2576A+K	12.35
TDA2581	2.25
TDA2582	2.18
TDA2591	2.50
TDA2594	3.26
TDA2593	2.47
TDA2591Q	0.83
TDA2595	3.65
TDA2600	5.50
TDA2611AQ	2.98
TDA2612Q	4.68
TDA2611A	1.25
TDA2610	2.79
TDA2620	2.15
TDA2630	1.96
TDA2631	2.73
TDA2640	2.59
TDA2652	13.45
TDA2653	3.65
TDA2654	6.18
TDA2670	2.54
TDA2680	3.20
TDA2690A	2.65
TDA2740	6.00
TDA2780AQ	5.14
TDA2795	2.78
TDA2791	2.5
TDA2910	13.25
TDA3000T	2.55
TDA3300B	6.98
TDA3330	3.30
TDA3506	7.98
TDA3501	7.25
TDA3500	4.25
TDA3510	6.55
TDA3520	9.71
TDA3540	2.98
TDA3541	3.80

TDA3560	5.25
TDA3571Q	2.97
TDA3576	7.09
TDA3590	5.79
TDA3591	6.45
TDA3650	7.50
TDA3652	5.44
TDA3651AQ	2.96
TDA3651	3.30
TDA3651A	2.75
TDA3950	4.98
TDA4050B	3.95
TDA4280	7.20
TDA4290	4.47
TDA4400	2.27
TDA4420	5.01
TDA4422	8.32
TDA4427S	9.00
TDA4431	2.27
TDA4440	2.87
TDA4442	4.75
TDA4500	6.30
TDA4600	2.84
TDA4610	4.80
TDA4620	4.78
TDA5500	4.78
TDA5700	2.60
TDA7270S	2.25
TDA8190	3.47
TDA9403	3.15
TDA9503	2.92
TDA9513	5.44
TDB1033	6.68
TDE1081	6.61
TE626	1.49
TEA1002	3.47
TEA1009	1.86
TEA1014	3.15
TEA1020SP	8.21
TIC106C	0.61
TIC106M	0.77
TIC116Y100	2.07
TIC44	0.72
TIC45	0.77
TIC47	0.35
TIP120	1.06
TIP110	0.53
TIP112E	0.85
TIP112	0.88
TIP117	0.95
TIP121	0.87
TIP126	0.73
TIP132	1.40
TIP137	1.50
TIP29	0.66
TIP2955	0.95
TIP29A	0.46
TIP29B	0.63
TIP29C	0.40
TIP29D	0.75
TIP3055	0.75
TIP30A	0.41
TIP30C	0.16
TIP31A	0.34
TIP31B	0.38
TIP31C	0.50
TIP32A	0.53
TIP32B	0.69
TIP32C	0.40
TIP33	0.85
TIP33A	1.05
TIP33C	0.80
TIP34	3.54
TIP41A	0.49
TIP41B	0.65
TIP41C	0.49
TIP42A	0.49
TIP42B	0.53
TIP42C	0.53
TIP47	0.65
TIP48	0.92
TIP49	3.61
TIP55A	3.65
TIS43	1.43
TIS90	0.28
TL011CP	1.55
TL072	2.85
TL494CN	6.74
TL072CP	2.55
TMP4320	15.00
TMS1024NLL	6.86
TMS1025N	6.25
TMS3720ANS	19.50
TMS3748NS	14.95
TMS3755	13.65
TMS3894NL	19.25
MS5102NLL	6.25

TUA2000	8.98
TV106	1.76
TY6010B	2.97
U05G	1.14
ULN2204	11.45
UPA53C	4.94
UPC1003	5.95
UPC1009C	6.32
UPC1025H	2.90
UPC1026C	1.24
UPC1028H	2.00
UPC1020H	2.77
UPC1032H	0.62
UPC1042C	8.95
UPC1156H	2.96
UPC1158	5.84
UPC1161C	4.50
UPC1182H	1.82
UPC1186H	1.05
UPC1181H	1.25
UPC1185H	2.94
UPC1188	6.95
UPC1213C	0.99
UPC1212C	1.72
UPC1225H	3.25
UPC1230	7.24
UPC1238	3.15
UPC1263	3.45
UPC1277H	5.85
UPC1278H	4.85
UPC1351C	1.81
UPC1350C	1.40
UPC1353	7.85
UPC1355C	2.13
UPC1363	4.20
UPC1362	2.98
UPC1365C	6.98
UPC1366	7.25
UPC1360C	4.51
UPC1378H	4.25
UPC141C	3.75
UPC1458	8.66
UPC151C	2.95
UPC2002	1.48
UPC30C	2.51
UPC324C	4.70
UPC32C	4.94
UPC339C	4.90
UPC41C	4.10
UPC4558C	2.15
UPC474	5.11
UPC554C	1.85
UPC566H	2.95
UPC574	3.25
UPC575C2	2.40
UPC576H	2.58
UPC577H	1.25
UPC578C	7.35
UPC580C	4.13
UPC587C2	1.34
UPC592H	2.15
UPC595	2.95
UPC596	1.98
UPD1514C	8.95
UPD2819C	4.98
UPD4013B	4.00
UPD4066B	4.95
UPD553-164	19.25
UPD8049C-1	10.85
X0007TA	4.68
X0022CE	5.75
X0029CE	7.09
X0031CE	4.95
X0035TA	5.98
X0040TA	4.50
X0042CE	4.35
X0043CE	2.75
X0056CE	5.11
X0057GE	6.00
X0062CE	6.52
X0065CE	6.25
X0074GE	10.00
X0077GE	15.96
X0079CE	4.95
X0092CE	4.95
X0096CE	5.98
X0109CE	11.25
X0113CE	2.07
X0195CE	4.00
X0204CE	8.74
X0261CE	8.75
X1222AF	3.63
IX0111CE	2.95
Y969	0.82
TDA3310	2.15
ZPY120	0.95
ZTK33	0.43

Full list available with order or SAE please 9" × 4"

Telephone answering machine available 24 hours

0902 - 712083

for Access and Barclaycard customers

Stock queries by post only

For quantities of 100+ per line – Please ask for special quote.
Orders from Govt. Institutions, Schools, Nationals etc., accepted with official order.

All goods should be delivered within 4 working days.

REGISTERED OFFICE: THE COACH HOUSE, MUXTON LANE, TELFORD ★ MAIL ORDER – CALLERS STRICTLY BY APPOINTMENT

The Operation of Electric Motors

Part 2

Mike Phelan

A more efficient method of producing a rotating electromagnetic field is to use two sets of windings, with the second set arranged so that the current, and therefore the magnetic flux, is out of phase with that produced by the first set of windings. If the two sets of windings are on interleaved poles, as shown in Fig. 1, the arrangement will produce a rotating field similar to that produced by the shaded-pole motor (see last month).

Phase-shift Arrangements

One way of providing the necessary phase shift is to include a large value capacitor – typically several microfarads – in series with one set of windings so that the current flowing through this set leads that flowing through the other by up to 90°. Ninety degrees cannot be achieved because of losses in both the winding and the capacitor, but the rotating field is smoother than that provided by the shaded-pole arrangement. The latter provides much less phase shift, indeed sufficient to start the motor under only the lightest loads. The capacitor-start motor has much better starting torque and smoother running than the shaded-pole motor. The smoother running is due to the fact that it is a motor with effectively double the number of poles running from a 100Hz supply.

It is quite common with larger capacitor-start motors, such as those used in domestic appliances etc., to use a centrifugal clutch to disconnect the start-up winding when the motor has reached some 75 per cent of its full speed. This is possible because the rotor's inertia will allow the motor to run, but not start, with a pulsating field. The advantage of smoother running is lost with this arrangement however. Even larger motors have another capacitor in series with the running winding, but this is mainly for power factor correction.

An alternative way of producing a phase shift in the starter winding is to include inductance instead of capacitance. For the starter winding to have a larger inductance than the running winding it would have to have more turns, and would therefore take up more winding space. So the opposite approach is taken. The starter winding is made with few turns of relatively thin wire. It's thus mainly resistive, so that the current flowing in the more inductive running winding lags that in the starter winding. Because of the small number of low current-carrying capacity turns the starter winding would overheat after a few seconds, so a centrifugal switch is necessary. This type of motor has not entered the realms of consumer electronic products yet – we have covered it for the sake of completeness. Fig. 2 summarises the phase-shifting methods we've been discussing.

Synchronous Motors

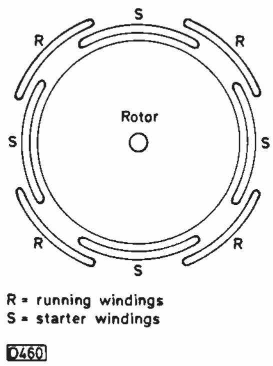
For some applications a motor whose rotation is dependent on the supply frequency is required. Electric clocks and slot-meter mechanisms are two such applications, though the crystal-controlled timepiece has succeeded the former. High-quality turntables also require accurate speed control, but servo technology now takes care of this. There is use for the synchronous motor in timer mechanisms however.

For a motor to run at a speed dependent on the supply frequency there must be no slippage between the rotor and the rotating electromagetic field. As the squirrel-cage type of rotor described last month relies on this slippage to induce current in the rotor, and thus magnetise it, it would clearly not do – the maximum speed would be only some 98 per cent of that of the rotating field. The answer is to use a permanent magnet as a rotor. Since it's usually a time-keeping function that's required, the motor is designed to run as slowly as possible to reduce the amount of reduction gearing required. The only way to do this, assuming that a mains supply is being used, is to increase the number of poles – thirty or more is not unusual. One method of construction is shown in Fig. 3: only a single coil is needed. The rotor does not need to have as many poles as the stator, provided they are no wider than the stator poles.

Some method of starting the motor is still required. Any of the methods used with a squirrel-cage motor could be employed, but getting two sets of windings on multiple poles of thirty or so would be difficult and expensive. Even shading rings would present a problem. Another method is used therefore: the rotor has an extra pole which causes a slight movement at switch on, sufficient to get the motor moving at its running speed. This pole can take many forms and indeed is not always visible – the rotor is somethimes a ferrite-plastic disc with no clue as to how it has been magnetised. Another type consists of a three-armed spider made of soft iron and attached to the rotor, or one stator tooth may be made wider than the rest.

The only problem is that the direction in which a motor of this type starts is, without some extra arrangement, indeterminate. The starting and thus running direction of a split-phase motor with two windings is fixed and can be changed only by reversing the connections to one, not both, set of windings. The shaded-pole motor can be reversed only by completely reversing the stator, in effect using the other end of the motor. Synchronous motors with the type of impulse start mechanism just described will quite happily start in whichever direction they feel like, so some means of stopping the motor and reversing it if it starts backwards must be provided. The mechanism shown in Fig. 4 is normally used. If the motor starts in reverse it's allowed to complete part of a revolution, in order to store inertia. The friction from the disc on the rotor spindle moves the pawl into engagement with the pin, so that the rotor is suddenly arrested. The stored energy is transferred into bending the springy pawl, which releases the energy to give the rotor a kick in the correct direction of rotation. This mechanism is sometimes applied at a later point in the reduction gearing: this is more effective, as the inevitable amount of flexibility in the drive imparts a greater impulse to start the motor on the straight and narrow.

For interest we would mention that a few synchronous motors used in clocks in the past had no starting mechanism of any kind. They relied on the user giving the motor a push when setting the clock's hands. This idea was also used with some turntables, the on-off switch lever propel-



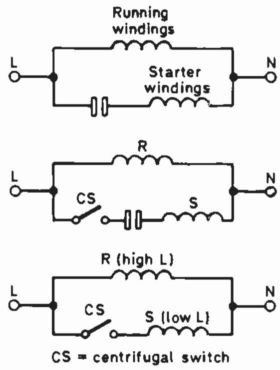


Fig. 1 (left): Pole arrangement for a split-phase motor.
Fig. 2 (right): Methods of phase shifting.

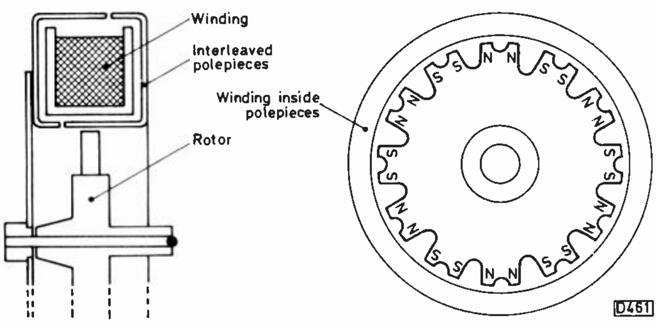
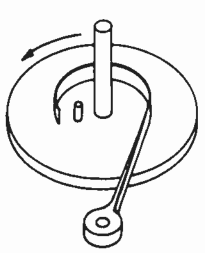


Fig. 3 The synchronous motor.



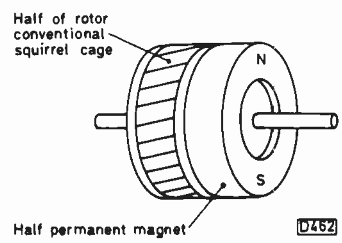


Fig. 4 (left): Anti-reverse mechanism.
Fig. 5 (right): Rotor arrangement for a synchronous-hysteresis motor.

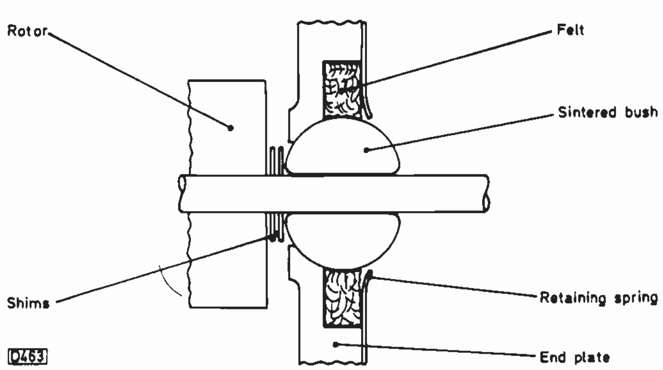


Fig. 6: Bearing construction.

ling the platter in the direction of rotation. The method was taken to the extreme by a well-known manufacturer of electronic organs: the electromagnetic tone generator was driven by a synchronous motor, with another shaded-pole motor used for starting only, a process involving two switches and taking about half a minute!

The synchronous motor will run at only the correct speed. Any excess load will stall it. With a self-starting motor this fact may be masked by the motor restarting itself when stalled, but one couldn't rely upon this mode of operation. In fact the synchronous motor is suitable for accurately driving only light loads. To the best of our knowledge, the only motor of this type used in a VCR was that employed in the N1500 series clock.

A hybrid type of motor known as the synchronous-hysteresis type (see Fig. 5) combines the advantages of the synchronous and squirrel-cage types. The rotor is of squirrel-cage construction, but part of its length consists of a permanent magnet. At start up the pole shading brings the rotor to about 95 per cent of the synchronous speed, with reasonable torque. It then pulls into synchronism with the supply frequency. These motors were used by Garrard in their higher priced turntable units and performed admirably well before the advent of servo control in this type of application.

Servicing Aspects

Because the only moving parts in these motors (in our sizes at any rate) are the rotors they are very reliable units. Unless you are engaged in audio work, probably the only a.c. motors you'll be called upon to service are those in elderly Sony, Sanyo and Philips VCRs. Troubles with the windings are rare, but remember that the shaded-pole motor inherently runs hot.

The bearings normally consist of sintered bronze self-aligning bushes. If that sounds rather a mouthful, look at Fig. 6. Sintered means that the bushes are made of metallic powder compressed to the required shape under heat. The bush is therefore porous and can retain lubricant, thus increasing the intervals between servicing. If the bush is spherical it will align itself without the accurate machining that would be needed if it was fixed in position rigidly. The bush is retained by some sort of spring which allows the bush to align itself under running conditions. A felt washer soaked in oil surrounds the bearing – this, by capillary attraction, replenishes the oil impregnated in the bush.

A common fault when the motor is mounted with the spindle vertical and dust can gain entry is that fluff gets wrapped around the top of the spindle, leaching the oil from the bearing to form an abrasive goo that soaks down into the bearing clearance, eventually seizing up. This was a frequent occurrence with some autochangers. Loose laminations in the stator or rotor, or loose shading rings, will cause buzz – sometimes a dollop of liquid epoxy resin will stop this.

Servicing a motor of this type is simple. Dismantle, after marking the stator and rotor ends so that they can be reassembled in the same relative positions. It's quite possible with most motors of these types to put them together with the stator upside down, so that it runs backwards! If the bearings will come apart, i.e. they are not rivetted, dismantle them. Clean all parts – except the stator – in solvent, then dry off. Take care not to lose any shims fitted to the spindle.

If possible soak the bushes and felts in warm engine oil overnight. Examine the spindle for any signs of seizure, and clean carefully without using abrasives. Reassemble and test. Don't worry if the spindle feels tight on initial assembly: just tap it (lightly!) with a piece of wood to align the bearings. With some motors of this type the bearings are retained by springs that are rivetted or pressed into place. Complete dismantling is clearly impractical in this case but the endplate can be soaked in oil, the surplus being wiped off afterwards. These motors should be virtually silent in operation.

Sinclair QL Test Pattern Program

John de Rivaz, B.Sc. (Eng.)

Although the future of the Sinclair QL computer is uncertain quite a lot of them were produced and have recently been made available via various special offers. This article presents a test pattern program for the machine, based on the pattern that appeared on the front cover of the May 1984 issue of *Television*.

It has a coloured border with a similar order of colours, the display going right to the edges of the screen. Thus arrows are produced at the edge of the pattern, allowing sets to be adjusted for a slight overscan. The pattern has a black background with a centre circle and white crosshatch. There are two columns of colours approximately a quarter and three quarters of the way across. Within the circle there's a vertical white column and to the right of this a column of frequency gratings. These are somewhat larger than with a conventional test pattern because of the limitations imposed by the QL's 256 vertical line resolution in the full colour mode. A black bar on a white background appears at the top while a bright white rectangle with the word "Television" appears at the bottom.

Randomly composed music will play while the pattern is being displayed. If a sound through the TV adaptor is fitted to the QL the sound will play via the TV set. Pressing key s switches the sound on and off.

Colour bars with an overprinted menu of options appear when the program is first run. The pattern is selected by pressing c: b selects bars, g selects the crosshatch and e exits the program. The menu disappears as soon as one of the options is selected. You can switch between crosshatch, bars and the pattern. If a wrong key is pressed however the menu returns. Please note that the computer should *not* be in the upper case mode.

Entering the program should be straightforward – follow the listing. If you don't want the music leave out the procedure tune in line 840 onwards and instead of the word "tune" in line 260 put "LET i$=INKEY$(-1)". This waits until a key is pressed. For those who don't want to type it in I am willing to provide copies for £2 plus a blank microdrive cartridge to record it on. Send orders to RTL, West Towan House, Porthtowan, Truro TR4 8AX. Cartridges are at the owner's risk whilst in the post. The previously published Spectrum test pattern program is available at £2 including post – in this case a cassette is provided.

As a result of the relatively high resolution of its TV output the test pattern produced by the QL is much better than those produced by many other machines.

Program

```
100 REMark set up data
110 REMark ————————
120 DATA 7,5,3,1,6,4,2,0
130 s=0 : i$ = ""
140 DIM c(15)
150 RESTORE : FOR n=0 to 7 : READ c(n) : c(15-n)=c(n)
160 WINDOW 512,255,0,0 : MODE 8
170 :
180 REPeat control_panel
190 REMark ————————
200 CLS : bars : CSIZE 3,1 : OVER 1 : INK 0 : PRINT\
    "Television Test Patterns"\" By J. de Rivaz
    B.Sc.(Eng)"\" (c) 1 August 1986"\\" Press "\" b bars "\"
    c card"\" g grid"\" s sound on/off"\" e exit program" :
    OVER 0
210 REPeat control_keys
220 IF i$="c" THEN card
230 IF i$="b" THEN bars
240 IF i$="g" THEN w=32 : grid
250 IF i$="e" THEN BEEP : STOP
260 tune : IF i$<>"c" AND i$<>"b" and i$<>"g" THEN EXIT
    control_keys
270 END REPeat control_keys
280 END REPeat control_panel
290 :
300 DEFine PROCedure bars
310 REMark ————————
320 FOR j=0 TO 7 : BLOCK 64,255,j*64,0,c(j)
330 END DEFine
340 :
350 DEFine PROCedure grid
360 REMark ————————
370 SCALE 255,0,0
380 spacing = 27
390 PAPER 0 : INK 7 : CLS
400 FOR n=spacing to 360 STEP spacing
410 LINE n,0 TO n,255
420 IF n<255 THEN LINE 0,n-spacing/4 TO 512,n-spacing/4
430 END for n
440 END DEFine
450 :
460 DEFine PROCedure card
470 REMark ————————
480 w=32 : grid
490 REMark border
500 REMark————
510 FOR i = 0 TO 1
520 FOR j=0 TO 15
530 BLOCK w,w/2, j*w,1*(255-w/2),c(j)
540 IF j<15 THEN BLOCK w,w/2,1*(512-w),j*w/2,c(j)
550 END FOR j
560 END FOR i
570 CIRCLE 190,128,76
580 REMark colour columns
590 REMark ————————
600 FOR m=0 TO 1 : FOR n=0 TO 7 : BLOCK
    40,20,90+m*292,47+n*20,c(n+8) : NEXT n : NEXT m
610 REMark white column
620 REMark ————————
630 BLOCK 40,108,200,72,7 : FOR i=0 TO 1 : BLOCK
    40,1,200,125+i+i,0
640 REMark pulse and bar
650 REMark————————
660 BLOCK 69,10,222,28,7 : BLOCK 2,10,230,28,0
670 REMark top and bottom arrows
680 REMark——————————————
690 INK 2 : FOR i=0 TO 237 STEP 237 :FILL 1: LINE
    180,255-i TO 188,247-i TO 197,255-i TO 180,255-i: FILL
    0 : FILL 1:LINE 188,247-i TO 180,237-i TO 197,237-i TO
    188,247-i:FILL 0
700 REMark side arrows
710 REMark————————
720 FOR i=0 TO 362 STEP 362 : FILL 1 :LINE i,120 TO
    8+i,128 TO i,137 TO i,120 :FILL 0: FILL 1:LINE 16+i,120
    TO 16+i,136 TO 8+i,128 TO 16+i,120 :FILL 0
730 REMark gratings column
740 REMark————————
```

```
750 BLOCK 40,108,272,72,0
760 FOR j=1 TO 4 : FOR i=0 TO 9-(j=2)*5-(j=3)*7-(j=4)*7:
    BLOCK 2*j,27,272+i*2*2*j,45+j*27,7 : NEXT i : NEXT j
770 FOR i=0 TO 1 : BLOCK 40,1,272,125+i+i,0
780 BLOCK 40,1,272,126,7
790 REMark name
800 REMark ——
810 PAPER 7 : INK 0 : CURSOR 160,211 : CSIZE 3,1 : PRINT
    " TELEVISION "
820 END DEFine
830 :
840 DEFine PROCedure tune
850 REMark ————————
860 REPeat compose_tune
870 length = RND (5 to 20) : cycle_length = RND (3 TO 5) :
    variation = RND (5 TO 10)
880 DIM notes(length,1) : DIM notes1(length)
890 FOR n=0 TO length : LET notes(n,1)=RND(0 TO
    255):LET notes1(n)=notes(n,1):LET notes(n,0)=2*RND
    (1 TO 6)
900 FOR vary1=1 TO variation
910 FOR vary1=1 TO variation : notes(RND(0 TO
    length),1)=RND(0 TO 25)
920 FOR play_tune=0 TO cycle_length
930 FOR n=1 TO length
940 LET i$ = INKEY$ : IF i$="s" THEN BEEP : s=s=0
950 IF i$<> "" AND i$<>"s" THEN EXIT vary1
960 IF s=1 THEN EXIT n
970 BEEP 0,notes(n,1)
980 LET i$ = INKEY$(notes(n,0)) : IF i$="s"THEN BEEP :
    s=s=0
990 IF i$<>"" AND i$<>"s" THEN EXIT vary1
1000 END for n
1010 END FOR play_tune
1020 END for vary
1030 FOR n=0 TO length : notes(n,1)=notes1(n)
1040 END FOR vary1
1050 BEEP
1060 IF i$<> "" THEN END DEFine
1070 END REPeat compose_tune
1080 BEEP
1090 END DEFine
```

Modern Receiver Circuitry

Part 6: SAA5000 Remote Control System

J. LeJeune

For the majority of people TV viewing is a passive occupation. Armchair detectives, sportsmen, naturalists, politicians, quiz contestants and those who just want to be entertained are frequently happier if they don't have to leave their armchair to operate the set's controls. Remote control provides this facility, and in this concluding instalment in the present series we'll be looking mainly at the Mullard SAA5000 remote control system.

Development of Remote Control

Early remote control units were wired to the receiver by a long and troublesome cable. An early Philco system however used a flash of light from a pocket torch to operate the motorised turret tuner in a sequential selection of the two channels then available – older readers may recall this "Selectaflash" arrangement. Ultrasonic remote control systems first made their way here from the Continent: though they had drawbacks such as spurious responses to rattling keys and coins, aerosol squirts and chattering budgerigars they gave added facilities and freedom from the tethering cable. Ultrasonic systems are slow however and provide only a limited number of functions. The possibilities offered by infra-red light as the communicating link rapidly pushed it into favour. Infra-red remote control systems are capable of a higher degree of sophistication, greater speed of response, allow smaller handsets and have reduced battery consumption compared to their ultrasonic predecessors.

Remote control systems are currently beginning to resemble data transfer links. Microcomputer chip technology is taking over, with hardware being ousted by software. Such systems provide an even wider range of facilities. A suitably equipped VCR can be controlled via the TV set, increased sound functions can be added and more teletext features. The systems most likely to confront the service engineer however are those based on the SAA5000 series of integrated circuits, with an infra-red transmission link and mixed digital and analogue control outputs in the receiver.

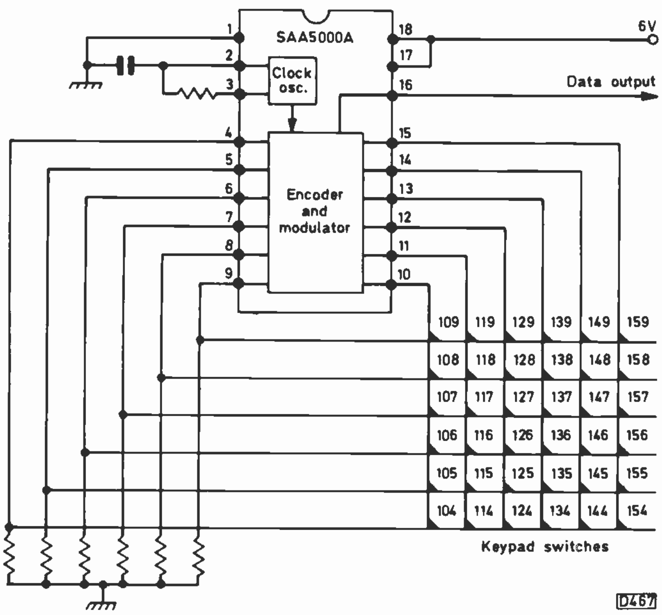


Fig. 1: Transmitter keyboard and encoder.

Transmitted IR Signals

The remote, hand-held transmitter unit uses an SAA5000A integrated circuit to translate a keyboard input to a series digital code. Fig. 1 shows a typical arrangement. The SAS5000A can be operated with up to 36 keys in a 6 × 6 matrix. Pressing a key connects one of the i.c. pins numbered 4 to 9 to one of the pins numbered 10 to 15. The full 36 keys are seldom used. 32 is the average for an eight-channel colour set with teletext and 20 for the same set without teletext. The output from the i.c., at pin 16, is a repetitive 24-bit data sequence (see Fig. 3).

The zeros and ones in the data output from the chip are represented by 4·7msec long pulse periods which differ

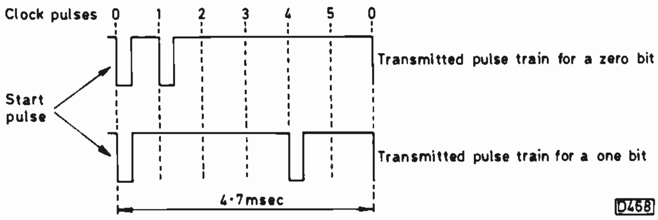


Fig. 2: Output pulse trains for "zero" and "one" bits.

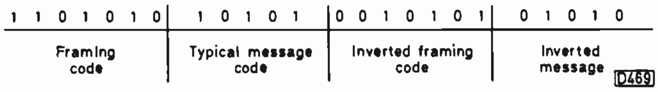


Fig. 3: Typical 24-bit command signal.

from one another in the position of the second negative-going pulse: Fig. 2 shows the zero- and one-bit pulse outputs. The bits are not transmitted in their initial binary data form because of the characteristics of the infra-red link which wouldn't tolerate a continuous stream of the same bits (this would result in the transmitting and receiving diodes being continuously on or off, a condition that would cause a heavy battery drain and amount to the handset being in effect switched off). To remove the "d.c. component" the transmitted zeros and ones are encoded in the manner shown in Fig. 2. Pulse-position modulation is used: a zero data bit sets the clock-pulse counter to produce a second pulse one clock-pulse period after the initial start pulse, while a one data bit sets the clock-pulse counter to produce a second pulse four clock-pulse periods after the start pulse.

The transmitter handset keys shown in Fig. 1 are numbered to help identify which two SAA5000A input pins are being connected: key 126 for example links pins 12 and 6. Pressing a key causes the binary code for the pin combination to be passed to the modulator section of the chip. This converts each zero and one bit into the appropriate pulse train and assembles the 24-bit command signal sequence – see the example shown in Fig. 3.

The message section of the command signal has five bits. It's preceded by a seven-bit "framing code" which always marks the start of a command. This twelve-bit sequence is then inverted – zeros become ones and vice versa – to complete the 24-bit command signal. A command takes 113msec to transmit and is repeated for as long as the key is depressed. Should a key be released before the end of a command sequence the transmission continues until the sequence has been completed. The presence of the inverted section of the sequence means that there should always be an equal number of zeros and ones in the command. This enables a simple type of error detection arrangement to be used in the receiver – in the event of an error, i.e. the received command does not contain an equal number of zeros and ones, the receiver ignores the command.

The use of pulse-position modulation means that the output from the modulator in the SAA5000A chip consists of 24 pairs of short pulses, zero data bits being represented by a closely spaced (783μsec) pair of pulses while one bits are represented by a more widely spaced pair (3·13msec). The time duration of these short pulses is further reduced by differentiation before being clipped and applied to the infra-red light emitting diode drive circuit. Three IR diodes are generally used, arranged to produce a wide conical beam to allow for considerable misalignment between the handset and the receiving diode. Each IR diode passes slightly over 7A peak, but the on period is only 5μsec. The average power consumption is thus very low, the duty cycle of the on:off periods being 1:470. This gives an average current for all three diodes in parallel of only 15mA.

Remote control transmitters also incorporate some method to indicate that the unit is actually transmitting – usually a red LED triggered by the output from the SAA5000A. Some have a low battery voltage warning as well. The latter is often in the form of a low-frequency oscillator that's held off by a zener diode which conducts as long as the battery voltage is acceptable. When the battery voltage falls below the acceptable level the zener diode ceases to conduct and allows the oscillator to operate, flashing the LED.

Remote Control Receiver

The pulsating infra-red output from the transmitter is detected by one or more photodiodes that are sensitive to infra-red radition. The signal produced by the detector is first fed to a low-noise amplifier which raises the level of

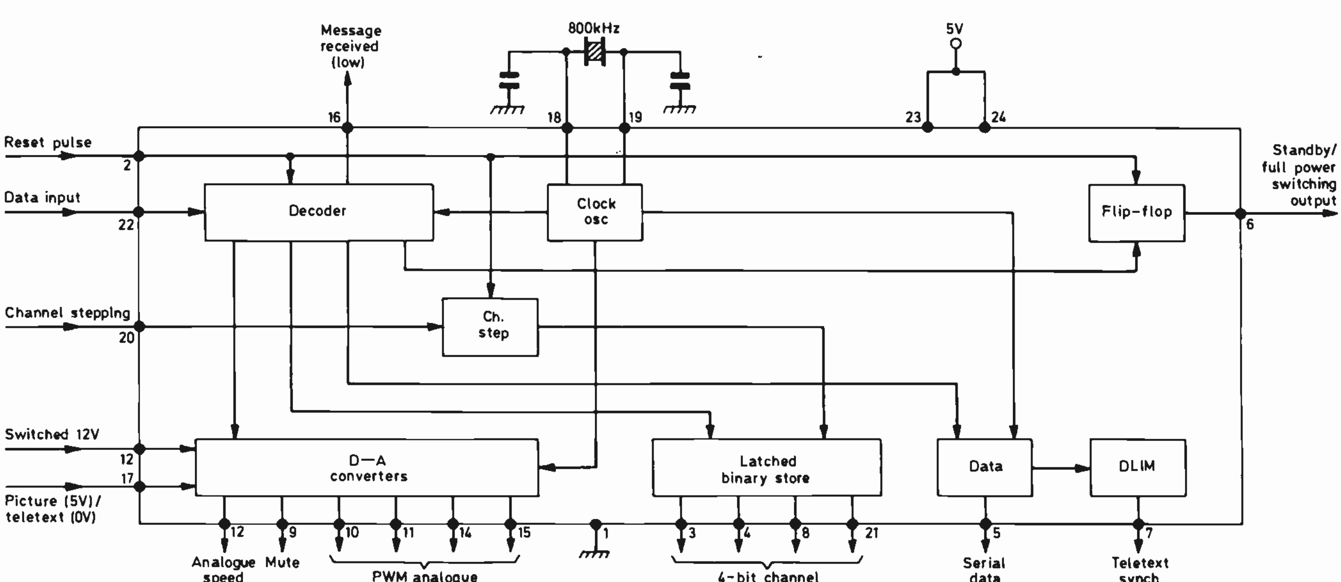


Fig. 4: Block diagram of the SAA5012 decoder chip.

the received pulse-train commands to approximately 5V peak-to-peak for feeding to the decoder module. Some preamplifer circuits use a standard low-noise operational amplifier arrangement with an a.g.c. level adjustment to set the sensitivity for the local conditions; others employ discrete component circuitry to achieve the same ends. The circuitry involved is straightforward and should cause no problems.

The Decoder Chip

The matching decoder in the SAA5000 series is the SAA5012 (see Fig. 4), a 24-pin MOS device with low power drain. It has a built-in clock oscillator, a command decoder, digital-to-analogue converters, a four-bit binary counter with latching and stepping inputs, a data amplifier and a "limited data" output for synchronising teletext decoder commands, also a flip-flop to control a TV set's main power supply – the on/standby switching.

The received 24-bit command signal is first decoded into binary form and the framing code is detected. Finding that the framing code is present simply provides a "thumbs-up" to tell the decoder that the next five bits contain a message. The message code is then translated into action by the decoder and the appropriate output is produced.

Channel Change Commands

A programme-change command will be loaded into the latched store in binary form: for programme one the output at pins 3, 4, 8 and 21 will be 0000, for programme eight it will be 0111 and so on. This four-bit code is passed to other circuitry – a "one of sixteen decoder" – for further decoding into one tuning output of the sixteen possibilities. It can also go to a seven-segment display decoder-driver. There may in addition be detection logic for AV switching, a.f.c. defeat, and possibly audio muting to quell noises from the loudspeaker during channel changing. The system allows for direct selection of the desired programme via the handset or sequential selection of programmes via a pair of pushbuttons on the receiver's control panel – one for upward stepping and the other for downward stepping. The latter method of programme selection is intended primarily for use during initial setting up of the receiver on installation, or for emergency use should the transmitter be inoperative. Upward stepping is achieved by pulsing pin 20 of the SAA5012 chip to 5V: downward stepping is achieved by pulsing pin 20 to 5V and pin 2 to 0V simultaneously.

Resetting and Analogue Controls

In receivers using a system like this the mains power switch carries a pair of auxiliary contacts which momentarily make when the shaft of the on/off switch is pushed fully in. These contacts serve to reset some of the logic circuits in the SAA5012 to ensure that the receiver comes on with programme one selected and the four analogue controls normalised. "Normalised" settings of the four analogue controls (volume/brightness/contrast/colour) are provided by preset controls which can be mounted on the control panel or elsewhere in the receiver.

Remote control of volume/brightness/contrast/colour is achieved by digital-to-analogue conversion of the outputs from four separate counters driven by the clock pulses. When an analogue up or down command is received the appropriate counter is driven by the clock pulses in whichever direction it is instructed. The counter's six-bit binary output is then converted to analogue form, controlling the pulse width of a squarewave derived from the clock oscillator. Since a six-bit binary signal will provide a maximum count of 64, including zero, the analogue control voltages vary in steps totalling 64, with the normalised setting at the half-way point – see Fig. 5(a).

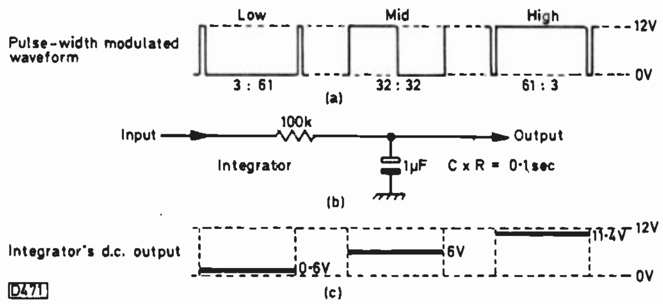


Fig. 5: Conversion of a pulse-width modulated "analogue" output from the SAA5012 to a d.c. control voltage.

The pulse-width modulated outputs at pins 10, 11, 14 and 15 of the SAA5012 chip are of 12V p-p amplitude. These are converted to d.c. control voltages by integration – see Fig. 5(b). With a small pulse width the charge on the capacitor is not very large. With equal pulse on/off times (32:32) the integrator's output will reach half the amplitude of the p-p squarewave, i.e. 6V. It will rise higher as the pulse's on time increases. Integration in this way gives a small time-constant to the rise and fall of the d.c. output. Further speed control of the analogue functions can be obtained by using pin 12 of the i.c., but for most applications this pin is grounded.

Pin Round Up

The input at pin 17 is obtained from a teletext decoder. It's at 0V when teletext is in use, freezing the programme selection counter and the brightness, contrast and colour analogue controls – remote volume control is still possible however. For a normal TV picture display pin 17 will be at 5V. Audio muting is included with the analogue controls simply because it's operated from the switched 12V supply.

Pin 6 has an output from the flip-flop, which is reset by an input from the pair of auxiliary contacts on the receiver's on/off switch. This reset signal makes pin 6 go low, allowing the main power supply to energise the receiver. Receipt of a standby signal drives pin 6 high.

As previously mentioned some of the analogue controls are disabled in the teletext mode. Programme selection cannot be used either, as the numerical part of the keypad is required for page selection. This data is decoded by the SAA5012 chip in the normal way but is passed to the teletext module via pin 5 – with pin 7 supplying clocking information to synchronise the teletext unit with the incoming command data.

On receipt of any command pin 16 goes low. This output is used to light a LED to indicate that a message has been received, telling the user that this portion of the remote control system is functioning correctly.

Remote Control Interfacing

The SAA5012's analogue control and programme selection outputs require further processing before they will interface with the rest of the receiver. The teletext side is

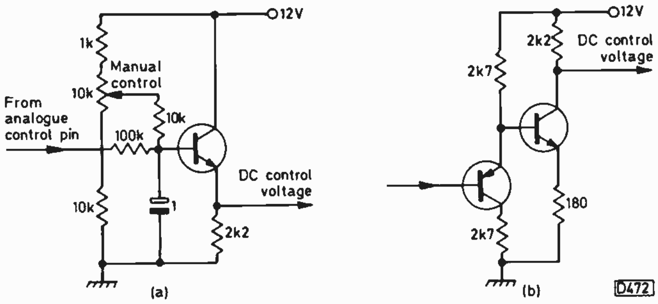


Fig. 6: Analogue control interfacing circuits.

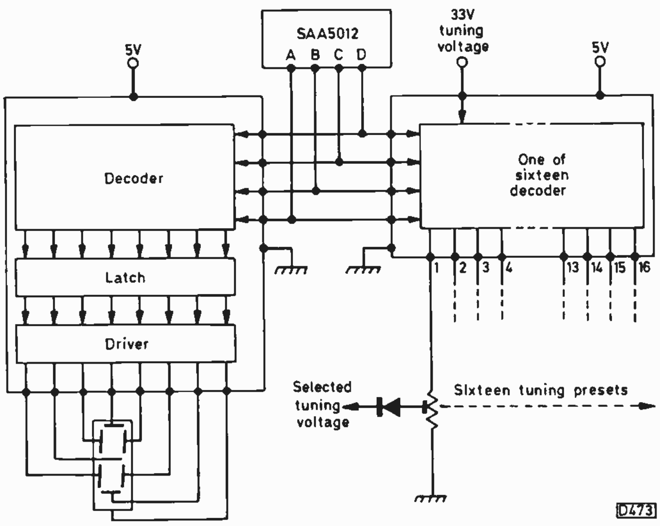


Fig. 7: Programme selection and indication system.

a subject all of its own and can't be covered here.

As we've seen, the outputs from pins 10, 11, 14 and 15 consist of pulse-width modulated positive-going square-waves. After integration (see Fig. 5) the d.c. control voltage is passed via a buffer amplifier to the receiver's control circuits – d.c. voltage control is used with modern sound and video signal processing i.c.s. A buffer amplifier is necessary to provide a degree of current gain and any control characteristic shaping that may be called for – where a logarithmic law is required for example. Only linear amplification is normally required however. Fig. 6 shows the kind of buffer circuits used – (a) shows a simple emitter-follower and (b) an arrangement used to provide higher gain and a greater control range.

Channel Selection

Since the programme selection command outputs from the SAA5012 are in binary-coded decimal (BCD) form further decoding is necessary. This form of output is used because it's the accepted type of drive for a "one of sixteen" decoder chip and for seven-segment indicator decoder chips – if you like to put it this way, BCD is the common language for these devices. In a sixteen-programme receiver all four lines are used (see Fig. 7), the ABCD inputs to the "one of sixteen" and the seven-segment driver decoders being connected in parallel. The seven-segment decoder is a non-standard type that decodes 0000 as 1 – 0000 is normally the BCD equivalent of zero. This non-standard arrangement is used to obtain sixteen channels from a four-line counter – the BCD equivalent of 16 is usually 10000, which requires five lines. A standard "one of sixteen" decoder can be used but it's more usual to employ a special type designed to switch the 33V tuning voltage through to one of the outputs – some standard "one of sixteen" decoders will not stand this voltage. Fig. 7 shows a pair of decoder chips in a typical arrangement. The details tend to vary between manufacturers and even between different chassis in one manufacturer's range. With an eight-programme receiver the D output is not used and the decoder D inputs are grounded.

Developments

Similar remote control systems abound, but the SAA5000 is a good example of its type. The increasing use of microcomputer chips further widens the range of functions offered by remote control systems. Devices like the Philips MAB8410 and the Texas TMS1000 series are already known in the TV trade. With a bit of expansion you could also use the remote control handset to control the room lighting, cat-flap, teasmade and so on. Developments in this area of TV circuitry are breaking down the divisions between TV and other consumer electronics and electronically-controlled equipment.

Cable '86 Report

Cable '86, the fourth Cable and Satellite TV Exhibition and Conference, was held at Brighton on July 8-10th. How things can change! Back in 1983 the accent was very much on cable TV; Cable '84 and Cable '85 saw a swing towards MATV systems while this year's show was mostly concerned with the TVRO market. You get a lot more for your money with a TVRO installation as the months go by: suppliers are striving to keep their packages down to the £1,000 level whilst incorporating remote control for channel selection, also polarisation and dish position. Offset dishes are gaining in popularity. Their improved efficiency along with the development of quieter LNBs makes for much smaller packages.

There were few novelties or surprises. We were a bit startled however when Anderson Scientific from the USA set up a card table and 2ft dish on the tarmac of the "dish farm" down on the beach and within seconds of their arrival displayed snow-free Music Box signals – to the consternation of the engineers on the signals distribution side who'd been struggling with their 3m dishes. Sat-Tel showed a 1·4m rectangular offset receiving dish which is unpriced as yet. Unlike the elliptical offset dish the square dish gives equal performance with both vertically and horizontally polarised signals. It's said to provide the same performance as a 1·8m circular dish and to have a very low sidelobe response. SATVRN demonstrated clear pictures from the Intelsat V satellite which carries three German channels from a position low on the horizon at 60°E. They were using a 1·8m dish. One of this satellite's channels is a Musicbox programme that could become a second choice to our own Music Box.

DBS seemed to be something of a dirty word at the show. Even allowing for the deferred launches due to recent rocket failures neither the broadcasters nor the public showed much enthusiasm. More than one exhibitor suggested to us that the future lay with clean PAL signals and financing by advertising revenue. "Watch out for Luxembourg's SES" one of them said knowingly.

Cable '87 will be held at Brighton on June 2nd-4th 1987. **H.P.**

VCR Clinic

Reports from Hugh Allison, Christopher Holland, Philip Blundell, Eng.Tech., Steve Leatherbarrow, R. T. Rees, Brian Wright and K. N. Bayes

Sharp VC9300

Reel motor faults are well known on these machines (occasional refusal to either wind forward or backwards, at first "curable" by pressing the opposite button, slowly leading to complete refusal to work). Take care before replacing the motor however: the plastic sleeve on the motor shaft can sometimes ride up, causing very similar results. Listen for the motor whilst the machine isn't rewinding. If it's running, check that the sleeve hasn't ridden up the shaft – even an eighth of an inch is enough – and check that the jocky wheel isn't worn (there's no clutch, so something has to wear!). If the motor doesn't start up (common), replace it. Expensive aren't they? Incidentally, a motor out of the unit will normally run off the current supplied by an Avo on the ohms range, a useful check if start-up is the problem.

Intermittent stopping in any mode of operation (play, record, rewind, etc.) is often caused by the trip counter. This is because the take-up reel drives the motion detector via a belt, a further belt driving the counter from the detector. A worn gear in the counter can thus stop the motion detector, causing the shut down. A good tip is to reset the counter before giving the machine a test. If it always stops at a certain number you've found the cause of the fault – check by removing the counter belt before ordering a replacement. In a rare burst of honesty I must confess to knackering a counter mechanism: if you don't line up the reset button with its hole when replacing the front panel . . . **H.A.**

JVC HRD140

This machine had three faults that at first seemed to be unrelated. The drum speed was varying, the pinch roller was turning in a most erratic manner, and the resulting picture suggested that the video heads were dirty – though curiously enough there was video coming through on the top two inches of the monitor's screen. The common factor came to light when I slowed down the head drum with a finger: what seemed to be the Channel 4 test card on my test tape appeared upside down and back to front at the top of the screen. You've guessed it – the heads were spinning backwards. A check in the drum servo circuit revealed that the drum servo error voltage that's fed to the drum motor amplifier was virtually non-existent instead of the 2·8V the manual said it should have been. Zener diode D408 (5·1V) turned out to be leaky. **C.H.**

Ferguson 3V23

Frame jitter or frame roll on playback with VHS machines is normally due to a problem in the area of the left-hand tape roller and shows up as part of the f.m. signal envelope being missing. Causes can be the guide roller itself, the guide roller base assembly not sitting correctly in the vee block, the base assembly being bent in such a way that the tape is not presented to the heads correctly, or insufficient back tension. The other point that can give rise to this sort of problem is incorrectly set head switching points.

The machine concerned was operating correctly in all these respects however. The f.m. signal envelope was as perfectly formed as any I've seen, while altering the back tension by manipulating the cue head that acts as a back-tension arm produced no improvement. When the picture did stop jumping for a few seconds I could see on the monitor, with the height altered, that the switching points were spot on. The only clue was that the picture had a slightly weakish look about it, as though the video heads were worn. Since this could conceivably cause the field jitter a new drum was fitted, to no avail – furthermore the picture quality was still poor.

The search moved to the luminance panel, where test point 6 showed good line sync pulses but no field pulses, their absence being very noticeable when the machine was returned to the E-E mode. Tracing through the signal path led us to C44 (33μF) which, when checked with an ohmmeter, seemed to be low in value. After replacing it, refitting the original drum, and resetting the previously twiddled (in frustration) left-hand guide pole we were rewarded with a rock steady picture. **C.H.**

Ferguson 3V29

The complaint was failure to record, but the actual fault was a very overloaded E-E video signal with good sound. The signal entering IC201 on the bottom luminance panel, at pin 26, was good but nothing came out at pin 5. Since all the relevant d.c. voltages around the i.c. seemed to be correct there appeared to be a good case for changing it. Needless to say this proved to be a fruitless exercise. Close comparison between the conditions in a good working machine and the faulty one eventually showed that the signal at pin 26 of the good machine sat on a d.c. level of 6V while the signal in the faulty machine was sitting on 4V d.c. Further checks showed up what should have been obvious from the start: the playback 9V line was present in the E-E mode, with the result that Q208 was switched on. The playback 9V line was there because Q103 was on: the culprit eventually turned out to be Q107 (2SB643) which was leaky. **C.H.**

Ferguson 3V36

It's quite common on these machines for the mechacon microcomputer chip IC201 to "crash" and cause odd faults. Switching the mains supply off and on usually provides a cure. On this occasion however the machine wouldn't come out of standby after doing this. Checks around IC201 revealed that the clock oscillator was running, the supply was o.k. and the power switching signal was reaching the chip, but it wasn't taking any notice. The reset signal was over so quickly that it couldn't be seen on the scope, so a few d.c. checks were made in the reset pulse generator circuit. Zener diode D203 (5·1V) turned out to be leaky. **P.B.**

Sharp VC3300

I had quite a few lightning damaged items after a thunder storm. One of them was a VC3300 – the strike had come along the mains, destroying the mains adaptor. When the machine was powered via the bench supply the loading, reel and capstan motors were all going backwards. The mechacon F/R (forwards/reverse) line was found to be permanently high, but quite a few devices on three different boards are connected to it. After a lot of disconnecting pins and plugs and sockets the capstan F/R switch chip IC711 was found to be faulty. **P.B.**

Sanyo VTC5000

This machine would play prerecorded tapes all right but wouldn't play back its own recordings without having to adjust the tracking control from the click position. It had a small subpanel called the "control pulse rec/play circuit" mounted piggy-back on the main servo panel SV1 (this subpanel is not fitted on later versions). The fault turned out to be on this subpanel, which has to be unsoldered from the main servo panel before you can work on it. Oscilloscope checks revealed that the tracking pulses to pin 8 of IC4501 were of reduced amplitude and incorrect shape. The culprit was C4505, a tiny 1μF, 50V working capacitor which was virtually open-circuit. Replacement restored normal operation. **R.T.R.**

Sharp VC9700, VC381, etc.

When replacing the cassette lamp, beware – it's not the usual 12V, 60mA type, the rating being 5V, 100mA. We found this out the hard way with a Philips VR501/79, which in New Zealand is a Sharp VC9700 clone. A normal VHS lamp produced incorrect operation of the microcomputer chip when the machine was cold. The reason for this is that the lamp current flows via R872-5 (four 270Ω resistors in parallel), the voltage drop across these resistors providing a feed to IC802. The correct lamp gives 8V but a 12V, 60mA lamp produces 4V which makes IC802 unreliable. **B.W.**

Panasonic NV300/NV333

One of these machines had the not uncommon fault of failure to record the sound. This time it wasn't caused by the bias oscillator transistor Q4014 failing to start, and we'd already done the modification of bridging out its emitter resistor R4049. To complicate things the voltages around Q4001 and Q4002, which switch the audio head from record to playback, were all wrong. The culprit turned out to be the STR1096 regulator IC1001 in the power supply. Its 9V output had gone up to 10·8V, which was enough to upset the bias on Q4001/2. Why such a small increase in the voltage on the 9V rail should completely upset Q4001/2 is hard to see, but it did. Much time had been spent changing audio transistors to no avail before the regulator was changed. **B.W.**

Ferguson 3V44

The complaint with this machine was no operation. We inserted a cassette which the machine promptly swallowed, but it wouldn't run in any mode. Neither would it eject the cassette. Attention was turned to the microcomputer chip IC601. Using a logic probe we eventually discovered that pin 32 hovered at 3·2V regardless of the position of the cassette housing switch. The cause was D628 which was leaky: instead of clamping the logic level at pin 32 to 5V it was confusing the microcomputer chip by producing an indeterminate logic level. Replacing the diode restored normal operation. **K.N.B.**

Sharp VC9300

The ticket said "deck service", the fault being the usual Sharp take-up one. I tackled the problem by removing the supply/take-up spools then cleaning and lightly lubricating the shafts. The idler was replaced and the grooves in the chassis it sits in were treated to a smear of silicone grease. All surfaces were cleaned and the tape path was given a good clean up. After doing all this and carrying out a functions check I found that the machine wouldn't reverse search. At least it wouldn't with a tape inserted. Without a tape the machine would reverse search and there seemed to be plenty of torque. Replacing the reel motor cured the fault. We get a lot of these Sharp machines with this type of fault and are forced to reflect on how badly off we would all be without "stock problems" like this. **S.L.**

TV Fault Finding

Reports from Richard Roscoe, Alan Shaw, Roger Burchett, J. R. Armagh, Geoff Fardon and L. Dinsdale

Decca 80 and 100 Chassis

In the May 1983 issue I reported that the bulk of the problems we'd been having with our Decca 80 and 100 series chassis had centred around failure of the triplers and line output transformers, either singly or both together. Up to about eighteen months ago the pattern remained broadly the same. Well over half the calls were to dead sets with blown mains fuses – the previous report gave the procedure we adopt in such cases.

Since then, as the sets have got older, there's been a change in the pattern of stock faults. We now have to deal with many more dry-joints associated with the numerous plugs and sockets on the PCBs. The plugs and sockets on the line output and convergence panels have always been suspect of course, due to the high currents they carry and the heat generating components mounted close to them. But even such cool running and lightly loaded connectors as those on the i.f. panel are now no longer above suspicion. Field jitter, colour flashing, hum bars, line shake, low gain, poor sync, field roll on picture change and many more obscure symptoms have been encountered during the past year or so and traced to the poor condition of PCB connections.

The first few faults of this sort we came across were laboriously tracked down to the individual cause. We soon came to the conclusion however that each particular fault we were dealing with was only the tip of the iceberg. A much better approach is to strip out each PCB (easily done in these chassis), then systematically resolder all the plugs and clean all the sockets on each one. This takes only half an hour or so and avoids a lot of fruitless prodding and tapping.

A component that's now giving a lot of trouble in the 100 series chassis is the 37V supply reservoir capacitor C407 (680μF). The usual symptoms are weak line sync or line pulling on picture content. We find it worthwhile changing this capacitor every time. Even if it seems o.k. electrically it's usually in a sorry state physically due to its closeness to the hot EW modulator diodes. **R.R.**

C-sick Skantics

A monochrome Skantic receiver, type 1241, had a rolling picture when first switched on. It would settle down after half an hour, but the field lock was still touchy. Now if the line or field sync is weak in a Skantic set our first thought is always the power supply decoupling. Scope checks showed that all the main supply lines were fairly smooth, but when we looked at the video output from the i.f. can it had a definite hum component. Inside the can were three fine examples of the Red Breasted Decoupler (Genus Tantalum), C515, C518 and C530, all 10μF, a species widespread in Scandinavia and notoriously fickle. For future reliability we replaced all three, and were rewarded with not only solid field lock but also a marked improvement in picture contrast.

Another of these Skantic breeds worth noting is the Yellow Bellied Axial, whose natural habitat is the switch-mode power supply of Skantic colour chassis types 4751, 5151 and 5661. This power supply was covered in detail in the January 1982 issue of *Television*. There are two of these electrolytics in the circuit, CN04 (10μF) and CN05 (4·7μF). Now that these sets are getting a bit long in the tooth, in almost every example we come across one or both of these capacitors is in a bad way. The result is low or, worse, high output voltages with poor regulation. **R.R.**

Plustron Palladium C14ENS

This set was a real stinker and had apparently led many engineers a merry dance. I bought it when my local co-op closed down. The only certainty was that the tube had plenty of life left – it hadn't worked long enough to wear out, having been in and out of two or three houses and back to the workshop a number of times. All this travelling hadn't done the cabinet any good, and the line hold control knob (it's a customer control, and it needed it!) was missing. Still, it was cheap and I didn't have any qualms. I should have done!

On soak test there was first loss of colour then loss of line lock. Left to itself it had a fit of the sulks and after a sharp crack it went off. After finishing the set I was doing I investigated and found a fuse blown, caused by the line output transistor being short-circuit. A new fuse and BU208A were fitted but the result of switching on was – nothing . . . While checking around the line oscillator it came on again – and stayed on all day. Next day we had a repeat performance. On the third day the set changed its tactics. When it did start up it screamed at me and stopped before I could switch it off. Fit a new BU208A – this is beginning to get expensive.

To shorten a long story, once the set started it performed well, though the line hold was still drifting. The merest touch with a meter would start it, either correctly or with painful protests from the line output stage. There eventually came a quiet day and, armed with infinite patience, it was down to component changing. Out came the transistors, resistors and then the capacitors in the line driver and oscillator stages. In went new ones until we came to Cd07 (0·047μF) in the line oscillator circuit (feedback coupling). When this was changed the set started up nicely and is still going strong. Cd07 checked all right out of circuit of course. I'm not putting the set out to a customer just yet however. Anybody want to buy a set with four careful lady owners? **R.B.**

Decca 70 Series Chassis

An epidemic of tuning problems on these sets has broken out in our area. The culprit is the tuning voltage stabiliser feed resistor R108 (33kΩ). Sometimes the tuning drifts off then corrects itself a few times before finally succumbing. **R.B.**

Thorn 9000 Chassis

A dead set due to a short-circuit Syclops transistor proved quite a headache as each replacement R2540 transistor died either immediately or after several hours. We eventually found that R419 (33kΩ) which biases the base of the driver transistor was going open-circuit intermittently – it had a loose end cap. **A.S.**

Hitachi NP9A Chassis

Now and again 6 or 7 would show on the digital display when the channel 5 or 6 button on the remote control handset was pressed. The i.c.s and one or two transistors on the remote control receiver/decoder panel were tried without success. I then decided to replace the 4·43MHz crystal, using the old-fashioned, big reliable type – one obtained from a Pye 725 test panel. We now got standby only. The "reliable" crystal was leaky! Fitting another one cleared the fault. **J.R.A.**

Bush T20 Chassis

There was a rush of sound then the set went dead – power supply o.k. No it wasn't 4R16 (910Ω) in the 12V regulator circuit! 4C19 in the line oscillator start circuit was bridged with a 5·6kΩ resistor to ensure that the line oscillator was working but this made no difference. Neither did fitting a known good line output stage panel, so attention was turned to the scan drive panel. At this point I did something not normally advised – I overrode the trip circuit by placing a bridge across 5C4. This provided a clue – 4R9 (330Ω) in the field output stage started to burn up. Checks here revealed that one of the field output transistors (4VT4) was leaky while the driver transistor 4VT2 was short-circuit. Replacing these transistors and 4R9 plus removal of the link across 5C4 restored a good picture.

The fault with another of these sets was a background drone. 3C75 (0·47μF electrolytic) in the base circuit of the constant-current transistor 3VT15 had gone almost open-circuit. **G.F.**

Philips G11 Chassis

This set had a negative picture. The waveform at pin 15 (luminance output) of the vision detector module U5600 on the i.f. panel was found to be negative-going instead of positive-going. Changing the TCA270S chip within the module cured the fault. **G.F.**

Bush T26 Chassis

The trouble with this set was no colour. The colour-difference signals were present at the outputs from the TDA2522 chip but were of low amplitude – they could be seen to vary slightly when the colour control was adjusted. A new TDA2522 i.c. was tried, and the usual troublesome capacitors in this area were replaced (C84 – use a polyester type – C83, C85 and C87). All to no avail. The hairdryer was then brought into play. When the area around VT5, i.e. the sandcastle pulse generator circuit, was heated the monochrome picture first went darker than usual then colour appeared. Replacing VT5 made no difference: the culprit eventually turned out to be C58 (330pF) which was intermittently open-circuit. **G.F.**

Thorn 9000 Chassis

After replacing the tripler we were confronted with an uncontrollable brightness fault. We decided to check around the tripler circuit before getting involved in the RGB output stages. R725 (180kΩ) and R724 (22kΩ) in the beam limiter circuit were both found to be open-circuit, but the fault was still present after replacing them. Diode W722 measured o.k. but when the parallel capacitor C729 (0·1μF) was checked out of circuit it was found to have a 3kΩ leak. Fitting a replacement cured the fault. These oblong, white capacitors are usually extremely reliable – this is the first time we've had one break down.

We had another brightness fault on one of these sets recently. This time the first anode voltage was high and the preset control R721 had no effect. R722 (2·2MΩ) on its earthy side turned out to be open-circuit.

No sound in another of these sets was traced to R141 (470Ω) being open-circuit. This resistor provides the supply for the SN76666N intercarrier sound channel chip IC2. **L.D.**

Long-distance Television

Roger Bunney

Reception conditions during June were quite remarkable. Sporadic E propagation produced excitement for many, with a very active start to the month but tending to die away later on. Very warm weather caused by stationary high-pressure systems produced tropospheric openings during the middle and final two weeks of the month, with signals in Band III and at u.h.f. – generally of "super DX" quality.

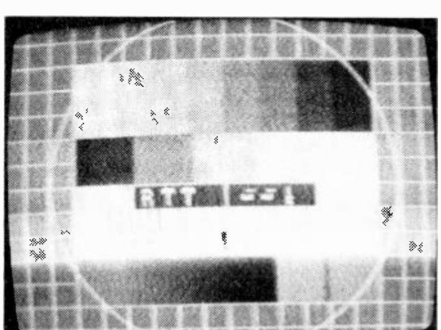
The first tropospheric opening occurred on the 14th, giving Band III/u.h.f. signals in south, central and eastern UK from Holland, Denmark, W. Germany and France – there had been improved French/Benelux signals in the south and central areas over the 12/13th. Tropospheric conditions in Scotland improved over the 15/16th, when Derek Juniper (Arbroath) received good signals from NRK (Norway) and W. Germany. A lull followed until the 19th when conditions again picked up, particularly in the north and eastern areas, with more Norwegian, Denmark, German (W. and E.) and Benelux reception. The most active period seems to have been the 19th-23rd, though tropospheric enhancement continued on and off, varying from area to area, until July 2nd – an unusual and difficult period to report in fact due to the regional variations. During the main peak period there were really strong signals from E. and W. Germany, Denmark, Norway and the Benelux countries – Canal Plus from France was noise-free for most of the time!

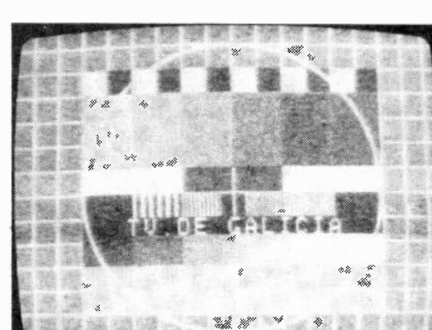
Further reports of reception of the French TV5 service in the south and London areas have been received. Simon Hamer (Powys) sent in a very extensive report, including several E. German Band III and u.h.f. stations – a commendable effort considering the distance from the east coast. Simon's peak days were the 21st and 26th. In late June Swiss signals in chs. E9, E12, E24, E29, E31 and E34, also French TV6 service signals, were received at St. Leonards-on-Sea.

There seems to have been little 435MHz ATV activity despite the latest lift. Cyril Willis (Downham Market) noted only two contacts between Dutch and UK stations. There are rumours that part of the 430-440MHz band could be allocated to commercial mobile radio: this could well end 435MHz ATV if more activity isn't seen.

Overall then a rewarding period for tropospheric reception, enhancing an already busy SpE period. A small aurora was noted in Scotland on the 11th, giving the usual Norwegian Band I signals.

As far as SpE propagation is concerned much of the excitement was produced by the reception of Arabic signals. RTM (Morocco) was received on many days on ch. E4, though some confusion has been caused by a new country operating on this channel – RTT (Tunisia) from a site at Remada. We hope to obtain more details of this transmitter shortly. So care is necessary to check whether ch. E4 Arabic signals are from RTM, RTT or Bahrain. A further transmitter is now operating on ch. E3, from Abu Dhabi, UAE (Habshan,1kW e.r.p.). A pleasure to note stations opening in Band I rather than the reverse. The extensive SpE log for the month is as follows:





Left: RTT Tunisia ch. E4 received by Michel Dubernat via SpE in France. Centre: Russian first programme news caption, received by Derek Juniper in Arbroath on ch. E2. Right: TV de Galicia test card received by Michele Dubernat in France.

5/6/86 TVE (Spain) chs. E2, 3, 4, TVE-2 E2; RAI (Italy) IA, B; RTP (Portugal) E3; +PTT (Switzerland) E2; ARD (West Germany) E2; TSS (USSR) R1; MTV (Hungary) R1, 2; TDF (France) L4: EPT (Greece) E3; RTT (Tunisia) E4; RTM (Morocco) E4.

6/6/86 TVE E2, 3, 4; RAI IA, B; JRT (Yugoslavia) E3, 4; MTV R1, 2; RTP E3; ARD E2, 3; ORF (Austria) E2a; CST (Czechoslovakia) R1; DFF (East Germany) E4; TVP (Poland) R1; RTS (Albania) IC; RTM E4.

7/6/86 TVE E2, 3, 4; RAI IA, B; JRT E3; TVR (Rumania) R2; ORF E2a; MTV R1, 2; SR (Sweden) E2; TVP R1, 2; CST R1, 2; TSS R1, 2, 3; NRK (Norway) E2; ARD E2, 4; RTS IC; JTV (Jordan) E3; RTT E4.

8/6/86 TVE E2, 3, 4; RAI IA, B, C(!); JRT E3, 4; TSS R1, 2; CST R2; MTV R1, 2; ORF E2a, 4; SR E2, 3; TVR R2; RTS IC; RTM E4; Aramco TV, Saudi Arabia ch. E3 (0550-0625 CET); Iran E4 at 0625 CET, news with hospital visit – the latter plus two unidentified Arabic ch. E3 signals were received simultaneously by Ryn Muntjewerff in Holland.

9/6/86 TVE E2, 3, 4; RTP E3, 4; RAI IA; ORF E2a, 3, 4; TSS R1, 2; CST R1, 2; TVP R1, 2; SR E2, 3, 4; TVR R2, 3; ARD E2; MTV R1, 2; +PTT E3; Radio Tele Uno, ch. IA (Italian private station).

10/6/86 SR E2; CST R1; DFF E4; TVE E2, 3, TVE-2 E2; RAI IA.

11/6/86 RAI IA; TVE E3, 4; CST R2.

12/6/86 JRT E3, 4; RAI IA; ORF E2a; TVE E3; EPT (Greece) E3.

13/6/86 TVE E2, 3, 4; RAI IA, B; TVR R2; TSS R2.

14/6/86 TVE E2, 3, 4; RTP E3; RAI IA; TVE-2 E2; ARD E2.

15/6/86 RAI IA, B.

16/6/86 TSS R1; RAI IA; CST R1.

17/6/86 RTP E3; ARD E2; CST R1; TVP R2; TVE E2.

18/6/86 TVP R1, 2; TSS R1, 2; MTV R1; JRT E3; RTP E3; RTS IC; TDF L3.

19/6/86 RAI IA, B; JRT E3; TVE E2, 3: ORF E2a, 4; ARD E2; TDF L3; +PTT E3; CST R1, 2; NRK E3; TSS R1, 2, 3; EPT E3; JTV (Jordan) ch. E3 at 1050BST; TVP R1, 2; MTV R1; YLE (Finland) E3,4.

20/6/86 TVR R2; MTV R1, 2; TSS R1,2; RAI IA; TVE E3, 4.

21/6/86 TVE E2.

23/6/86 TVE E3; RAI IA; JRT E4; TSS R1.

24/6/86 RUV (Iceland) E3, 4; DR (Denmark) E3; TVE E2, 3, 4; RTP E3; RAI IA, B; ARD E2; MTV R1, 2; TVP R1; CST R1, 2; +PTT E3; ORF E2a, 4; JRT E3, 4; TSS R1, 2.

25/6/86 RUV E3, 4; RTP E3; TVE E2, 3, 4; MTV R1; DFF E4; RTT E4.

26/6/86 RTP E3; RUV E3, 4; SR E2, 3; NRK E2, 3, 4; JRT E3; TSS R1, 2, 3; CST R1; TVP R1.

27/6/86 SR E3; NRK E2.

28/6/86 TVE E3, 4; +PTT E2; RAI IA, B.

29/6/86 TVR R3; JRT E3; RAI IA, B; MTV R1, 2; TSS R1, 2; DR E3; ARD E2; TVE E2, 3, 4.

30/6/86 CST R1; TVP R1, 2; TSS R1, 2; MTV R1, 2; ARD E2; EPT E3.

1/7/86 RAI IA, B; TVE E2, 3; ARD E2; MTV R1, 2; TSS R1, 2; EPT E3.

2/7/86 CST R1; TVP R1; RAI IA; TSS R1, 2; MTV R1; ORF E2a; TVE E2, 3, 4.

3/7/86 RAI IA.

Certainly an active month for SpE then! Several points arise. System L (France) colour bars on ch. L3 (54MHz vision carrier) were logged on the 19th at 1142 BST – most likely from Le Plessis-Robinson at only 16W. The Italian private station Radio Tele Uno was received several times on ch. IA: it has a distinctive test pattern with white/black squares across the top and a moving series of letters at the lower centre – I'm told this is an advertisement. The Czechoslovakian Fubk pattern was logged (ch. R1) with a different identification, "DDK 2" – any ideas? I understand that Rumania has reduced weekday programming to 2000-2200 local time, with the test pattern often not seen until 1945.

I feel that the catches of the month were RTT and RTM on ch. E4, Ryn's reception of Aramco ch. E3 and Iran ch. E4, and Derek Juniper's reception of BFBS (British Forces TV, W. Germany) on chs. E23, E41, E48 and E51 at Arbroath during a tropospheric opening on June 28/29th.

The FY7THF (French Guiana) 50·39MHz beacon (amateur band) was heard via multiple-hop SpE on June 2nd and 5th. On June 7th, SpE at 144MHz gave two-way UK amateur contacts with Yugoslavia, Rumania and Hungary.

My thanks to the following for supplementing my own loggings during this active month: Roy Fussell (Torpoint), Bill Cotterhill (Tipton), Tony Privett (Basingstoke), Roger Pates (Northampton), Iain Menzies (Aberdeen), Dave Shirley (Hastings), Tim Anderson (St. Leonards-on-Sea), Cyril Willis (Downham Market), Gareth Foster (Middlesex), Derek Juniper (Arbroath), Keith Chaplin (Leicester) and Ryn Muntjewerth (Holland).

It seems that the next edition of my TV-DXing book, in a new larger format, will not be published by Bernard Babani (publishing) Ltd. till late next year.

From our Correspondents...

Michael Dubernat (France) has sent us a shot of "TV de Galicia" which he says is well received in France during tropospheric openings. The ch. E31 transmitter is at

Lugo, Spain.

George Gaskin (Gibraltar) reports that TVE (Spain) now operates from the early morning: TVE-1 starts at 0730 local time on weekdays, 0930 on Saturdays and 0830 on Sundays. He mentions that GBC (Gibraltar) operates the transmitters round the clock, with programmes from 1900-2400 daily. The main transmitter operates on ch. E6 at 1kW e.r.p. Relays operate on chs. E12, E53 and E56.

A correction from Tony Dunnett, New Zealand (see June issue). His firm SAT—TEL is at Motueka, South Island but the reception from AUSSAT-1 was near Auckland, North Island. Overspill from the south-east beam gives signals there from transponders 5 and 7 – with transponder 8 to be used for commerial transmissions later. SAT-TEL manufactures 5 and 7m dishes, NTSC-to-PAL converters, decoders and TVRO receivers, but the head electronics at present have to be imported.

News Items

UK: An interesting development of the Racal-Vodaphone cellular telephone network: during a visit by the French premier slow-scan TV pictures were transmitted from a moving police vehicle near Canterbury to Maidstone.

Belgium: The price of the "List of European Television Broadcasting Stations", no. 31, published by the EBU, 32 Avenue Albert Lancaster, Centre Technique, Bruxelles B-1180, Belgium will increase to BF1,000 this summer. It's the most accurate TV transmitter listing for the European broadcasting area.

USSR: The 1,125-line HDTV standard has been "approved" by the broadcasting authorities.

Iceland: A commerial TV station, "Islenska Sjonvarpsfelagid", is due to start operations this month. The 20kW e.r.p., ch. E12 transmitter is located at Reykjavik, with omni-directional, horizontally polarised aerials.

Dual-channel TV sound: WDR-1 and WDR-3 (W. Germany) now carry two-channel sound during test transmissions. The main channel (ton 1) carries the normal TV sound/music while the second channel (ton 2) carries the WDR-4 radio programme. A new station in Lima, Peru is understood to be the first in Latin America to have stereo sound. It operates on ch. 33 at 10kW.

Transmitter news: A new DR (Denmark) transmitter at Kalundborg operates on ch. E58 (vertical) with under 100W e.r.p. The W. German ch. E42 Kassel HR-3 transmitter closed at the end of May.

Satellite TV: The American forces SEB network via transponder 9 on the Intelsat V F2 satellite at 1°W has changed polarisation to left-hand circular. CNN-Europe has been seen with scrambling via both Intelsat V F2 at 1°W (4GHz) and Intelsat VA F11 at 27·5°W (11GHz). The VideoCipher-II system is used, apparently with sound in syncs. Decoders can be obtained from the USA for $395, plus a fee to CNN.

Signals at 49MHz

For TV-DXers the 49MHz part of Band I means ch. R1 whose vision carrier frequency is 49·75MHz. Unfortunately there's extensive use of cordless phones in this part of the spectrum, despite the fact that it's illegal. A major manufacturer of such phones, Supaphone, lists some 22 channels for base station use, paired with remote handset frequencies in the 67-70MHz spectrum. The list is as follows:

Channel	*Base (MHz)*	*Handset (MHz)*	*Channel*	*Base (MHz)*	*Handset (MHz)*
1	49·68	70·275	12	49·44	70·025
2	49·71	70·335	13	49·29	67·550
3	49·74	70·365	14	49·32	67·60
4	49·80	70·425	15	49·35	67·55
5	49·77	71·745	16	49·38	67·70
6	49·62	71·775	17	49·41	67·75
7	49·65	71·805	18	49·11	69·84
8	49·59	70·225	19	49·08	69·81
9	49·56	70·185	20	49·05	69·78
10	49·53	70·125	21	49·02	69·75
11	49·47	70·080	22	48·99	69·72

As you can see the frequency spread is quite wide – and these are just one manufacturer's channels. The powers used can be several watts, giving a range of several miles with external aerials. Walkie-talkies from toy shops and importer/retail outlets commonly operate at 49·86MHz. During a recent SpE opening I heard a base station at 49·86MHz calling CQ, giving a location at Southampton and a callsign GC1PF – the operator was complete with a CB echo mic.!

To make matters even more difficult the DTI has announced that on-site paging services will be offered a 500kHz allocation at 49MHz. This is because the UK CB band has been given 40 extra channels at around 27MHz to comply with European standards. Existing 27MHz paging systems are expected to co-exist with the new CB band for the present. The long-term aim is that site paging should be at 49MHz with 12·5kHz spacing. The DTI hopes to commence licensing the new 49MHz paging services this autumn. At present some 8,500 systems are licensed for operation in the 26/27MHz spectrum. There are three hospital channels at 31MHz (no change here) but a hospital allocation at 49MHz will also be available later this year.

A further DTI sheet advises that radio-controlled models are to be offered frequencies at 40MHz for surface use and 35MHz for airborne use. The problem here is that the new 26·96-27·4MHz CB allocation could cause interference to model operators. Hence the need to establish clear radio control frequencies. The existing UK CB band and the new Euro CB band will operate side-by-side for some years: the original UK CB allocation will eventually be withdrawn.

405-line Corner

In a recent column I mentioned that I had a couple of 405-line sets dating from the mid-fifties for disposal – otherwise they'd be dumped. The response was quite surprising, with ten local requests for the receivers. It seems therefore that there's a continuing interest in System A and the equipment for use with it. If you're thinking of scrapping a working 405-line set you may care to write in to put it on offer. Those seeking such sets may also care to write in. Please include a s.a.e. in both cases. It would be up to the parties themselves to arrange for collection etc. Even old 405-line VTR recordings could be useful.

We have a request from an established historic wireless/TV collection in the Dorset area for a System A signal source/pattern generator of the 405-line era. If any workshop has a disused one here's a good home for it. Please write in.

Service Bureau

Requests for advice in dealing with servicing problems must be accompanied by a £1·50 cheque or postal order (made out to IPC Magazines Ltd.), the query coupon and a stamped addressed envelope. We can deal with only one query at a time. We regret that we cannot supply service sheets nor answer queries over the telephone.

ITT CVC20 CHASSIS

The first problem we had with this set was a three-inch picture displacement accompanied by loss of colour. This was traced to a poor joint on the TBA920 sync/line oscillator chip. The fault that's now present is a slight disturbance of about ten successive lines on picture highlights, e.g. captions, the rest of the picture being perfect. All voltages in the line timebase are normal and the only clue is that the effect is diminished when the contrast control is set to zero. We suspect the line output transformer or tripler but are reluctant to replace either as the e.h.t. is constant.

This sort of problem can be caused by a fault in the line oscillator department. Check the supply decoupler C701 (100μF), the sync separator bias resistor R702 (1·2MΩ) and C708 (4·7μF) in the flywheel line sync filter network. It's just possible that the TBA920 itself is responsible. If necessary check the 25V supply reservoir capacitor C45 (4·7μF) in the power supply before suspecting the tripler rather than the line output transformer: before replacing either, make sure that the c.r.t.'s outer Aquadag coating is properly earthed.

TOSHIBA V8600B

The only thing that works is the clock. The rest of the machine is dead. The fuses are o.k. but after a few seconds IC604 (TD62003P) on the servo/logic panel becomes red hot.

Pin 9 of IC604 is fed from the 12V line. Disconnect this pin and confirm that the 12V line and the rest of the machine perk up. If so check diodes D626-D631 in the chip's output circuitry for shorts. If these are o.k. it's almost certain that the chip is faulty, with an internal short between pin 9 and one of the other pins.

THORN 9000 CHASSIS

I have purity problems that can't be removed by degaussing on a couple of these sets, i.e. incorrect patches of colour. One set has a red patch, the other yellow shading down the right-hand side. Known good chassis have been tried, proving that the trouble is to do with the tubes.

In theory the tube's purity (and convergence) rings are set and sealed at the factory. In practice small purity errors can be corrected by setting up a red raster then carefully adjusting the two rings nearest the tube base for the purest red field. Large adjustments should be avoided as this might upset the convergence, necessitating disturbance of the other ring magnets. Before carrying out any such adjustments confirm that the degaussing circuit is working: feel posistor X701 which should run warm.

MITSUBISHI HS303B

The original fault with this machine was failure to record sound. Replacing the AN262 audio i.c. provided a cure but the fault is now intermittent. I've tried cleaning the relay contact (K3F0) but the problem persists – the owner says it's been present from new.

In our experience there are two possibilities for this fault – provided the relay is in good condition. The more remote possibility is that the switching chip IC3F1 (4066B) is in trouble. It's more likely however that the alignment of the audio head is incorrect. Adjust carefully following the instructions given in the manual.

DECCA 70 SERIES CHASSIS

The problem with this portable is no colour – the decoder panel is the earlier one with a TDA2522 i.c. in position 2IC2. Disabling the colour-killer usually produces unlocked colour – occasionally the colour is stable but incorrect. Both i.c.s have been replaced and fine adjustment of the reference oscillator trimmer didn't help.

These symptoms can be caused by a small degree of jitter or mistiming of the sandcastle pulse. Check C301 (22μF) and C306 (220μF) in the line timebase before suspecting 2C16 (1μF), 2C18 (4·7μF) and 2C24 (47μF) in the decoder and finally the crystal 2XL1.

PHILIPS G11 CHASSIS

The set works perfectly when used with the remote control system. When using the touch buttons to change channels however the unit sometimes sticks on any one of the six positions and can be changed only via the handset.

It's possible that some of the high-value resistors in the control head have changed value but more likely that the buttons need cleaning – this can be done with a toothbrush soaked in white spirit. Another possibility is that the user has hard skinned fingertips or is standing on an especially dry floor. It's sometimes necessary to moisten one's fingertips or hold a radiator when changing channels on these sets.

ITT CVC9 CHASSIS

The initial fault was intermittent loss of sound and could be instigated by tapping the cabinet. It appeared to be in the area of the muting circuit. The fault then became permanent. Bridging the E299DD/P344 VDR (R409) in the muting circuit with a high-value resistor brought back distorted sound, so the VDR appears to be suspect. It seems to be difficult to obtain however.

R409 commonly fails, giving this fault. If you can't get a VDR from a scrapped set try using a fixed resistor of around 100kΩ – choose a value that gives 115V at the junction of R409 and R413.

QUERY COUPON

Available until 17th September 1986. One coupon, plus a £1·50 (inc. VAT) cheque or postal order, must accompany EACH PROBLEM sent in accordance with the notice above.

TELEVISION SEPTEMBER 1986

TEST CASE

285

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

Tuning drift is never an easy fault to deal with, especially when it's intermittent – as is usually the case. It can be a nightmare with self-seeking and synthesis tuning systems. The set in our spotlight this month, a Sony Model KV1820UB, incorporated no exotic arrangements of this sort but nevertheless proved difficult to sort out.

The set is one we have out on rental and the problem started, as these things usually do, with a call to the house. From the customer's description the fault certainly sounded like tuning drift but at the time of the technician's call all four channels were present and correct. The hard-pressed technician was a practical man: not for him the niceties of millivolts per MHz or a.f.c. capture range. He thrashed the programme buttons, squirted them and the a.f.c. slide switch with an aerosol switch cleaner, and knocked seven bells out of the varicap tuner with the handle of a screwdriver. None of this had much effect on the Channel Four test pattern display and the technician (can we call him that?) was soon on his merry way. The customer didn't know whether to laugh or cry.

He wasn't laughing next day when he telephoned to say that the drift problem was still present. Was it doing it right now? Yes. Within minutes the man with the switch cleaner, screwdriver and carefree air was on the spot. He found that the Channel Four picture was coming and going, never completely disappearing into snow and sometimes passing through the correct tuning point. The other channels were similarly afflicted. After another screwdriver attack on the tuner, again with no effect on what was happening on the screen, the man bundled the set into the van and installed a tatty loan set in its place. Back to the ranch!

The diagnostic technique adopted in the workshop was more scientific if just as fruitless. The set was switched on and tuned to a strong local transmission. A digital voltmeter was hooked to the tuner's varicap tuning pin and the reading (12·12V) was carefully noted and recorded. There followed a long and uneventful period during which the set behaved perfectly. Sod's Law in action once again. Finally the set did start to drift about. As before the range of drift was fairly limited but the DVM indication didn't help at all – the third and fourth digits in the display gave a fair imitation of a bell fruit machine while the second digit flickered to one now and again. Was this the cause of the trouble or, via the a.f.c., the effect? The probe was transferred to the cathode of the μPC574 33V tuning voltage stabiliser, on the front panel, where a rock-steady reading of 32·8V was recorded, proving that this device at least was blameless.

A microammeter was next connected in series with the varicap tuning pin. Again there was a long period free from drift, then a frenzied (but limited) thrash around the correct tuning point. Two points emerged from this. First the microammeter's needle moved not a jot, ruling out leakage within the tuner. Secondly the drift effect was present whether or not the a.f.c. was switched in.

The tuning potentiometer bank next came under suspicion. As the right type wasn't in stock a good quality 22kΩ preset was substituted for the whole potentiometer bank and wired to channel selector switch one. After a lengthy run the set drifted just as before! The next proposal was to check the tuner by substitution. But before this could be done someone sensible disconnected one resistor as a test: he soon had the correct diagnosis. Which resistor was it? See next month.

ANSWER TO TEST CASE 284
– page 667 last month –

Decoder faults are quite rare these days, but the one described last month was solidly present. The trouble was no colour and the technician, unfamiliar with the Philips range and, it seems, with modern decoder practice, was completely thrown by the presence of the burst signal – and nothing else – in the chroma delay line circuit. This led him to replace the first of the two i.c.s in the decoder, the TDA2560Q which provides luminance and chroma signal amplification and brightness/contrast/colour control. The new chip left the fault condition as before.

In this decoder the amplified chroma signal passes from the TDA2560Q i.c. to the delay line circuit where the B−Y and R−Y components are separated in the usual way. These are then fed to the second, TDA2523/4Q i.c. Since the burst phase detector and the a.c.c. detector are both in this second i.c. the burst signal has to pass through the delay line circuit along with the chroma signal proper. Furthermore it must pass through the first chip and the delay line circuit at constant level, unlike the chroma signal whose amplitude is affected by the colour and contrast controls. The action of these controls within the TDA2560Q i.c. is gated so as not to affect the burst signal.

The amplitude of the chroma signal is set by the voltages at pins 4 (d.c. colour control voltage) and 16 (d.c. contrast control tracking voltage) of the TDA2560Q i.c. The problem lay at pin 4, where the voltage should vary from 2V to 4V as the customer colour control is operated. In this set the voltage was permanently low, cutting off the chroma amplifier – during the chroma signal periods, not the burst periods. Pin 4 is taken to pin 17 of the decoder module and an ohmmeter check between this point and chassis (pin 1) produced a very low resistance reading. It remained low with the module removed from the set. The culprit was the colour control voltage decoupling capacitor C3204 (0·01μF) which was leaky – it measured about 50Ω. The man (technician?) is still kicking himself. Are you?

Published on approximately the 22nd of each month by IPC Magazines Limited, King's Reach Tower, Stamford Street, London SE1 9LS. Filmsetting by Trutape Setting Systems, 220-228 Northdown Road, Margate, Kent. Printed in England by the The Riverside Press Ltd., Thanet Way Whitstable, Kent. Sole Agents for Australia and New Zealand – Gordon and Gotch (A/sia) Ltd.; South Africa – Central News Agency Ltd. Subscriptions: Inland £14, overseas (surface mail) £17 per annum, payable to Quadrant Subscription Services Ltd., Oakfield House, Perrymount Road, Haywards Heath, Sussex RH16 3DH. "Television" is sold subject to the following conditions, namely that it shall not, without the written consent of the Publishers first having been given, be lent, resold, hired out or otherwise disposed by way of Trade at more than the recommended selling price shown on the cover, excluding Eire where the selling price is subject to currency exchange fluctuations and VAT, and that it shall not be lent, resold, hired out or otherwise disposed of in a mutilated condition or in any unauthorised cover by way of Trade or affixed to or as part of any publication or advertising, literary or pictorial matter whatsoever. ISSN 0032-647X.

SONY SPARES FAST! ex-stock from LRC (SPARES) LTD

ORDERS BEFORE 4.00 P.M. – SAME DAY DESPATCH!
LIST PRICES EXCLUSIVE OF VAT
ORDERS UNDER £50 ADD £1.00 P&P

01-388 1714

9 FITZROY MEWS · LONDON W1P 5DQ

SEMICONDUCTORS

DIODES

10E2	Gen	0.23
GH 3F	KV Gen.	1.35
IS 1555		0.23
VIIN	KV 1810UB	0.91
CV 12E	GEN.=CSM-2A 4A 101	2.20
UO6G	KV 1810UB	0.91
BR 303	KV 2704=SHOR 3042	1.54

THYRISTORS

SG-264A	KV Gen.	3.82
SG-629	KV 1810UB	6.05
SG-6533	KV Gen.=SG613	8.60

IC's

BX-342	SLC7UB	3.82
CX-104A	KV 1810UB	4.90
CX-136A	VTR Gen.	7.25
CX-143A	SLC5/7UB	6.90
CX-177		4.90
CX-186	SLC5UB	4.90
CX761A		8.35
M51231P	KV 2200UB	2.20
STK 1225		12.90
STK 2129		12.90
STK 4026		8.35
STK 5314		6.95
TBA 120U		2.98
TCP 4621 AF6		10.39
TDA 2578A	KV 2752UB	3.85
TDA 3652	KV 2752UB	3.95
TDA 4600-2	KV 2052/6UB	4.90
UPC 1365C	KV Gen.	8.35
UPC 1394C	KV 2060/62UB	2.20
UPO 546C107	SLC7UB	16.65
UPD 547C049	SLC7UB	8.45

TRANSISTORS

P.S.U. TRANS. KIT 2SC 2335 SLC7		7.60
TRANS. ASSY. TAF 40		6.30
2SA 771	TAF 5A=2SA 1206	1.60
2SA 835	Gen.	1.35
2SA 1027R	ICF-C820L=2SA 1115P	0.91
2SA 1175	SLC7UB	0.23
2SB 733	KV 2204UB	0.91
2SB 740C	TCK 88B	0.91
2SB 856	Gen.	1.06
2SC 403C		0.23
2SC 867A	Gen.	2.20

TRANSISTORS CONTINUED

2SC 945=2SC	634 SP=2SC 1364	0.23
2SC 1034		4.90
2SC 1061	Gen	2.25
2SC 1114	Gen.	4.90
2SC 1124		0.91
2SC 1316	Gen. Trs. Assy.	6.10
2SC 1362-7	Gen.=2SC 634 SP-47	0.23
2SC 1413A	KV Gen.	6.95
2SC 1475	KV 1810UB=2SA 1174	0.91
2SC 1962	Gen	1.35
2SC 2009	Gen.	0.23
2SC 2278	Gen.	0.91
2SC 2369	SLC5/7UB	2.98
2SC 2551	KV Gen.	0.91
2SC 2785	AG-7UB	0.23
2SC 3153	KV 2060UB	3.82
2SC 14544		3.95
2SD 257	ST 5150	2.20
2SD 725	KV 2204/2704	8.40
2SD 773	Gen.	0.23
2SD 774	SL/HMK	0.91
2SD 870	KV 2704	5.35
2SD 1164	SLC6UB	0.91
2SD 1497-02	KV 2252/2752	3.82
2SD 1497-06	KV 2252/2752	3.82

PLEASE ASK FOR ANY PARTS NOT LISTED.
NON-STOCK ITEMS AVAILABLE ON REQUEST.

VIDEO HEADS & ACE ASSY.

SL8000/8080	DSR-43R	45.40
SLC5/6/7	DSR-36R	38.85
SLC9	OSR-21R	42.30
SLC20/30/40	DSR-35A	38.75
SL-F1	DSR-35A	38.75
SLC6	ACE	28.75
SLC7	ACE	23.55

PILOT LAMPS	SONY PART NUMBER	
STR6060F	1-518-070-00	0.95
Gen.	1-518-115-XX	0.95
360mA 11V Gen.	1-518-116-00	0.95
40mA 4.5V Gen.	1-518-169-XX	0.95
130mA 23V	1-518-263-00	1.15
13V HMK11	1-518-323-00	0.95
40mA 8V TAF-45	1-518-409-21	0.95

MANUALS (0 VAT RATED)
ALL SONY TV & VIDEO SERVICE MANUALS 7.75

VIDEO SPARES

SLC5/7	SONY PART NUMBER	
BOOSTER ANTENNA	1-463-296-00	30.50
MODULATOR	1-464-116-00	50.50
TAPE UP SENSOR (C7)	1-543-145-00	1.35
CONTROL KNOB (C7)	3-659-547-00	0.94
LID TIMER (C7)	3-703-075-00	0.25
CAPSTAN MOTOR	8-838-008-10	32.60
IDLER KIT	A-670-634-8B	4.45
LIMITER ASSEMBLY	X-365-331-00	2.30
IDLER ASSEMBLY	X-365-932-40	0.94
BRAKE ASSEMBLY	X-365-932-82	1.35
PINCH ROLLER	X-365-933-70	0.95
SLC6		
SOLENOID	1-454-293-11	8.75
MODULATOR	1-464-188-00	58.80
THREADING GEAR	3-671-126-00	0.94
DC MOTOR	8-835-070-11	13.50
IDLER KIT	A-670-639-1B	3.30
REEL MOTOR (MK1)	A-673-710-1A	13.50
REEL MOTOR (MK2)	A-673-710-6A	21.50
FORWARD ASSEMBLY	A-674-007-1A	3.10
CAPSTAN MOTOR	A-675-113-1A	6.50
PULLEY ASSY. LOAD	X-367-101-50	0.94
SL-F1/C9		
DC/DC CONVERTOR	1-464-217-00	18.75
CARRIAGE MOD KIT (C9)	A-675-121-2B	7.55
CASS. LOAD MECH. (C9)	A-675-123-6A	58.60
GUIDE PIN KIT	A-675-910-7C	5.11
UPPER CYLINDER	A-676-013-8A	22.30
5 RING ASSEMBLY (C9)	X-366-943-10	15.05
PINCH ROLLER (SLC20)	X-366-930-76	7.35

BELTS

INDIVIDUAL BELTS AVAILABLE IF REQUIRED

SL8000 KIT 5 PIECES		6.55
SLC5/7 KIT 6 PIECES		4.45
SLC6 KIT 6 PIECES		6.20
TC Gen.	3-434-110-00	0.94
TAKE UP BELT TC Gen.	3-472-332-00	0.94
BELT DRIVE TC Gen	3-498-114-00	0.94
BELT MIDWAY TC 161SD	3-531-646-00	0.94
BELT CAPSTAN TC 92	3-536-447-01	0.94
CAPSTAN TC 135/136SD	3-542-458-00	0.94
BELT FLAT TC 186SD	3-543-978-00	0.94
BELT CAPSTAN TC Gen.	3-558-706-00	0.94
BELT CAPS. HST-300	3-564-319-00	0.94
T/UP BELT HMK-3000	3-573-122-00	0.94
BELT HMK3000	3-573-153-01	0.94
HMK 70 & UNIV. T/TABLE	4-827-489-XX	2.76

SWITCHES & RELAYS

RELAY SLC7	1-515-416-00	3.75
RELAY	1-515-418-00	3.75
RELAY TC-K55	1-515-547-11	3.75
CHANNEL KV1340/1820	1-516-847-00	15.75
PUSH SW SL8000	1-552-438-00	1.40
POWER SWITCH	1-554-965-11	3.95
SLIDE SW REC SL8000	1-552-834-00	0.94
SLIDE SW R/P SL8000	1-552-836-00	1.40
SW POWER KV Gen.	1-554-820-11	3.95
SW PUSH KV 1612	1-554-966-11	3.95
SW PB POWER KV 2060	1-554-967-11	3.20

REMOTE CONTROLS

RM 604B KV 1612	A-100-902-8A	35.20
RM 606 KV 2704	A-100-904-1A	42.60
RM 603B KV 2206	A-100-904-2A	50.50
RM 609 KV 1612 (MK2)	A-100-905-7A	35.20
RM 615	A-100-909-4A	42.60
RM 620 KV 2200	A-147-026-1A	30.50
RM 632 KV 2252	A-147-064-0A	30.50
RMT 200 SLC7	A-670-107-1A	42.60
RM 75T SLC5/T7	A-670-110-2A	19.40
RM 616	A-670-123-2A	42.60
RM 72 SLC6	1-463-424-00	17.40

GENERAL COMPONENTS

CAP 33mF 160v KV	1-123-024-11	0.94
CAP 22mF 400v KV	1-123-032-11	0.94
CAP 0.018mF 1.5v KV	1.129-952-11	1.38
TRAP 6MHz	1-409-333-00	0.94
TELE. AERIAL KV1400	1-501-178-00	6.30
FILTER 6Mhz	1-527-262-11	0.94
TERMINAL ANTENNA	1-536-683-11	7.30
STYLUS ND 143G	1-549-114-00	9.75
REC/PLAY HEAD	8-825-710-00	17.60
R/P HEAD PP128-3602C	8-829-236-XX	13.50
R/P HEAD 181-3602D	8-829-373-40	4.10
MOTOR DNF-1001B	8-835-006-00	17.40
MOTOR DNE-4100A	8-835-049-01	13.65
VID. TEST TAPE KR52H	8-969-995-52	32.20
CARTRIDGE XL 150	A-450-506-9A	17.40
STYLUS ND 150G	A-458-706-2A	7.90
PINCH ROLLER TC Gen.	X-348-930-60	0.94
P. ROLLER TC 204SD	X-354-241-30	1.40
MOTOR KIT MT-Gen.	X-354-931-41	13.50
PINCH RDLLER	X-355-862-00	0.94
PINCH ROLLER TCK 55	X-356-400-60	0.94
CAS. HOLD. ASSY. TCK44	X-357-350-91	1.40
BEARING ASSY. HMP70	X-482-740-81	3.10

TELE-PART

Telegen-1

PRICE £18.35 (Inc. VAT)
* *EXCEPTIONALLY LIGHT AND DURABLE*
* *POCKET SIZE FOR OUTSIDE SERVICE*
* *PP3 BATTERY POWER SOURCE*
* *FIVE DIFFERENT TEST PATTERNS FOR COLOUR & MONO TV*
* *CROSSHATCH GRID* * *DOT MATRIX*
* *WHITE RASTER*
* *HORIZONTALS* * *VERTICLES*
* *3.5mm JACK SOCKET FOR OPTIONAL P.S.U.*

A lightweight, extremely portable and versatile pattern generator for black/white and colour T.V. alignment and service at the customer's home. At the turn of a switch, the generator can provide five essential test patterns for correct installation, fast checks and repairs. Pattern stability is first class and compares favourably with other more costly bulky generators only suitable for bench work. The generator is pocket size measuring 10 × 7.5 × 4 cm and weighs only 190 grams. Switched 3.5 mm jack socket allows use of external power supply with battery in situ.

Telegen-2

PRICE £34.45 (Inc. VAT)
* *EXCEPTIONALLY LIGHT & DURABLE*
* *COMPACT 10 × 12 × 4.5 cms*
* *RED RASTER* * *GREEN RASTER*
* *BLUE RASTER*
* *COLOUR BARS*
* *3.5 mm JACK SOCKET FOR P.S.U.*
* *PROVIDES UHF SIGNAL APPROX. CHANNEL 35*

Telegen 2 is a colour bar generator at a very modest price and yet is extremely effective, stable and durable. It is the perfect compliment to Telegen 1, giving colour bars arranged in the following sequence: white, yellow, cyan, green, magenta, red, blue and black. The unit provides a signal in the UHF band approx. Channel 35 and requires a supply of 14 to 18 volts D.C.

Power Supply

A switchable power supply ideally suited to both Telegen 1 and Telegen 2.
PRICE £4.55 (Inc. VAT)
ALL ITEMS POST AND PACKING £1.44 (Inc. VAT)
All goods should be delivered within 4 working days.

32 TEMPLE STREET, WOLVERHAMPTON
WV2 4AN. TEL: (0902) 29022
(U.K. ONLY)

TV LINE OUTPUT TRANSFORMERS

FAST RETURN OF POST SERVICE

RANK BUSH MURPHY
A816 solid state mono 9.00
CROWN 14CX25 15.00

DECCA
MS1700 2001 2020 2401 mono 7.00
MS2404 2420 2424 mono 7.00
CS1730 1733 colour 9.00
CS1830 1835 colour 9.00
'30' series Bradford colour 9.00
80 series colour 8.00
100 series colour 8.00

FERGUSON HMV MARCONI
1600 8.00

G.E.C.
2047 to 2105 7.00
2000 to 2064 dual std mono 7.00

Indesit 20EGB 24EGB mono 8.00

KB - ITT
VC200 VC205 VC207 mono 8.00
CVC5 CVC7 CVC8 CVC9 col. 9.00
CVC20 series colour 8.00
CVC30 CVC32 series colour 8.00
CVC45 8.00
FT100 FT110 state p/no. 10.00
TXV80 10.00

PHILIPS
170 series dual std mono 8.00
210 300 series mono 8.00
G8 & G9 series colour 8.00

PYE 368, 169, 569, 769 mono 8.00
725-741 colour 8.00
REDIFFUSION Doric Mk.3 10.00

WINDINGS
Autovox 2282 2693 8.00

RANK BUSH MURPHY
A640, A793, A774 overwind 6.00
T20a T22, T26 Pri & Sec 6.00
Z718 primary state 18" or 22" 6.00
Z718 EHT overwind 8.00
SONY 1320UB overwind 15.00

SOVEREIGN FARA £15.00
14" colour overwind

ULTRA THORN
1690–1691 EHT overwind 7.00
Waltham 190 EHT overwind 6.00
1590 EHT overwind 6.00

PRICES INCLUDE P.P. & 15% VAT

All lopts and windings are new and guaranteed

Open Mon.-Fri. 9 to 5.30 pm
Delivery by return.

PAPWORTH TRANSFORMERS

80 Merton High Street,
London SW19 1BE

REWIND SERVICE
S.A.E. all enquiries
Barclaycard and Access welcome

For orders placed at the post office
Trans cash 506 4856

24 hour answering service
01-540 3955

SPECIAL OFFER THIS MONTH

PHILIPS YEARS AHEAD
THE CREDIT CARD CALCULATOR
SOLAR POWERED £6.00

NEW PHILIPS SBC 1833 Solar & Battery Powered Calculator	£10.00

NEW PANELS

G8 100K Pots on Panel & Lead for 6 Push Button Unit	£2.00
K30 Mains Switch remote	£1.00
K35 Mains Switch remote	75p
K35 Aerial Socket and Plug in Lead to Tuner	£1.50
KT3-K30 Slider Pots 4.7ku 47ku	20p each
LARGE Foucs Pots. Fits Pye, GEC, ITT, Decca	75p
G8 Power Supply Panel	£4.00
EX DECCA 100 Line O/P Panel	£7.00
EX DECCA 100 Decoder	£7.00
EX DECCA 100 Frame	£7.00
THORN 8000-8500-8800 Decoder	£6.00
GLASS BEADS Diodes 200v/1.2A	25 for £1.00
G11 IF Panel	£8.00
THORN 9600 Line Panel	£12.00
G11 Decoder Panel	£8.00
POWER SUPPLY 731	£6.00
G11 611 Condenser 470/250V ITT	£1.50
G9 Power Panel	£3.50
G8 Line Panel	£12.00
G8 6 Push Button	£9.00
KT4-KT3-K30 Handset Replacement	£8.00
HT520 METER 20.000 Fuse Diode Protector Logic Test Facility	£15.90
9000 SERIES Decoder 01 929 014 080 Thorn	£5.00
THORN TX remot panel. 51.C. ML923-SL490-MC14528B-MC14493P-SL470 & Main Trans	£5.00
20AX GEC LOPT Panel with Split Diode	£4.00
LOPT Split Diode 2432871	£7.00
RANK T20 Fouces Pot	75p
RANK 718 Foucs Pot	£1.00
THORN 9000 LOPT Panel	£12.00
26" LOPT Split Diode 2432301	£8.00
16" LOPT Split Diode 2433481	£6.00
Ex Panel Split Diodes 2432871/2432981	£5
HITACHI Mains Switch	50p
HITACHI AE Socket	30p
1 CONDENSER Axail Leads 450 A/C 1200 D/C	15p
MAINS TRANSFORMER 240v in/20v/8v	£1.00
GREEN FLAT, NEC, LED's	3p each 100 for £2
240V 50HZ	
12+12V 2.8VA Print 1"×1"	75p
8+8V 1 Amp Print	75p
HITACHI 6 x 4 – 8Ω Speaker	50p
ET596 UHF V/CAP Tuner, small	£2.50
FIDELITY Panels with I.C.	£1.00
FIDELITY LOPT Split Diode AT2076/80	£3.00
FIDELITY FBS 1245AE LOPT Mono	£1.00
FIDELITY Split Diode FCC2015BE	£5.00
HI-FI MICROPHONE N8501 Philip	£8.00
G8 TUNER V/CAP on Panel	£3.50
G8 SPEAKER	75p
9,000 SPEAKER	£1.00
5 AMP METERS, AC, DC	£2.00
THORN 9000 Sound OP Panel	£30p
ONE I.C K35 Decoder	£7.00
THICK FILM, Hitachi RB-32 4A	£2.00
K30 IF/K35 IF	£3.00
THICK FILM, Hitachi Frame	£5.00
THORN Lopt 8500-8800	£4.00
TX9 THORN Tuner Panel with ICS Pots	£3.00
N.E.C. Light Emitting Diodes	40p
Split Diode 2433752	£6.00
BY223 Replacement	30p
THORN CHASSIS 1600-1700 Series Mono	£10.00
THORN 1600 Rec- & Anode Cap	50p
KT3-K30 Slider Pots 4.7k	£1.00 for 10
ET-614 UHF V/CAP Tuner	£2.00
6 x 2¼ SPEAKER 5W Hitachi 8Ω	50p
K35 20 Turn Pots	6p each
HITACHI & GEC 20k Pots	20 for £1.00
KT3 K30 Speaker	30p
K35 Sound O/P Panel Plug in	£3.00
K35 12 way Push Button Unit	£1.50
K35 L.O.P.T. Split Diode	£6.00
RANK T20 Front Panel	£6.00
G8 6 Button Unit, New Type	£9.00
6 off LED DISPLAYS, Mixed	£1.00
HAND SET TESTER, Infra Red	£8.00
PHILIPS SBC 471 2 Way Stereo Headphone with Volume Controls	£17.00
AERIAL SPLITTER with filter	£1.00
DYNAMIC STEREO HEADPHONE EM 6146	£10.00
PHILIPS UNI DIRECTIONAL Dynamic Microphone	£10.00
20 TURN POTS with Band Switch	10p
PUSH BUTTON Mains Switch with Screw Holes Fixing	4 for £1
PYE 713 Line Trans	£4.50
PYE 731 Line Trans	£3.50
800v DIODES at 3 amps. Glass Beads	6p each, 20 for £1.00
G11 6 Touch Unit with Cable Forms (Drawer Unit)	£12.00
KT3 Line Output Transformer	£5.00

SENDZ COMPONENTS

63 BISHOPSTEIGNTON, SHOEBURYNESS, ESSEX SS3 8AF.
SAME DAY SERVICE

All items subject to availability. No Accounts: No Credit Cards. Postal Order/Cheque with order. Add 15% VAT, then £1 Postage. Add Postage for Overseas.
Callers: To shop at
212 LONDON ROAD, SOUTHEND. Tel. 0702-332992
Open 9-1/2.30-6. GVMT + school orders accepted on official headings. Add 10% handling charge.

★★ CHANGE OF ADDRESS ★★

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

TOP 50 VIDEO SPARES

CASSETTE LAMP (FERG/JVC)	£1.80	PINCH ROLLER (SANYO)	£7.95
CASSETTE LAMP (PANASONIC)	£1.80	PINCH ROLLER (SONY C5/C7)	£5.95
CASSETTE LAMP (SHARP, 9300 ETC)	£2.15	VIDEO HEAD DRUM (FERG)	£37.50
BELT KIT SONY (STATE MODEL)	£6.50	VIDEO HEAD DRUM (PANASONIC)	£39.50
BELT KIT FERGUSON (STATE MODEL)	£6.50	VIDEO HEAD DRUM (PAN NV366)	£56.95
BELT KIT SHARP (STATE MODEL)	£6.50	VIDEO HEAD DRUM (HITACHI)	£39.95
BELT KIT PANASONIC (STATE MODEL)	£6.50	VIDEO HEAD DISC (SONY C5/C6/C7)	£39.50
BELT KIT SANYO (9300, 5300, 5400)	£6.50	VIDEO HEAD DISC (SONY SL8000)	£44.50
BELT KIT SANYO (5000)	£1.99	VIDEO HEAD DISC (SANYO)	£49.90
BELT KIT HITACHI (STATE MODEL)	£6.50	VIDEO HEAD (SHARP 7300, 7700)	£66.40
REWIND KIT SONY C5/C7	£6.95	VIDEO HEAD (SHARP 9300, 381 ETC)	£49.90
REWIND KIT SONY C6	£6.95	VIDEO HEAD (TOSHIBA 9600)	£49.95
REEL IDLER (SHARP, 9300, 381, ETC)	£3.90	VIDEO HEAD (TOSHIBA 8600)	£56.95
FF/REW IDLER (HITACHI VT-11, ETC)	£6.50	REEL DRIVE PULLEY (SANYO 5000)	£8.88
FF/REW IDLER (HITACHI VT8000)	£4.72	REEL MOTOR (SANYO 5000 ETC)	£14.20
FF/REW IDLER (HITACHI VT9300)	£4.75	REEL MOTOR (SHARP 9300, 381, ETC)	£15.30
REEL IDLER (FERG, 3V29/30)	£3.45	CAPSTAN MOTOR (SONY C5/C7)	£39.85
PLAY IDLER (HITACHI 9300)	£6.50	A.C.E. HEAD (SONY C5/C7)	£26.45
FF/REW IDLER (NAT/PAN NV370)	£4.50	CAPSTAN MOTOR FERG/JVC 3V22 ETC	£36.45
REEL IDLER (NAT/PAN) STATE MODEL	£3.45	DRUM MOTOR FERG/JVC 3V22 ETC	£36.60
PLAY IDLER (NAT/PAN) STATE MODEL	£4.72	TAKE-UP CLUTCH (FERG/JVC)	£6.95
PLAY CLUTCH (PAN NV7000)	£5.50	CLUTCH ASSY (FERG 3V29/30)	£4.50
PINCH ROLLER (FERG)	£5.95	AUDIO RELAY (SONY C5/C7)	£3.95
PINCH ROLLER (SHARP)	£7.90	HEAD CLEANING STICKS	£0.50
PINCH ROLLER (PANASONIC)	£5.95	HEAD CLEANING FLUID	£1.50

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

TELEVIDEO SERVICES

NOTTINGHAM (0602) 226070
145 STATION RD, BEESTON, NOTTINGHAM.

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

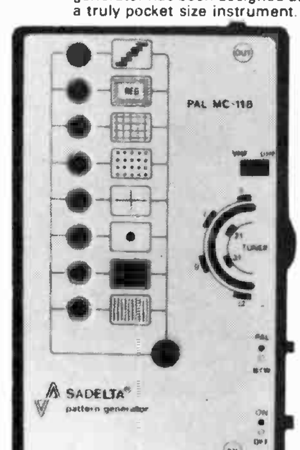
ALL STOCK ITEMS ARE DESPATCHED BY RETURN OF POST

Send 2 × 17p stamps for full list

SADELTA

TV COLOUR PATTERN GENERATOR MODEL PAL MC 11B UK

THE SADELTA TV HAND HELD COLOUR PATTERN GENERATOR is intended for use in production, installation and service of both colour and monochrome TV sets. In order to control and adjust the various parameters of the colour TV, eight switchable patterns are provided. The technician has ready access to laboratory workshop and field use as the generator has been designed using the latest micro technology to achieve a truly pocket size instrument.



FEATURES

- PAL System I
- Eight switchable patterns:— colour bar, grey scale, red, crosshatch, dots, centre cross, centre dot, white and vertical lines.
- Sound output.
- Band IV (21-34) Band III (5-12)
- Output 10mV into 75 Ohms.
- Internal rechargeable Ni-Cd battery.
- Supplied with soft carry case and 9 volt power supply/charger.
- Pocket size 131 × 81 × 23mm.
- Weight only 250 gms.

PRICE £124.95 + £18.74 VAT

Also available to special order SECAM, Video Composite, and R.G.B. versions. Details available upon request.

U.K. POST PAID, export enquiries welcome, Visa/Access or cheque with order, payable to B.K. Electronics. Official orders welcome from Govt. Depts., Colleges, P.L.C.s etc. Large S.A.E. for technical leaflets of complete range delivery normally within 7 days.

B. K. ELECTRONICS Dept. 'T'

UNIT 5, COMET WAY, SOUTHEND-ON-SEA, ESSEX. SS2 6TR TEL: 0702-527572

AA117	9p
AA119	9p
AAY32	9p
AC107	28p
AC126	17p
AC127	15p
AC128	15p
AC128K	23p
AC141K	30p
AC142K	30p
AC153K	23p
AC176	18p
AC176K	20p
AC187	15p
AC187K	20p
AC188	17p
AC188K	23p
ACY18	48p
ACY19	48p
AD142	60p
AD149	45p
AD161	22p
AD162	22p
AF124	25p
AF125	25p
AF126	25p
AF127	25p
AF139	22p
AF239	22p
AL112	70p
AL113	80p
ASZ15	100p
ASZ17	100p
AU110	110p
AY102	180p
AY106	180p
BA145	10p
BA148	10p
BA154	6p
BA157	12p
BB101	13p
BB103	16p
BB105B	18p
BB205B	24p
BC107	7p
BC108	7p
BC109	7p
BC115	10p
BC118	11p
BC140	19p
BC141	19p
BC142	19p
BC143	19p
BC147	6p
BC148	6p
BC149	6p
BC157	6p
BC159	6p
BC182	6p
BC182L	6p
BC183	6p
BC183L	6p
BC184	6p
BC184L	6p
BC212	6p
BC212L	6p
BC213	6p
BC213L	8p
BC214	6p
BC214L	6p
BC237	7p
BC238	7p
BC300	16p
BC301	18p
BC302	18p
BC303	16p
BC327	8p
BC328	6p

BC337	6p
BC338	6p
BC557	6p
BCY32	150p
BCY33	150p
BCY34	150p
BCY42	20p
BCY56	16p
BCY70	16p
BCY71	16p
BCY72	16p
BD115	26p
BD124P	50p
BD124	110p
BD128	35p
BD131	25p
BD132	25p
BD135	20p
BD136	20p
BD137	20p
BD138	20p
BD139	20p
BD140	20p
BD144	90p
BD150	30p
BD157	38p
BD158	38p
BD166	30p
BD175	30p
BD177	30p
BD179	32p
BD181	45p
BD182	60p
BD183	60p
BD187	30p
BD201	33p
BD202	38p
BD203	42p
BD204	42p
BD222	31p
BD225	31p
BD232	31p
BD234	32p
BD235	28p
BD236	30p
BD237	21p
BD238	24p
BD244	50p
BD245	50p
BD433	28p
BD434	30p
BD435	31p
BD437	28p
BD438	36p
BD439	40p
BD440	40p
BD441	40p
BD442	40p
BD533	50p
BD534	36p
BD535	38p
BD536	38p
BD537	40p
BD538	40p
BD675	40p
BD676	40p
BD677	38p
BD678	40p
BD679	40p
BD680	40p
BD681	45p
BD682	45p
BDX32	100p
BDX65	80p
BDY92	100p
BF180	16p
BF181	18p
BF183	20p

BF184	20p
BF185	20p
BF194	5p
BF195	5p
BF196	6p
BF197	7p
BF198	7p
BF199	6p
BF200	16p
BF240	16p
BF241	10p
BF255	12p
BF256	18p
BF257	18p
BF258	18p
BF259	18p
BF262	25p
BF263	25p
BF270	18p
BF273	15p
BF311	21p
BF324	25p
BF336	20p
BF337	20p
BF338	20p
BF355	28p
BF362	30p
BF367	13p
BF371	17p
BF414	18p
BF420	16p
BF421	18p
BF422	21p
BF423	15p
BF440	16p
BF451	17p
BF455	14p
BF458	19p
BF459	19p
BF461	60p
BF462	62p
BF469	30p
BF470	28p
BF471	28p
BF479	30p
BF493	18p
BF494	16p
BF595	16p
BF596	16p
BF597	10p
BF615	30p
BF758	41p
BF869	22p
BF870	22p
BF872	23p
BF960	38p
BF963	40p
BF964	38p
BF966	40p
BFR40	26p
BFR51	21p
BFR62	21p
BFR79	26p
BFR90	62p
BFR91	99p
BFX29	20p
BFX84	20p
BFX85	20p
BFX87	15p
BFX88	15p
BFX89	60p
BFY17	30p
BFY18	40p
BFY41	28p
BFY50	14p
BFY51	14p
BFY52	14p
BFY56	25p

BFY57	25p
BFY64	25p
BFY90	45p
BLY48	85p
BLY49	85p
BR100	14p
BR101	43p
BR103	37p
BSX20	15p
BSX26	18p
BSX29	19p
BT106	90p
BT109	90p
BT116	80p
BT119	100p
BT120	100p
BU100A	110p
BU104	100p
BU105	80p
BU108	100p
BU110	110p
BU111	140p
BU124	60p
BU126	70p
BU204	75p
BU205	70p
BU208	75p
BU208A	80p
BU208D	100p
BU325	55p
BU326	85p
BU406	85p
BU406D	95p
BU407	75p
BU407D	95p
BU408	85p
BU408D	95p
BU409	95p
BU426	120p
BU500	110p
BU526	80p
BU801	95p
BU806	120p
BU807	95p
C106D	23p
MJ2500	100p
MJ2501	110p
MJ2955	65p
MJ3000	115p
MJ3001	115p
MJE29A	30p
MJE30A	30p
MJE340	25p
MJE350	80p
MJE520	30p
MJE2955K	90p
OC28	100p
OC29	80p
OC35	100p
OC36	120p
OC45	50p
OC71	30p
OC72	50p
OC200	180p
R2008B	100p
R2010B	100p
TAG4443	76p
TAG4444	76p
TIP29	15p
TIP29A	22p
TIP29C	25p
TIP30	25p
TIP30C	30p
TIP31A	24p
TIP31C	30p
TIP32	24p

TIP32A	24p
TIP32C	28p
TIP33	50p
TIP34	50p
TIP41A	22p
TIP41C	25p
TIP42A	22p
TIP42C	25p
TIP47	40p
TIP48	40p
TIP50	60p
TIP51	120p
TIP52	120p
TIP53	120p
TIP54	140p
TIP105	65p
TIP106	65p
TIP107	65p
TIP110	47p
TIP111	50p
TIP112	40p
TIP115	45p
TIP116	45p
TIP117	50p
TIP120	43p
TIP121	46p
TIP122	47p
TIP125	47p
TIP126	56p
TIP127	56p
TIP141	90p
TIP142	90p
TIP145	65p
TIP146	90p
TIP147	100p
TIP2955	42p
TIP3054	45p
TIP3055	42p
TIS43	45p
TIS44	40p
TIS61	15p
TIS88A	45p
TIS90	15p
TIS91	18p
TIS93	20p
VK1010	88p
VN.10KM	60p
VN.46AF	88p
VN.66AF	100p
VN.88AF	115p
VN.89AF	110p
ZTX107	11p
ZTX108	11p
ZTX109	12p
ZTX212	27p
ZTX300	13p
ZTX301	16p
ZTX302	16p
ZTX303	24p
ZTX304	17p
ZTX320	29p
ZTX326	29p
ZTX500	13p
ZTX501	13p
ZTX502	18p
ZTX503	18p
ZTX504	25p
ZTX550	24p
2N.696	26p
2N.697	22p
2N.698	40p
2N.699	45p
2N.706A	22p
2N.708	22p
2N.914	28p
2N.918	36p
2N.930	18p

2N.1131	28p
2N.1132	28p
2N.1613	24p
2N.1711	24p
2N.2102	50p
2N.2160	300p
2N.2218A	24p
2N.2219	24p
2N.2221	23p
2N.2222	23p
2N.2369	15p
2N.2484	20p
2N.2646	40p
2N.2904	20p
2N.2905	20p
2N.2906	18p
2N.2907	18p
2N.2926	8p
2N.3019	28p
2N.3053	18p
2N.3054	35p
2N.3055	35p
2N.3055H	50p
2N.3440	58p
2N.3442	85p
2N.3702	9p
2N.3703	9p
2N.3704	9p
2N.3705	9p
2N.3706	9p
2N.3707	9p
2N.3708	9p
2N.3771	85p
2N.3772	90p
2N.3773	100p
2N.3819	29p
2N.3866	68p
2N.3903	11p
2N.3904	11p
2N.3905	11p
2N.3906	11p
2N.4031	25p
2N.4036	25p
2N.4037	25p
2N.4058	13p
2N.4443	76p
2N.4444	78p
2N.5061	20p
2N.5294	30p
2N.5296	30p
2N.6106	40p
2N.6107	40p
2N.6109	40p
3N.128	55p
3N.143	65p
DIODES	
AA119	9p
BY100	40p
BY103	32p
BY126	6p
BY127	8p
BY133	8p
BY164	40p
BY176	85p
BY179	35p
BY182	32p
BY184	32p
BY187	32p
BY196	20p
BY206	11p
BY207	11p
BY208	18p
BY210	22p
BY223	72p
BY225	120p
BY226	18p
BY227	19p
BY228	32p

BY296	20p
BY298	26p
BY299	28p
BY476	90p
BYX10	15p
BYX55/350	30p
BYX55/600	30p
BYX55/800	32p
BYX70/300	29p
BYX70/500	32p
BYX70/800	36p
BYX71/600	80p
OA47	8p
OA90	4p
OA91	4p
OA200	7p
OA202	7p
IN.914	2p
IN.4001	4p
IN.4002	4p
IN.4003	4p
IN.4004	4p
IN.4005	4p
IN.4006	4p
IN.4007	5p
IN.4148	2p
IN.5400	9p
IN.5401	10p
IN.5402	10p
IN.5403	11p
IN.5404	11p
IN.5405	12p
IN.5406	13p
IN.5407	13p
IN.5408	13p
ZENERS	
400MV BYZ88 Range 2V7 to 39V	6p
1.3W Zeners BZX61 Range 2V7 to 39V	12p
JAPANESE TRANSISTORS	
2SB324	55p
2SB507	68p
2SB754	80p
2SC495	60p
2SC1060	99p
2SC1061	200p
2SC1096	78p
2SC1161	110p
2SC1172	150p
2SC1306	90p
2SC1307	100p
2SC1678	120p
2SC1969	130p
2SC2028	75p
2SC2029	120p
2SC2078	120p
LOW PROFILE SOCKETS	
8pin	6p
14pin	8p
16pin	9p
18pin	12p
20pin	14p
22pin	16p
24pin	18p
28pin	20p
40pin	25p
VOLTAGE REGULATORS	
7805	35p
7812	35p
7815	35p

7818	35p
7824	35p
7905	35p
7912	40p
7915	40p
7918	40p
7924	40p
78L05	28p
78L12	28p
78L15	28p
78L18	28p
78L24	28p
79L05	40p
79L12	45p
79L15	48p
LM309K	100p
LM317K	220p
LM317T	180p
LM323K	420p
LM723	32p
78HGKC	570p
78HO5KC	520p
78GU1C	190p
79GU1C	215p
79HGKC	670p
VALVES	
DAF96	60p
DF96	50p
DL92	47p
DY86	50p
DY87	50p
DY802	45p
EABC80	50p
E891	44p
EBF80	45p
EBF89	50p
ECC82	40p
ECC83	43p
ECC84	40p
ECC85	40p
ECH81	49p
ECH84	52p
ECL80	57p
ECL82	59p
ECL84	57p
ECL85	57p
ECL86	49p
EF80	31p
EF85	34p
EF89	43p
EF183	45p
EF184	53p
EL34	190p
EL36	60p
EL84	50p
EL95	50p
EL500	80p
EL504	100p
EY86	31p
EY87	31p
EY88	42p
EZ35	45p
EZ80	50p
EZ81	55p
GZ34	180p
PC97	100p
PCC85	42p
PCF80	58p
PCF200	135p
PCF801	110p
PCF802	57p
PCF806	115p
PCH200	100p
PCL81	54p
PCL82	63p
PCL84	50p
PCL85	55p
PCL86	55p

PCL805	55p
PFL200	85p
PL36	80p
PL82	45p
PL83	32p
PL84	50p
PL95	140p
PL500	110p
PL504	95p
PL508	170p
PL519	450p
PY81	70p
PY88	48p
PY500A	160p
LINEAR IC'S	
AN-214P	200p
AN-240P	150p
AN-360	120p
AN-7110	140p
AN-7114	160p
AN-7115	160p
AN-7120	140p
AY3-1270	680p
AY3-1350	300p
AY3-8910	360p
AY3-8912	400p
AY5-3600	570p
CA270	40p
CA3046	60p
CA3048	190p
CA3060	280p
CA3080E	70p
CA3086	55p
CA3089E	150p
CA3090AQ	300p
CA3130E	80p
CA3130S	100p
CA3140E	38p
CA3189E	250p
CA3240E	90p
HA-1156W	110p
HA-1197	150p
HA-1306W	170p
HA-1319	250p
HA-1339	170p
HA-1342	170p
HA-1366WR	160p
HA-1368	160p
HA-1377	220p
HA-1389	140p
HA-1392	230p
HA-1397	250p
HA-1398	240p
LA-1201	85p
LA-1352	120p
LA-1365	140p
LA-3301	120p
LA-3350	120p
LA-3361	115p
LA-4030	200p
LA-4031	140p
LA-4032	140p
LA-4050	130p
LA-4051	160p
LA-4100	120p
LA-4101	100p
LA-4102SK	140p
LA-4112	250p
LA-4125	210p
LA-4140	70p
LA-4201	120p
LA-4220	120p
LA-4400	190p
LA-4420	140p
LA-4422	130p
LA-4430	130p
LA-4460	170p

LA-4461	180p
LA-5112	120p
LM301	26p
LM311	35p
LM324	35p
LM325	45p
LM339	40p
LM348	60p
LM380	100p
LM381	150p
LM382	130p
LM387	100p
LM709DIL	30p
LM723	40p
LM741DIL	18p
LM741 MET	45p
LM747	58p
LM748	35p
LM1458	33p
LM3900	30p
M-51513L	180p
M-51515BL	270p
M-51516	280p
M-51517L	280p
MB3712	150p
MB3730	260p
MB3756	260p
MC1327	70p
NE555	20p
NE556	40p
SAS560	110p
SAS570	110p
SN76003N	140p
SN76013N	140p
SN76023N	140p
SN76033N	150p
SN76110N	70p
SN76115	70p
T2800D	52p
TA-7120	55p
TA-7137P	83p
TA-7146P	400p
TA-7193P	400p
TA-7200	200p
TA-7201	200p
TA-7203	180p
TA-7204	110p
TA-7205	80p
TA-7210	200p
TA-72222AP	120p
TA-7310P	100p
TA-7609	270p
TAA550	16p
TBA120S	45p
TBA395	60p
TBA396	60p
TBA520	100p
TBA530	100p
TBA540	100p

TBA560	100p
TBA750	100p
TBA800	35p
TBA810S	60p
TBA820	75p
TBA920	100p
TBA950	100p
TBA990	100p
TCA270	40p
TCA800	200p
TCA940	100p
TDA1170	100p
TDA1412	60p
TDA2002	80p
TDA2003	150p
TDA2020	140p
TDA2030	140p
TDA2522	90p
TDA2530	100p
TDA2532	100p
TDA2540	100p
TDA2560	100p
TDA2593	100p
TDA2690	100p
UPC-555H	60p
UPC-556H	80p
UPC-575C2	100p
UPC-577H	64p
UPC-592H2	95p
UPC-1001H	220p
UPC-1025H	230p
UPC-1026C	105p
UPC-1028H	90p
UPC-1031H2	180p
UPC-1032H	70p
UPC-1155	200p
UPC-1156H	140p
UPC-1181H	115p
UPC-1182H	150p
UPC-1185H2	250p
UPC-1350C	150p
74LS SERIES	
74LS00	17p
74LS01	17p
74LS02	17p
74LS03	17p
74LS04	17p
74LS05	17p
74LS08	17p
74LS09	17p
74LS10	17p
74S11	17p
74S12	17p
74S13	26p
74S14	30p
74S15	17p
74LS20	17p
74LS21	17p

74LS22	17p
74LS24	38p
74LS26	17p
74LS27	17p
74LS28	17p
74LS30	17p
74LS32	17p
74LS33	17p
74LS37	17p
74LS38	17p
74LS40	17p
74LS42	39p
74LS47	70p
74LS48	60p
74LS51	17p
74LS54	17p
74LS55	17p
74LS73	28p
74LS74	26p
74LS75	32p
74LS76	28p
74LS78	34p
74LS83	46p
74LS85	50p
74LS86	30p
74LS90	39p
74LS91	75p
74LS92	46p
74LS93	40p
74LS95	52p
74LS96	63p
74LS107	35p
74LS109	36p
74LS112	38p
74LS113	32p
74LS114	38p
74LS122	44p
74LS123	50p
74LS124	85p
74LS125	36p
74LS126	42p
74LS132	44p
74LS133	34p
74LS136	35p
74LS138	38p
74LS139	40p
74LS145	63p
74LS147	120p
74LS148	110p
74LS151	38p
74LS153	42p
74LS154	100p
74LS155	51p
74LS156	49p
74LS157	35p
74LS158	47p
74LS160	52p
74LS161	56p
74LS162	50p
74LS163	50p

PLEASE PHONE US FOR TYPE NOT LISTD HERE AS WE ARE HOLDING 3000 ITEMS AND QUOTATIONS ARE GIVEN FOR LARGE QUANTITIES.

Please send 50p P&P and VAt at 15%. Govt, Colleges, etc. Orders accepted. Quotations given for large quantities. Please allow 7 days for delivery. All brand new Components. All valves are new and boxed.

GRANDATA LTD

9 THE BROADWAY, PRESTON ROAD, WEMBLEY, MIDDLESEX, ENGLAND

Telephone: 01-904 2093 & 904-1115/6

Telex No: 932 885 (Sunmit)

MANTEL

No 1 for Quality TVs & Videos 100s of V.H.S. Videos in stock

Large Quantities of Late Model Thorn TVs. All with first class cabinets.

TELE-TEXT/ULTRASONIC/INFRARED/REMOTES

All at UNBEATABLE PRICES for QUANTITY & QUALITY

Also Philips G11/Pye G11/Basic/Remote/TELE-TEXT

Some examples of QUALITY working TVs

THORN 8800 ★★★★★★★★★★★★★★★★★★★★★★★★£25
THORN 8800 **(remote)** ★★★★★★★★★★★★★★★★★★★£30
THORN 9000 ★★★★★★★★★★★★★★★★★★★★★★★★£30
THORN 9000 **(remote)** ★★★★★★★★★★★★★★★★★★★£35
THORN 9600 ★★★★★★★★★★★★★★★★★★★★★★★★£40
THORN 9600 **(full feature remote)** ★★★★★★★★★★★£45

THORN 9600 TELETEXT ★★★★★★★★★★★★★ **from £75**
(VARIOUS MODELS)
THORN 9900 ★★★★★★★★★★★★★★★★★★★★★★★★£50
THORN 9900 **f/f remote** ★★★★★★★★★★★★★★★★★£60

PHILIPS G11 ★★★★★★★★★★★★★★★★★★★★★★★★£55

(prices quoted are based on quantity)

NO DEALER TOO LARGE OR SMALL. SINGLES SOLD

Brand New Remote Control Hand Sets Available for the majority of British & European TV sets.

1000s of UNTESTED Colour TVs

I.E. DECCA 30s, GEC 2110, GRUNDIG, TANBERGS, G8s 520s-550s, Thorn 3500/8000/8500, TT, PYE, ETC.

(Many of these untested TVs just switch on)

ALL AT LOW LOW PRICES

VAN LOADS DELIVERED DIRECT FROM SOURCE RING FOR QUOTE

New TV Trolly Stands **£4.95** Also Video Stands **POA**

Colour TV panels & tubes available

All prices subject to V.A.T. *CALLERS WELCOME*

Export Orders Welcome for those Countries using the P.A.L. System

419 BARLOW MOOR ROAD, CHORLTON, MANCHESTER M21 2ER.

TEL: 061-861 8501

AN127Q	£1.75
AN203	£2.20
AN210	£1.75
AN211A	£2.25
AN214Q	£1.80
AN217B	£2.20
AN228W	£2.75
AN236	£2.50
AN239Q	£3.80
AN240P	£1.50
AN241P	£1.50
AN247P	£2.50
AN259	£2.75
AN262	£1.50
AN271A	£2.50
AN274	£2.50
AN295	£3.25
AN303	£2.50
AN313U	£2.75
AN315	£2.00
AN316	£3.50
AN318	£4.75
AN331	£2.75
AN360	£1.20
AN362L	£1.30
AN366P	£1.50
AN610P	£1.75
AN612	£1.75
AN5722	£1.50
AN5730	£1.85
AN5732	£1.85
AN5753	£1.95
AN6250	£2.30
AN6344	£4.75
AN7105	£2.20
AN7110	£1.40
AN7114E	£1.60
AN7115E	£1.60
AN7120	£1.40
AN7130	£1.50
AN7145M	£1.80
AN7146M	£1.85
AN7154	£1.75
AN7156N	£2.40
AN7158N	£3.25
AN7168	£2.50
AN7310	£0.80
AN7311	£1.00
BA301	£0.75
BA311	£0.95
BA313	£0.75
BA318	£1.30
BA402	£0.75
BA511A	£1.80
BA514	£1.75
BA521	£1.75
BA527	£1.50
BA532	£1.50
BA536	£2.25
BA612	£1.80
BA1310	£1.75
BA1320	£1.25
BA1330	£1.75
BA6304	£2.20
CX0642	£8.50
CX065B	£2.50
CX075B	£2.20
CX095C	£2.80
CX100D	£5.75
CX101G	£7.50
CX130	£4.50

CX136	£5.50
CX143A	£7.50
CX157	£3.95
CX158	£3.50
CX160	£2.50
CX161A	£2.50
CX162	£3.40
CX170	£6.50
CX181	£8.50
HA1124A	£2.75
HA1125	£1.50
HA1137	£1.75
HA1149	£1.40
HA1151	£2.50
HA1156	£1.10
HA1166	£1.60
HA1196	£3.75
HA1197	£1.50
HA1199	£1.40
HA1306W	£1.60
HA1319	£2.00
HA1339A	£1.60
HA1366W	£1.50
HA1366WR	£1.50
HA1367	£3.25
HA1368	£1.60
HA1368R	£1.65
HA1370	£2.75
HA1374	£2.50
HA1377A	£2.20
HA1388	£2.35
HA1389	£1.75
HA1389R	£1.40
HA1392	£2.30
HA1394	£2.75
HA1397	£2.50
HA1398	£2.40
HA1457W	£0.90
HA11215A	£4.25
HA11221	£2.30
HA11223W	£3.80
HA11225	£1.95
HA11235	£2.00
HA11423	£4.75
HA11701	£4.50
HA11702	£4.90
HA11703	£4.50
HA11704	£4.75
HA11705	£6.50
HA11706	£4.75
HA11710	£5.50
HA11711	£9.50
HA11713	£6.00
HA11714	£5.75
HA11715	£6.25
HA11716	£6.25
HA11717	£6.25
HA11718	£4.75
HA11724	£18.25
HA11725	£16.00
HA11726	£15.00
HA11727	£9.50
HA11736	£16.00
HA11745	£9.00
HA11747	£9.50
HA11747ANT	£9.50
HA11749	£4.50
HA11750	£5.00
HA11753NT	£8.50
HA11758NT	£8.50

HA11768	£4.50
HA11788	£4.50
HA11816NT	£6.50
HA11828NT	£9.50
HA12035	£9.50
HA12413	£2.50
HA13402	£3.50
HA13403	£7.50
HA13430A	£3.50
LA1111P	£0.80
LA1201	£0.85
LA1222	£0.80
LA1230	£1.50
LA1240	£1.75
LA1320	£1.50
LA1365	£1.20
LA1368	£2.20
LA1460	£1.95
LA2200	£1.75
LA3101	£1.60
LA3155	£0.95
LA3160	£0.90
LA3201	£0.95
LA3300	£1.40
LA3301	£1.20
LA3350	£1.20
LA3361	£1.20
LA4030P	£2.00
LA4031P	£1.40
LA4032P	£1.40
LA4051P	£1.50
LA4100	£1.00
LA4101	£1.00
LA4102	£1.20
LA4110	£1.40
LA4112	£1.30
LA4120	£2.50
LA4125	£2.00
LA4140	£0.70
LA4182	£2.00
LA4192	£1.95
LA4200	£1.50
LA4220	£1.20
LA4230	£1.75
LA4400	£1.90
LA4420	£1.40
LA4422	£1.20
LA4430	£1.30
LA4440	£2.20
LA4460	£1.75
LA4461	£1.75
LA4500	£2.50
LA4505	£2.50
LA6458	£0.90
LA7800	£1.95
LA7806	£2.50
LC7120	£3.50
LC7130	£3.50
LC7131	£3.75
LC7136	£2.75
LC7137	£2.75
M5106P	£2.25
M5115P	£3.50
M5134P	£2.75
M5135P	£2.30
M5155	£1.50
M51513L	£1.50
M51514AL	£1.75
M51515BL	£2.50
M51516L	£2.50
M51517L	£2.50
M51518L	£1.75

M51521AL	£1.75
M54543L	£2.75
M54548L	£6.75
MB3705	£1.60
MB3712	£1.50
MB3730	£1.75
MB3731	£2.50
MB3756	£2.60
MB8719	£3.50
PLL01A	£2.30
PLL03A	£4.95
SI-1125H	£7.50
STK011	£3.75
STK013	£6.25
STK014	£6.25
STK015	£5.00
STK016	£4.75
STK020	£4.50
STK022	£5.25
STK025	£6.75
STK041	£6.50
STK077	£5.95
STK078	£5.50
STK080	£7.20
STK082	£7.75
STK0B6	£9.25
STK430	£4.75
STK433	£4.50
STK435	£5.00
STK436	£5.00
STK437	£6.30
STK439	£5.50
STK441	£6.00
STK443	£6.95
STK457	£5.50
STK459	£5.75
STK460	£7.50
STK461	£6.50
STK463	£7,40
STK465	£8.50
STK0025	£4.95
STK0029	£4.35
STK0039	£4.25
STK0040	£5.50
STK0049	£5.75
STK0059	£6.00
STK0080	£6.50
STK2028	£6.50
STK2029	£3.75
STK2230	£6.00
STK2240	£9.75
STK3042	£6.50
STK5211	£6.75
STK5421	£6.50
STK5451	£6.75
STK5720	£6.80
STK5730	£6.75
TA7050P	£0.80
TA7051P	£0.80
TA7054	£1.70
TA7063	£0.80
TA7066	£1.50
TA7070P	£1.40
TA7073	£2.25
TA7074P	£1.95
TA7104P	£1.35
TA7108	£1.50
TA7109	£2.30
TA7119	£1.75
TA7120P	£0.50

TA7130P	£1.00
TA7136P	£1.00
TA7137P	£0.80
TA7139P	£1.50
TA7145P	£1.80
TA7150P	£1.80
TA7176P	£1.50
TA7193P	£3.50
TA7200	£2.00
TA7201	£2.00
TA7202P	£2.00
TA7203P	£1.80
TA7204P	£1.10
TA7205AP	£1.00
TA7207P	£1.50
TA7208P	£1.50
TA7210P	£2.00
TA7214P	£2.50
TA7215P	£1.80
TA7217AP	£1.20
TA7220P	£1.75
TA7222AP	£1.20
TA7223P	£1.95
TA7224P	£2.75
TA7225P	£2.50
TA7226P	£2.20
TA7227P	£1.50
TA7229P	£3.00
TA7230P	£1.75
TA7232P	£2.75
TA7310P	£1.40
TA7312P	£1.30
TA7313AP	£1.30
TA7315AP	£1.75
TA7325P	£0.85
TA7328	£1.60
TA7607AP	£2.75
TA7608	£3.50
TA7609P	£2.30
TA7611	£2.75
TA7658P	£1.50
UHIC001	£4.80
UHIC004	£4.80
UPC16C	£1.30
UPC20C	£2.20
UPC30C	£1.80
UPC41C	£2.00
UPC554C	£1.25
UPC555	£0.60
UPC561C	£2.00
UPC566H	£0.60
UPC571	£1.95
UPC573C	£2.20
UPC574J	£0.35
UPC575C	£1.00
UPC576H	£1.75
UPC577	£0.70
UPC580	£2.75
UPC585C	£0.95
UPC592	£0.95
UPC595C	£1.70
UPC596	£1.50
UPC1001H	£2.00
UPC1009C	£1.20
UPC1017G	£1.30
UPC1018C	£0.95
UPC1020	£1.75
UPC1023H	£0.60
UPC1025H	£2.30
UPC1026C	£1.00

UPC1028H	£0.90
UPC1031H	£1.80
UPC1032H	£0.50
UPC1035C	£1.20
UPC1037H	£0.75
UPC1043C	£1.20
UPC1158H	£0.60
UPC1161C	£0.75
UPC1163H	£0.60
UPC1167C	£0.70
UPC1168C	£0.90
UPC1170H	£0.75
UPC1171C	£1.50
UPC1176C	£1.20
UPC1177H	£1.20
UPC1178C	£1.00
UPC1180C	£1.40
UPC1181H	£1.00
UPC1182H	£1.00
UPC1183H	£1.20
UPC1185H	£2.20
UPC1186	£0.80
UPC1187V	£1.30
UPC1190C	£0.95
UPC1191V	£0.95
UPC1198H	£0.70
UPC1200V	£0.80
UPC1208C	£0.95
UPC1211V	£1.90
UPC1215V	£1.25
UPC1216V	£0.95
UPC1217G	£1.60
UPC1218H	£1.40
UPC1222C	£0.90
UPC1223C	£1.75
UPC1225H	£1.60
UPC1226C	£1.25
UPC1227V	£0.95
UPC1230H	£2.50
UPC1238V	£0.85
UPC1245V	£1.00
UPC1277H	£2.75
UPC1278H	£2.50
UPC1350C	£1.20
UPC1353C	£1.75
UPC1356C	£1.50
UPC1358H	£1.50
UPC1360C	£1.60
UPC1363C	£1.95
UPC1365C	£3.00
UPC1366C	£1.50
UPC1367C	£1.50
UPC1368H	£1.75
UPC1370C	£1.95
UPC1373H	£0.75
UPC1378H	£1.95
UPC1382C	£0.75
UPC1384C	£2.50
UPC1458C	£0.90
UPD277	£4.50
2SA103	£0.60
2SA350	£0.60
2SA495	£0.35
2SA539	£0.30
2SA562	£0.30
2SA634	£0.60
2SA643	£0.65
2SA673	£0.35
2SA684	£0.70
2SA699A	£0.85
2SA762	£1.95

2SA899	£0.75
2SA940	£0.80
2SA952	£0.35
2SA1015	£0.30
2SA1102	£1.90
2SA1103	£1.90
2SA1104	£1.90
2SA1105	£2.25
2SA1106	£2.50
2SA1198	£0.35
2SB22	£0.40
2SB54	£0.70
2SB75	£0.60
2SB341V	£2.60
2SB405	£0.80
2SB426	£2.60
2SB471	£3/50
2SB492	£0.75
2SB509D	£1.70
2SB534	£0.60
2SB536	£0.95
2SB546	£1.50
2SB561	£0.30
2SB698	£0.30
2SB754	£0.95
2SB755	£2.50
2SB772Q	£0.90
2SC372	£0.30
2SC373	£0.30
2SC380A	£0.30
2SC458	£0.20
2SC460	£0.30
2SC461	£0.30
2SC503Y	£0.70
2SC536	£0.20
2SC537	£0.25
2SC620	£0.50
2SC632	£0.30
2SC681	£2.20
2SC681A	£2.30
2SC710	£0.30
2SC717	£0.50
2SC732	£0.30
2SC733	£0.30
2SC792	£2.85
2SC799	£1.75
2SC828	£0.20
2SC840	£1.50
2SC867	£2.75
2SC900	£0.35
2SC929D	£0.35
2SC930D	£0.30
2SC945	£0.35
2SC1034	£3.75
2SC1061	£0.95
2SC1096	£0.60
2SC1114	£3.50
2SC1115	£3.75
2SC1162C	£0.80
2SC1170B	£2.95
2SC1172	£2.75
2SC1316	£2.95
2SC1317	£0.30
2SC1342	£0.75
2SC1364	£0.40
2SC1417	£0.30
2SC1419B	£0.75
2SC1427	£0.30

2SC1505	£0.70
2SC1546	£0.30
2SC1664	£2.50
2SC1682	£0.30
2SC1741	£0.30
2SC1815	£0.25
2SC1826	£0.60
2SC1849	£0.30
2SC1945	£3.50
2SC1946A	£9.50
2SC1957	£0.80
2SC1969	£1.30
2SC2021	£0.30
2SC2026	£0.65
2SC2028	£0.75
2SC2075	£0.25
2SC2078	£0.75
2SC2091	£0.60
2SC2092	£0.95
2SC2098	£0.95
2SC2166	£0.95
2SC2238	£0.65
2SC2278	£0.70
2SC2335	£1.50
2SC2365	£4.25
2SC2540	£12.75
2SC2570	£0.70
2SC2577	£1.90
2SC2578	£2.20
2SC2579	£2.20
2SC2580	£2.20
2SD24	£0.50
2SD170	£0.60
2SD187	£0.60
2SD313	£0.95
2SD325	£0.65
2SD348	£4.50
2SD352A	£0.50
2SD371	£1.30
2SD401	£1.50
2SD467B	£0.30
2SD468B	£0.50
2SD718	£1.50
2SD734	£0.30
2SD916	£0.95
2SD1133	£1.75
2SD1276	£1.50
2SJ49	£4.00
2SJ50	£4.00
2SK19	£0.50
2SK38A	£2.70
2SK49	£0.60
2SK120	£0.90
2SK134	£4.00
2SK135	£4.00
3SK22	£1.75
3SK45	£0.60
3SK88	£0.50
TDA1515	£4.30
TDA2002	£0.80
TDA2003	£0.90
TDA2004	£2.20
TDA2005	£2.75
TDA2006	£1.20
TDA2020	£1.40
TDA2030	£1.40

T. POWELL

16 PADDINGTON GREEN, LONDON W2 1LG
Tel: 01-723 9246 (Answerphone)

VIDEO BELT KITS

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

LATE EXTRA

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

VIDEO HEADS

8000/9000 VT11/14/33/5000/5500	£33.50
17/19/7 State model	£44.00
4 HSs	£28.75
3HSS	£28.75
DSR 36R	£32.00

Also available:
Motors/Pressure Rollers etc.

HA13001	£2.95
SAA5042	£8.00
TA7240AP	£2.50
UPC1263C	£2.50

CASSETTE HEADS

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

TV CERAMIC SOUND FILTERS
3 LEAD TYPE

SFE 4.5MB	£0.35
SFE 5.5MB	£0.35
SFE 6 0MB	£0.35
SFE 6.5MB	£0.35
CDA 6.0MC	£0.40
CDA 6.5MC	£0.40

HIGH SELECTIVITY
4 LEAD TYPE

SFT 6.0MA	£0.90

Enquiries invited for any Japanese I.Cs. As we have imported for over 10 years.
ITEMS DESPATCHED WITHIN 48 HOURS
Please add 60p post and packing and then add 15% VAT to total.
Callers by appointment:
opening times 10am-5pm, Mon-Fri, 9-12 Sats.

VISA/ACCESS ACCEPTED   MIN. TELEPHONE ORDER £5.00

★ ★

JUNCTION 11

A NEW COMPANY IN THE NORTH WEST OFFERING A FRIENDLY, FIRST CLASS SERVICE TO THE TRADE AT COMPETITIVE PRICES

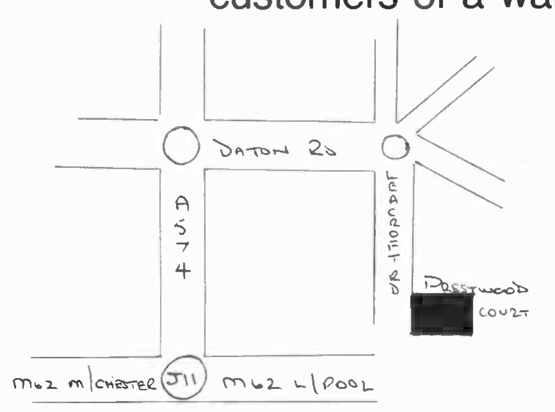
OUR RANGE INCLUDES

G.E.C. PYE PHILIPS I.T.T. DECCA R.B.M.

Now in stock V.H.S. V.C.R.s from £60 plus full range of Thorn remote control including T/Text

★ DISCOUNT FOR QUANTITY ★

The directors of this new company assure all our prospective customers of a warm welcome, and a fair deal.



COME TO JUNCTION 11, M62, YOU'LL FIND US HERE

JUNCTION 11
TV TRADE DISPOSALS LTD.,
Unit 11, Prestwood Court,
Leacroft Road,
Birchwood, Warrington.
Phone 0925 826387.

Open 6 days 9 - 5.30 (later by appointment)

SETS & COMPONENTS

NEW AND SECONDHAND COLOUR TV SPARES. Panels & Tubes most makes also panel repair service. Tel. Southport (0704) 74411 anytime (24hr).

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

GENUINE GRUNDIG SPARES. Fast helpful service. Sensible prices. TELEQUIPMENT PHILIPS Oscilloscopes. Test equipment, manuals. OCHRE MILL TECHNICAL. Stone 0785 814643.

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

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

NORMAN ENTERPRISES LTD

Weston-Super-Mare, Avon.
Tel: 518335

Colour TVs fully engineered with a special care on tubes

Hitachi 217 Remote Control £85
Thorne 9000 Remote Control £42.50
Pye G11 .... £47.50
Rank T20 .... £42.50
Pye Chelsea 6 Button £27.50
Pye 725 .... £37.50
Pye 721 .... £27.50
Thorne 9600 .... £45
Thorne 9200 .... £42.50
Bush T20 Remote Control £49.50
Bush T24 .... £55.50

ITT 20 INLINE TUBE
£45.00 + VAT.

All above prices include hand sets if available. Ready for sale.

Phone now, limited number each month. All the above off the pile, less a 3rd

Thorn 3000/3500
Thorn 9000
UNIVERSAL
1 year guarantee

TRIPLERS
£4.95 inc. p&p

The UNIVERSAL TRIPLERcan 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

B.G. COMPONENTS

T.V. & VIDEO SPARES

We supply spares for most makes including Sony and Fidelity all at competitive prices.

We also stock a comprehensive range of rebuilt C.R.T.'s including Hitachi and Sony.

Open Monday-Saturday.

Hill Street, Oldham OL4 2AG.
061-624 1753.

TELEVISION

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

The prepaid rate for semi display setting £6.78 per single column centimetre (minimum 2.5 cms). Classified advertisements 40p per word (minimum 12

PRICE BUSTERS IN BIRMINGHAM FOR

TESTED AND UNTESTED TV's AND VIDEO's
ALSO AVAILABLE DIRECT LORRY LOAD

RING – 021-772 2733

WILTSGROVE LIMITED

(Next Door to UNCLE'S DISCOUNT STORE)

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

CASH ONLY

"STOP PRESS"

NOW IN STOCK ELECTRONIC VIDEO'S AT UNBEATABLE PRICES

CASH PAID Now for your surplus TV spares, Transistors, I.C.'s etc. Tel. MR. FORSHAW 0902 29022.

EXPRESS PANELS

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

EXAMPLES FROM OUR RANGE (exch. basis)

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

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

TRADE SERVICE AVAILABLE for VCR's.

Callers by appointment only. Telephone orders accepted using Access & Visa.

021-359 3753

ARGO SERVICES (B.HAM) 53, Lawley St, B.Ham B4 7XH

WIZARD DISTRIBUTORS MANCHESTER

TV & VIDEO SPARES

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

FIDELITY SPARES MAIN DISTRIBUTOR.

Did you know we also stock

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

AND MUCH MORE

Counter open Monday-Friday 9am-4.45pm

TRADE ONLY

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

SERVICE PAGES

words), box number 70p extra. All prices plus 15% VAT. All cheques, postal orders etc., to be made payable to Television, and crossed "Lloyds Bank PLC". Treasury notes should always be sent registered post. Advertisements, together with remittance, should be sent to the Classified Advertisement Dept., Television Room 204B (H.H.), IPC Magazines Limited, Kings Reach Tower, Stamford Street, London SE1 9LS. (Telephone 01-261 5942).

BESCO LTD T/A
NORTH WEST ELECTRONICS
NEW STOCKS ARRIVING DAILY

NEW TRADE SHOWROOM NOW OPEN. WORKING TVS AND VIDEOS ON SHOW.

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

Refurbished TV's

BUSH T20/T26 £45
G11 .... £50
PYE KT3 .... £65

Others done to order.

DISCOUNT FOR QUANTITY

EX-EQUIPMENT PANELS
NO EXCHANGE REQUIRED

	IF	Decoder	Line scan	Power	Frame
T20/22	X	14	18	17	14
T26	X	16	20	17	X

ALL PRICES INCLUSIVE OF POSTAGE BUT PLUS VAT
CHEQUE WITH ORDER PLEASE

Annual Clearance Rock Bottom Prices

PYE G11 EXC CAB. £40
BUSH T20/26 CH £35
HITACHI 191 .... £20
FERGUSON TX (NOT D.E.R. Etc.) £65
GEC 2010 .... £20
PYE 222 .... £20
PHILIPS 550 ...... £15
BUSH 718 .... £20
BUSH 2 CHIP £8
GRUNDIG 5010 £10
PYE KT3 .... £50
GEC 2213 .... £30
THORN 3000 .... £7
GRUNDIG G415/4206

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

Special Price Quoted For Bulk Purchases From Source.

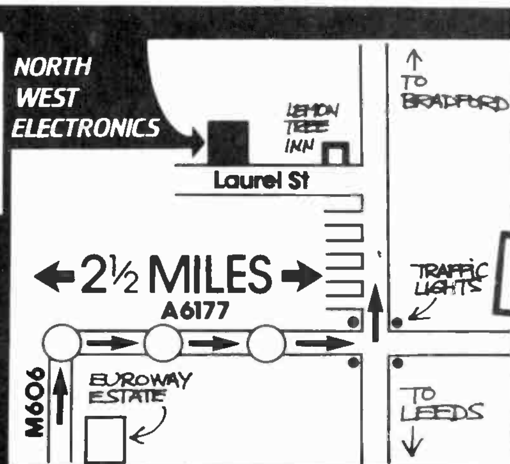
Video

SHARPS 7300, 8300, 9300
HITACHI, VT11,
FERGUSON 3V29
(Not Ex D.E.R. etc.)
SANYO, SONY, BETA

LAUREL STREET, LEEDS ROAD, BRADFORD, W. YORKSHIRE BD3 9TP.

5 MINS FROM MOTORWAY

100's PX
HOOVER JUNIOR VACS
All models in stock



P.X. WASHERS COOKERS ETC

CASH ONLY

Tel (0274) 660995

OPEN 6 DAYS SAT 9-5.30

WORKING CTVs
THE BEST & CHEAPEST IN LANCASHIRE
SPECIAL OFFER

Working Decca Bradford Including Black Fronts
18" 20" 22" 26" **ONLY £20.00 each** in 6 units

Working GEC Plastic & Wooden. All models 20" 22" 26" **ONLY £22.00 each** in 6 units

Working Bush 20" 22" 26"
ONLY £15.00 each

Philips G8 (520) 22" & 26"
ONLY £20.00 each

Plus many more makes & sizes in stock, inc. Tanburg, Nordmende, Thorn.

1st COME 1st SERVED

ALL SETS TESTED & WORKING

CALL
JOHN POWNEY
TRADE TV SALES & SERVICE
Unit 31 Progress Industrial Estate, Kirkham, nr Preston
(0772) 683392

UNTESTED PANELS FOR ALL MAKES OF TV
***£1.25 per panel** plus post & packing*

AERIALS

SATELLITE TV RECEPTION EQUIPMENT

Dishes 0.9 to 2.8m, complete systems 10.9-12.7GHz, 4GHz LNB's, demodulators, and all those accessories.

Manufacturers and Distributors of high quality satellite TVRO equipment.

DX ANTENNA

KESH ELECTRICS LTD.
Main St., Kesh, Co. Fermanagh, N.I.
Phone: KESH (03656) 31449

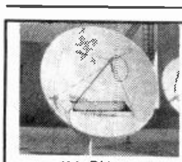
SATELLITE TELEVISION

Buy direct from the manufacturers, low cost, full band satellite TV systems. Full band system £650 + VAT and Carriage

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

NETWORK SATELLITE SYSTEMS LTD.
Unit 7-8, Newburnbridge Ind. Estate, Hartlepool, Cleveland
Tel. 0429 274239 or 869366

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



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

1M. DIA 11-12-4 GHZ BAND	£77.00
1.2M. DIA 11-12-4 GHZ BAND	£93.00
1.6M. DIA 11-12-4 GHZ BAND	£117.00
1.8M. DIA (PETAL) 11-12-4 GHZ BAND	£157.00
2M. DIA. 11-12-4 GHZ BAND	£215.10
2.3M. DIA. (PETAL) 11-12-4 GHZ BAND	£248.10
3M. DIA 11-12-4 GHZ BAND	£737.00

Euro–Sat
107 Cross Street, Sale, Cheshire, England.
Tel. 061-437 2631 061-881 4249

SERVICE SHEETS

TECHNICAL INFO SERVICES (T) – 76 Church St., Larkhall, Lanarkshire ML9 1HE.

World's Sole Publishers of Comprehensive TV/Video Repair Manuals & Largest Known Stockists of Service Manuals and Service Sheets for all kinds of equipment both British and Foreign from 1935 to latest issues.

Big Catalogues of thousands of Service Sheets & Manuals + Chassis Guide + £4 Vouchers – saves time and expense **£3.**

Any published single service sheet for **£2.50** + lsae except ctv/mus-c/combis from **£3.50** + lsae.
A selection from our stocks of thousands of Service Manuals ready for despatch by return post
Any Sony: Hitachi ctv from **£8.50.** Thorn 3000/3500 **£9.50.** Thorn 8000/8004/8500/8600 **£9.50.** Philips G8 complete **£9.50.** Decca 30/31 **£8.50.** Ferguson/JVC 1st video **£19.50** or 3V00 types basic manual **£19.50.** Any Finlandia: Tyne CTV **£9.50 each.** Rank A823 complete **£9.50.**

COMPREHENSIVE PRACTICAL TV REPAIR MANUAL **£9.50** PRACTICAL RADIO SERVICING & REPAIR COURSE **£9.50**
THE 11 TUNBRIDGE REPAIR MANUALS **ONLY £88** THE 5 McCOURT REPAIR MANUALS **ONLY £55**
ANY SET OF 5 INDIVIDUAL VIDEO REPAIR MANUALS FOR **£12.50** OR ALL 3 SETS (15 MANUALS) FOR **£36.**

UNIQUE COLLECTIONS OF CIRCUITS, LAYOUTS, ETC. . . . FANTASTIC VALUE
British ctv from hybrids to modern (3 binders) **£58** Videos, all types (3 binders) **£58 . . . any 1 for £20**
Mono TV (2) **£38** Foreign ctv (2) **£38** Domestic Eqpt (2) **£38** Portable British ctv (1) **£20.**

COMPLETE REPAIR SYSTEMS . . . huge savings from published prices
British ctv 3 binders of Circuits plus 6 Repair Manuals plus ref books, etc. **for only £140**
Foreign ctv 2 binders of Circuits plus 4 Repair Manuals, etc. **for only £65**
Videos 3 binders plus 15 individual Repair Manuals cover all the commonest models **for only £85**
Complete Integrated T.V. Repair System **only £250** or in 12 sections at **£25 per section.**
Contents: 8 binders of circuits/16 Repair Manuals/dozens of other manuals . . . Any new publications from us within 1 year of ordering 1st section will be added at no extra charge.

NEW – PRACTICAL TRANSISTOR – From beginners/students elementary theory to more advanced. Huge section British/Foreign equivalents/alternatives/other data. **£5.80** Post Free.

NEW – VIDEO REPAIR SYSTEM 3 **£28** – **NEW** Binder of Circuits alone **£29** 5 Repair Manuals **£12.50** 3V31/32 Sharp 2300 to 9700 Philips Laser Disc Pan 7000/7200/7800.

Repair data/Circuits/Service data almost any individual mono tv **£12.50** basic ctv **£16.00** video **£25.00**
Repair data/Circuits almost any individual mono tv **£10.50** ctv **£12.00** video **£10.50**

LSAE BRINGS ANY REQUESTED QUOTATION – FULLER DETAILS – FREE MAGAZINE – PRICE LISTS ETC.
PHONE 0698 884585 Mon-Fri before 5pm or 0698 883334 any other time – FOR FAST QUOTES

GERMAN SERVICE SHEET SPECIALISTS

We furnish any kind of German service sheet and manual. Also thousands of different sheets and manuals available.

For any enquiries:
DONBERG ELECTRONICS
Schoolmasters House, Rannafast, Co. Donegal, Republic of Ireland.
Phone: Annagry 175

SERVICE SHEETS ON MONO TV's, radio etc at £2 each plus S.A.E We also stock manuals on video recorders and colour TVs. Please send for quote: BELLS TELEVISION SERVICES, 190 Kings Road, Harrogate, N. Yorks HG1 5JG.

VIDEO

NEW VCR VIDEO CASSETTES

BSAF LVC 180 **£7.50:** LVC 150 **£6.00:** LVC 120 **£4.50:** LVC 90 **£3.50:** LVC 60 **£3.00**

NEW U-MATIC VIDEO CASSETTES

KCA 60 **£6.75:** KCA 30 **£4.75:** KCA 20 **£4.25:** KCA 10 **£3.25.** Once used for promotional films 25% the above prices (LVC 60 KCA 10-30 only). Bargain box 16 KCA60 used but tested **£55.00.** U-Matic portable cassettes, once used by broadcast companies KCS20 BR **£5.75:** KCS 20K **£4.25:** KCS20 **£3.25.** 10% discount on 10 or more tapes. All prices are inclusive.

Mail Order Address,
2 Buckhurst Way, Buckhurst Hill, Essex IG9 6HJ. Tel: 01-504 4177.

BUSINESS OPPORTUNITES

HI FI, TV, & VIDEO SALES AND SERVICE BUSINESS
FOR SALE

This very profitable business is situated in a large town & service income is virtually a monopoly, a one off chance for any competent engineer to obtain a ready made business, the premises are freehold & comprises of medium size sales & office with large & spacious workshop fully fitted out to cater for a large workload, the equipment is plentiful and spares abundant. Any prospective purchaser must be prepared to work all hours to cope with workload, the premises also have the benefit of six bedsits and guaranteed income that will more than cover any mortgage. There are good reasons for the sale of a business built up over the years and has acquired a large & faithful following of regular customers.

Price £60,000
Tel: 0423 500333

FOR SALE
SHOP IN EDINBURGH SCOTLAND
TV, VIDEO, HI FI REPAIR AND RECON SALES BUSINESS

Shop run on a five day a week by husband and wife team for ten years. Nice income from repairs and sales, a little from rental. Selling due to retirement from TV work. Freehold lock-up shop approx 700 sq ft plus 150 sq ft store room. Located on main bus route. Bus stop at door. No parking restrictions. Price £26.500 + S.A.V. for freehold, may consider £8,500 + S.A.V. for business plus lease on shop with freehold purchase option.

Box No. 222

METERS

AVON METERS

We buy and sell and repair TV coinmeter. Reasonable prices, one year guaratee.

327 Church Road,
St George, Bristol.
0272 559761

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

S4000 TV METERS

S4000 TV Meters 50p or £1 from stock. Reconditioned. All other types available plus repairs to all makes.

P & J Wales,
89 Twickenham Road, Newton Abbot,
Devon TQ12 4JG.

FOR SALE

"RADIO AND T.V. SERVICING" 1965 to 1981 (16 Volumes) £90. Tel. 061-798 7613.

PHILIPS V2000 TAPES, V2000 heads & spares, various service manuals. PM2517 digital meter. Telephone 074632 406.

---

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

VHS VIDEO'S
3V00/3V22
£45 each + VAT
Minimum quantity 10
Tel: (0602) 397555

DEVONICS

Quality Tube Rebuilders

2 YEAR WARRANTY

Inline Tubes	
Up to 19"	£43
20" to 22"	£45
26"	£46
Bonded Coil	+ £5
30 AX (−540×)	+ £7
Delta tubes from	£30

All plus carriage and VAT

We currently seek sound inline glass for narrow neck (29mm) and 30AX types espeically 560 AWB/BJB/BYB/CSB and 510 CJB.

2A BARTON HILL ROAD,
TORQUAY TQ2 8JH.
0803 33035

Sabaco For a great deal!

TRY US YOU'LL LIKE US
TOP QUALITY TV'S & VIDEO'S AT ROCK BOTTOM PRICES

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

VHS VIDEO'S

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

OPENING HOURS:
MONDAY TO SATURDAY 9am to 5.30pm

CASH ONLY All goods subject to VAT & availability

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

(0602) 397555

Only 2 minutes Junction 25 M1

(2 minutes from M8)

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

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

INDEX TO ADVERTISERS

Aerial Techniques 737
Apollo 746
Argo Services 750
Armstrong Television 755
Avon Meters 757
Barry (TV Services) 754
Bean, R.M. 753
Besco T/A North West Electronics 752
B.G. Components 750
B.K. Electronics 694, 706, 742
Bolten Ltd. 747
Broughton Radio 756
Bull, J.&N., Electrical 699
Burrows Service 756
Carter, John (Electrical) Ltd. 744
Celtel 694
Centrevision 746
Chromavac Ltd. 698
Chromavision 706
Claydon, P.B. 755
C.M.J. Electronics 753
Connexions Satellite Systems Ltd. 715
Crewe Wholesale TV 746
Cricklewood Electronics Ltd. 698
Croydon Discount 754
Devonics 757
Display Electronics Ltd. 758
Donberg Electronics 755
East Cornwall Components 700
Economic Devices 724, 725
Electric City 698
Euro-Sat 755
Flintdown 756
Ford, Frank 748
Fylde T.V. and Video Distributors 751
Garton, D.&G. 756
General Factors 754
G.G.L. Components 697
Grandata Ltd. 743
Halton TV 753
Harrison Electronics 706
Hillier, Anthony 751
Hockley Discount Televisions 747
Hussain Central T.V. Ltd. 695
ICS 697
Independent Television and Video Co. 751
Junction 11 T.V. Trade Disposals Ltd. 745
Kelleher Bros. 754
Kent Ledgerwood Wholesale Ltd. 749
Kesh Electronics 755
KLW Ltd. 758
London Electronics College 719
LRC (Spares) Ltd. 741
Mannion, R.B. 756
Manor Supplies .... Cover II
Mantel 743
Monolith Electronics Co. Ltd., The 748
Network Satellite Systems Ltd. 755
N.F.P.C. 754
N.G.T. Electronics Ltd. 758
Nikko Electronics 697
Norgrove TV Trade Services 746
Norman Enterprises Ltd. 750
P & J Wales 757
Papworth Transformers 741
Post A Part Electronics 705
Powell, T. 745
Powney, John 755
Precision Vision 754
P.V. Tubes 690, 691, 692, 693, 694
Quick Save T.V. Spares 696
Repossessed T.V. Centres Ltd. 759
Sabaco 757
Sendz Components .... 742, 760, Cover III, Cover IV
Sight and Sound 746
Southpark Distributors 749
Starlite Electronics 751
Stewart of Reading 744
Technical Information Service 755
Telemann 749
Telepanels 758
Tele-part 706, 741, 759
Teletraders 758
Televideo Services 742
Teleview 751
Tidman Mail Order Ltd. 703
Trent Tubes 754
TVS Trade Services 744
T.V. Trade Sales 759
T.V. Video 755
Universal Electronic Distributors 747
Universal Semiconductor Devices Ltd. 749
U-View Tubes 753, 756
Video & Hi Fi Electronics 753
Well View 748
Willow Vale Electronics Ltd. 756
Wiltsgrove Ltd. 750
Wing Electronics 750
Wizard Distributors 750
Woodsdale Components 754

- Philips small stereo headphones £4
- Stereo Philips Rank UHF 4 push button tuner £4
- GRC power supply PC743B £10
- Rank front panel Z950 £5
- Power panel 8.500 Thorn £5
- Fedility mains switch & lead and filter panel £1
- Fedility mono lopt with diode FBS1245AE £3
- 6 TAG print mains switch PREH 1983 ITT 75p
- Rank T603A tuner on panel £6
- Scan control panel Z544 £3
- Rank Z582 IF £3
- Rank convergence Z910 £3
- GEC IF tuner panel PC786B £12.50
- ML 232 I.C. on panel tuch unit Fidelity £3
- 2SC643A £1
- 2SC1617 £1
- 2SC1942 £1
- Hitachi power panel PC036A £1
- Rank IF 742 £3
- Rank decoder Board MTS 200/1 Tuner & IF £12.
- Z733 Rank mains in put-panel £1
- G11 Chroma Can 3113 108 25300 £3
- 20AX Line lin coil 50p
- GEC switch mode trans 20AX
- ITT CVC20 etc mains switch 60p
- ITT 2,800 mains remote switch 50p
- 2110 GEC Power Panel £8.00
- Line o/p frame panels GEC 20AX £10.00
- GEC 20 AX Transductor £1.00
- ITT CVC40 Push Button Unit & Mains Switch £8

Rank Panels

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

Rank Power Panel

- 300+300m with diodes degaussing £3
- BA 301 £1
- TA 4127 £1
- HD 3884 2A23 £3
- TA 4184 £1
- TA 2125 £1
- TA 4190 £1
- TA 4138 £1
- TA 4196 £1
- TA 4174 £1
- TA 4139 £1
- TA 4198 £1
- TA 4167 £1
- TA 4199 £1
- BA 546 £1
- BA 328 £1
- TA 4176 £1
- TA 4145 £1
- TA 4191 £1
- HA 11710 £1
- TA 4188 £1
- TA 4197 £1
- TA 4183 £1
- TA 4197 £1
- TA 4183 £1
- TA 4195 £1
- TA 4175 £1
- TA 4177 £1
- TA 4192 £1
- TA 4146 £1
- **The Service Engineers** Guide to Teletex £2
- **Teletex Colour Training Manual** £3
- **Mains Trans** C. Core 240v 4v+4v 4v04v 2AMP 12v lamp £2
- Mullard split diode AT2076/80 £6
- 4 Types Fedility front panels with i.c. & pats £2 each
- Amstrad TV chassis Complete damaged print £5 + £5 post
- BB 103 10p
- BB 105A×12 £1
- BB 105B×12 £1
- BB 105G×12 £1
- BB 121a 10p
- 47 10p each
- **A 823A chassis** Scan drive £5
- IF £3
- Scan control panel £3
- NEW A31/510 tubes with s/coil £6 + £2 post
- 1A/1600V 10p
- 2 amp bridge rec. wire end 15p

- CV 8617 10p
- Y 716 10p
- Y 729 30p
- Y 730 10p
- Y 827: 6A/1KV 20p
- Y 860 30p
- Y 933 5p
- Y 969 50p
- Y 997 30p
- Min 12 volt Relays 75p
- R 1038 40p
- R 1039 40p
- R 2009 80p
- R 2010b £1
- R 2029 50p
- R 2210 60p
- R 2257 60p
- R 2265 50p
- R 2305 50p
- R 2306 30p
- R 2322/2323 pair 80p
- R 2323 15p
- R 2396 50p
- R 2461 80p
- R 2030 50p
- R 2443=BD124 30p
- R 2540 £2
- R 2737 40p
- R 2738=TIP41 30p
- R 2775=TIP41c 40p
- R 3129=TIP47 40p
- R 4050 £1.00
- S 2008b 80p
- 2SD898B £1
- 2SC1942 £1
- **Hitachi sets etc.**
- STR441 £2.50
- STR454 £2
- S 2000AF line o.p. £1
- 2SC940 £1
- BU 105/04 80p
- BU 108 £1
- BU 124 50p
- BU 126 80p
- BU 180a 65p
- BU 204 70p
- BU 205 £1
- BU 206 £1
- BU 207 £1
- BU 208 80p
- BU 208A £1.10
- BU 208D 90p
- BU 222 £1
- BU 326 £1
- BU 407 60p
- BU 426V 60p
- BU 500 £1.10
- BU 500D £1
- BU 508A £1.20
- BU 526 75p
- BU 807 £1
- BU 824 50p
- BUW 11 £1.00
- BUW 84 60p
- BYW 20-08-9 £1
- BYW 95 10p
- TIC 106a 30p
- TIC 116m 40p
- TIC 116n/Y 1003 35p
- TIC 126N 40p
- TIC 206m 30p
- TIC 225S 40p
- TIC 226E 40p
- TIC 226m 30p
- TIC 236m 30p
- TICV 106D (T092 case 2A/400V) 10p
- TIP 29 20p
- TIP 30 35p
- TIP 30A 35p
- TIP 30B 40p
- TIP 30C 45p
- TIP 31 30p
- TIP 32 25p
- TIP 33B 50p
- TIP 33C 70p
- TIP 34A 50p
- TIP 34B 60p
- TIP 34C 70p
- TIP 35B 50p
- TIP 35C 70p
- TIP 35D 80p
- TIP 36 50p
- TIP 36C 70p
- TIP 41B 40p
- TIP 41D 70p
- TIP 42/BRC 6109 30p
- TIP 48 40p
- TIP 49 30p
- TIP 57 30p
- TIP 100 30p
- TIP 102 30p
- TIP 115 50p
- TIP 117 50p
- TIP 120 35p
- TIP 125 35p
- TIP 126 40p
- TIP 127 40p
- TIP 130 30p
- TIP 131 25p
- TIP 136 30p
- TIP 140 50p
- TIP 640 50p
- TIP 2955 35p
- T 6032 30p
- T 6036 40p
- T 6040 40p
- T 6047 40p
- T 6049 40p
- T 6051 40p
- T 6052 40p
- T 9004 40p
- T 9005 40p
- ZTX 107 10p
- ZTX 108c 10p
- ZTX 109k 5p
- ZTX 213 5p
- ZTX 341 10p
- ZTX 342 10p
- ZTX 384 10p
- ZTX 451 10p
- ZTX 550 10p

- MJ 2253 60p
- MJE 3040 60p
- MJE 2209 10p
- SP 8385 50p
- SAB 3205 £1.00
- SAB 4209 £1.00
- G11 condenser £1.75
- 300M + 700 320V £1.80
- 200 + 100 + 100 + 50 300V 50p
- 150 + 200 + 250M 300V 50p
- Chassis complete £35
- Computer Transformer 20v/2.25A; 20v/1.5A; 17/.5A; 19/.5A; 28/.05A £3
- Mains ViewData Torroidals £3.75
- 240V/240/6V/4 amp/6v 500m/a in / out - - - - - - -
- Mains trans 240/12v-0-12v 2 amp £3.50

Voltage Regulators

- +5V/UA78PO5SC 30p
- −5V/LM79MO5CP 25p
- −8V/79M08c 30p
- +6V/78M06c 30p
- +10v/78LA10 20p
- LM 317T 35p
- LM 337 30p
- LM 342/18 30p
- LM 340T 5.0 50p
- +12V/LM 340T12 50p
- +15V/78M15 15p
- +18V/MC78M18 20p
- +24V/78M24 30p
- MC 7724cp 40p
- MC 7824 40p
- TIS 90 10p
- TIS 91 20p
- TIS 92 20p
- TIS 93 20p
- U 19885 40p
- U 3832 15p
- U 3845 15p
- MR 508 10p
- MR 501 10p
- MR 502 10p
- BCW 71R 30p
- BYF 1202 10p
- BYF 1204 10p
- BYF 3126 40p
- BYF 3214 40p
- BYX 10 6p
- BYX 36/600 35p
- BYX 38/300 25p
- BYX49/600R 75p
- BYX 55/350 10p
- BYX 55/600 (Bead) 10p
- BYX 71/350 20p
- BYX 71/600 50p
- BYX 72/300 20p
- BYX 36/600 50p
- BYV 95B 10p
- BVY 95C 12p
- BYV 96D 10p
- BYZ 106 10p
- BPW 41 15p
- BYW 56 2A/1000v G11 8p
- BZU 15/24 54p
- BZY 93c75 50p
- BZV 15/18 30p
- BZV 15/30 30p
- BZW 70c6v2 10p
- BZX 79.3v 10p
- Bush thyristor RCA 76122 £1
- Transformer 240v/20v-500Ma 75p
- Chassis type Transformer 240v/12 Volts 500m/a 75p
- CVC 20 tube base £2
- Tube Base Rank & G11 £1.20
- 6v-9v-13v tape motor 75p
- Infra red led LD57CA 15p
- G 8 transductor £1.25
- AT 4041/41 transductor £1
- VHF 3 Transistor rotary tuner DX-TV £1
- 15K-20 turn pots 20p
- Thorn panel 6×100 pot + changeover switch (Irish) 50p
- Battery converter TA 75 for colour TV. 12/24v Thorn 3787 £6
- Thorn 3500 2A cut out 50p

Stereo GEC amp 20 watt + pre-amp with 4 pots + mains power unit with circuit £6

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

BRIDGES

- SKB 2/08 L5A 30p
- KBL 005 30p
- KBL 02 30p
- KBP 04 30p
- W02 15p
- W004 15p
- W005 20p
- AT 2076/35 £7
- AT 2076/55 GEC split diode transformer £10
- AT 2048/11 LOPTI Mullard £2.50
- Z918 Front Panel with Mains Switch & I.C. £4
- Thorn Chass U916D Compleat £10
- Thorn TX9 Remote Panels with I.C.s £2.50
- Thorn 9000 4 Slider Front Panel £4
- Philips 12 Volt car aerial 15.00
- Philips 2 off 30 watt car speakers. £15.00

- Philips car radio speaker door pair £7
- 2× Hi-Fi Philips car tune up tweeter EN8320 £10
- ITT CVC45 8 way resistor unit for v/cap £3
- 4700/10v × 10 50p
- 68/16 × 10 50p
- 150/16 × 10 50p
- 47/25 × 10 50p
- 220/25 × 10 50p
- 1/250 × 10 50p
- 8000/30v 50p
- 470/40v × 10 £1
- 22/100v × 10 £1
- 100/350v 70p
- 400/350v 70p
- .47/500v 25p
- 1/600v 25p
- .022/1kv 10p

VIEW DATA PANELS
NEW £3
Tel-Tex Decoder VM6101/01 **£10.00**

- NI.CD Charger MW398 6A.A £8
- NI.CD 5 Hours Battery Charger £8

Nickel Cadmium Battery Charger AA-C-D-PP9 £6

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

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

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

20AX GEC Split Diode lead **£1.00**

ITT Tel-Tex Decoder Panel **£6.00**

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

- ITT Display Tube 58705 50p
- 8 Seg Display FND500 20p
- Mullarad 12.5V/170 Mc/s 45 watts BLW60C £4.00
- Mullard Broadband R.F. power modules UHF. BGY22E £10.00
- PT4236C. PT8706C. PT9783 £3
- ITT Micro Phone M5 50p with switch
- 1½ Volt Sub Min Relays 25p
- 12 Volt Relays Double changer over 10A contacts 35p
- Sub-min Relay low voltage 50p
- Mains relay coil 230v 30p
- Philip PP3 batterys 10 for £3
- 12v battery holders A.A. 50p 1.5 battery
- T/V 12v 2 pin battery lead 30p

- 15 Watt Stereo Amp Sanyo Module with Data 50p
- 25pcs Precision Screwdriver & Tool Set £6.00
- 25 Watt Solder Iron £4.00

Various Tools and Accessories

- T/V V/Aerial 300Ω or 75Ω £1.50
- L.C.D. clock display with alarm 75p
- • D/P push mains switch 20p each
- Mains lead & two pin socket for radio cassette 35p
- Xcelitr cutter £3.90
- T/V loop aerial 75p
- Radio Telescopic Aerial £1.00
- Philips Neon Lamps for TV sets 5p
- Freeze £1.20
- Foam Cleaner £1.20
- Contact Cleaner £1.20
- Cans of Anti Static, Degrease Cleaner and Anti Corona All at £1.40
- Lorlin Full Remote Relay Switch fit most T/V sets, mains 4 tag, 2 tag 12 volt £1.00
- Mains timer. 13 amp — up to 2 hours: easy to use, plugs into socket £3.00
- Screen locking agent, large can £1.50
- 20 GEC Service Manuals £5.00
- Red E.H.T. LAED and Anode Cap £1.00
- 10 × G11 Cap 470/250 £15.00
- Weller solder iron 15 watt/25 watt £5.00
- Hitachi Silver Oxide Battery G13 UCC357 IEC SR44 1.5V 60p
- 70ML Silicone Sealer (clear) £1
- 100 Coax Plugs £12.00
- De-solder pump + 2 nozzels Philips £4.00
- Plastic box for i.c.s 6"×3"×½" 50p
- Flat Red LED and Green 5p
- 500gm 60/40 solder reel £6
- Solder 1 kilo reel £5.50
- Clearweld glue pack 30p
- Dual v/u meter -20 – +10db £1
- K30 thermistor 232266298009 75p
- GEC Mains Power Supply R.E.G. £3.00
- De-solder Pump £2.50

1061 Series
GEC Automatic Telephone Answering Machine £40

- SONY 1400KV Chroma Panel £6
- SONY 1400KV Touch button unit £3.50

PHILIPS Pattern Gen. PM5519 £400 Cost £1000

- 12 Volt Mains Trans 500M/A £1.00
- 18V or 12 Volt Mains Trans 500M/A 75p

Quantity Reductions

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

- Plastic Boxes 4¼ × 4 × 1 × ¼ 50p
- 100 Fuses £2.00
- 100 W/W Res. £1.50
- BF 199 20 for £1
- 10 × 20 Turn 100k pots. Rank £2
- BF 470 20 for £2
- 20 Slider Knobs 70p
- 6 Mixed UHF Aerial Isolating Sockets, some with long leads. Fit ITT, GEC, Philips, Pye £1.00

Mixed Packs

- TO66 12 Power Trans RCA 16182 NPN Replacement for BD124 and Mounting Kits £1.00
- 50 Mixed AC series Transistor £4.50
- 25 Panel Mount Bulbs & Neons £1.50
- 10A £1.50
- 25 LED red/yellow/green £1.50
- 20I/C Holders £1.20
- 20 Large LED Red £1.00
- 20 Small LED Red £1.00
- 10×20 Turn 100K Pots £1.00
- 100 Transistor £2.50
- 20 Convergence Pots 80p
- 10 Thermistors 50p
- 20 Slider Pots £1.00
- 30 Presets 50p
- 15 VDR + thermistors, degaussing, HT, etc. £1.00
- 40 glass reed switch £1
- 10 press to make switch 70p
- 40 Pots £1.50
- 5 Tube Bases £1.00
- 1,000 Diodes, Condensers, Resistors on Bandolier £2.00
- Lucky Dip 600 gram £1.00
- Jungle Bag 5Kg £5.00
- 20 Knobs £1.00
- 20mm Fuse Holders
- Chassis Mount 20 for £1
- IN4001/6 100 mixed £2.50
- EHT Diodes, small 20 for £1
- 200 Mixed Diodes £1
- 100 500M/A Fuse £1
- 100 1.225 Amp Fuse £1

SENDZ COMPONENTS
TO ORDER SEE BACK PAGE

SENDZ COMPONENTS

TO ORDER SEE BACK PAGE

Thorn Spares

New 9000 Decoder £8.50
9000 Frame panel £8
9000 Cyclops panel £1.50
8000/8500 timebase panel £8
8800 convergence panel £6
8500 convergence panel £6
4000 Power supply £3
1600 Mains lead, switch
3500 6 push button + cable form £1.50
T605 TvNPN T066 80v/6A 10p
9000 Sound output panel £1
3500 Focus unit £1.50
3500 Mains Trans £4
3500 cut outs 10 for £4
3500 IF panel £2
3500 Frame panel £3
3500 Line panel £3
3500 A1 Diode 20p
Export 3500 IF panel £2
IC board with set of SN74LS £1
4000 Tube base £4
3500 A1 pots 50p
Beam limiter panel £1.50
3500 Power panel with Y969 £1
3 Way regulated adaptor 240V 6V/7.5/9V/300mA £3.50
Rank/Toshiba preh unit 0354 £9.50
2 banks of 3 PB unit. Pye 731 £2
4 Push button unit preh £1.00
6 Push button VHF/UHF for v/cap. GEC-Decca type £7.00
7 Push button for CVC5 ITT £8.00
G8 Push Button Unit £10.00
KT3 12 Push button unit £2.00
KT3 (Export) 12 P.B.u £2
6 Push button Unit Thorn £1.00
6 Push button Unit fits GEC & Decca etc. £6.00
Hearing aid unit £3
Rank Z718 4 P/B/Unit MECH £4
7 Button Unit GEC with Lamps £7
Bush T515A 6 button unit with Pos & mains lead. 6 bush buttons. Bush £6.00
697 Push Button Unit £6.00

Mains Droppers

G8 2R2+68R £1.25
G8 47R 15 watt 75p
Pye 731 3+56+27R 50p
Thorn 50/17/1K5 £1.00
120/20/20/48/117 £1.00
270/10/6 for Thorn 4000 50p
18/320/70/39 £1.10
Thorn 50-40R-1K5 50p
Ac Socket & Lead
GEC, ITT, Philips, Pye 25p
7×3¾ Thorn £1
Thorn 1600-1700 £1.50
Rank Toshiba Tube Bases 30p

Speakers

6×4 G11 25 ohm £1.00
5½×2½ 3 ohm £1.00
5×3 80 ohm 70p
5×3 50 ohm 50p
5×3 35 ohm 70p
6×4 15 ohm £1.00
7×3 70 ohm £1.00
8×5 8 ohm 15 watt £2
8×5 8 ohm £1
5×3 8 ohm 70p
7×3 16 ohm £1.00
5" dia 16 ohm £1.00
5" dia 8 ohm £1.50
6½" dia 4 ohm £1.50
6½" dia 3 ohm £1.50
2¾" dia 8 ohm 75p
3" dia 8 ohm 75p
4½" sq. 15 ohm 75p
KT3 speaker K30 75p
3" dia 15 ohm 60p
1690 5×3 12 ohm £1
K45 Philip 15 ohm 75p
K30 15 watt £1

KT3-K30

OF-550 E.W. 10p
OF-513 correction 10p
OF-557 50p

DIODES

BY 126 10p
BY 127 10p
BY 133 10p
BY 134 10p
BY 164 50p
BY 176 25p
BY 179 40p
BY 184 25p
BY 187 10p
BY 190 40p
BY 196 30p
BY 198 10p
BY 204/4 8p
BY 206 8p
BY 208/800 8p
BY 210/400 5p
BY 210/800 10p
BY 223 60p
BY 224/600: 4.8A/600v bridge 50p
BY 226 15p
BY 227 15p
BY 228 10p
BY 229/400 30p
BY 237 5p
BY 254 10p
BY 255 30p
BY 298 10p
BY 299 10p
BY 406 8p
BY 527 20p
BY 407a 10p
BY 527 10p
BY 602 10p
F 247 10p
GP20G 5p
XK 3102 50p
BYV 28/200 20p
800v/2.75 amps 10p
International Rectifier EHT Diodes G770/HV34 6KV 3 for 8p
6A/600V Stud Diodes 20p
6A/1000V Stud Diodes 20p

K35 Decoder £8
K35 Sound OP £4
K35 Split Diode 3122-138-35930 £10.00

Fidelity Tube Base with transitor & focus pot £1.50

Bush Tube Base on panel £1.00

Line Transformers

Hitachi Split Diode and GEC 1981 to 1984 £13
2 J/Pots 3,500 1 off each type £3.00
G8 Trans. Philips £7.00
G11 Split Diode £12.00
CVC820 Split Diode ITT £10.00
Thorn B/W AD5308F + Stik + Lead £1.50
1690 Thorn EHT over-wind with diode lead & anode cap £2.50
GEC 2040 £3.00
GEC 2110 £7.00
Mullard AT 2036 £1.50
Pye 169 Line Trans £3.00
Pye mono £3.00
Rank mono T704A £3.50
Split Diode Trans £7.00
GEC 20 AX Rank Z522 £3
Rank L.O.P.T Z970 £3
CVC20 ITT £3.50
AT2080/15 £5.00
CVC30 ITT £5.00
CVC32 Line Tran £6.00
CVC800 Line Trans £6.00
CVC40 Slip/Diode £12.00
CVC 45 £5.00
GEC Portable G1OT2041 £3.00
GEC Portable G1OT2046 £3.00
EHT Split Diode Leads ITT £1.00
3500 L.O.P.T. & HT Trans each £2
LOPT Rank Z763 £5
K35 Split Diode 3122/13835930 £7

Triplers

11 TJT £2.50
11 TGA £2.00
ITT CVC 5-8-9 £3.50
Rank T25LE Tripler £2.00
Rank 11TCP A823 £3.50
TU 25 30K Rank £3.00
11 TEZ Rank £3.00
G9 Philips £4.00
GEC 2110 £4.00
3500 Thorn £3.00
8500 Thorn £4.00
9000 Thorn £6.00
9500 Thorn £4.50
2040 GEC £3.50
GEC TVM25 Tripler £2.00
Universal Tripler £5.00
TVK 76/9 £3.00
G8 £4.00
CVC 825 ITT CVC 20/25/30/32 £3.50
Decca 80 100 £4.50
Grundig TVK 52 £2.50
11TBQ Pye 731 £3.00
11THY £4.00
D22 for Pye 18" colour portable £4.00
LP 1193/63 £4.00
BG 100/41 £3.25
ERO Tripler print type with focus
PO7 BG2087 £5
T/text ultrasonic rec'r panel £14.00
Video cassette lamps on lead.
12-14V. 50p or 3 for £1.00
20 for £5.00 200 for £25.00
GEC 8 touch unit assy complete with all I.C.'s + pots £4.00
G11 E.W. Transformer 50p
G11 E.W. coils £1.00
G11 Transient Suppressors 245V 20p
G11 Scan Coils £5.00
G11 100K tuner pots 12 for £1
KT3 IF panel £6.00
KT3 line OSC transformer £1
KT3/K30 infra-red receiver head £1
K30 drawer unit with IC's (home) £10
K30 drawer unit with IC's (export) £10
KT3 AE Sockets 50p
KT3 receiver panel £8
KT3 line driver transformer 50p
Pye, K30, GEC, etc Pre-mains stand-by switch £1
Decca 80/100 IF panel £5
NPN PNP 80V 6 Amp TO66 O.P. Trans. pair 25p
5 button touch tuner BBC1/2 ITV1/2 video with ic SAS 560T/570T £7.00
Control panel 5 sliders + mains lead £1.50
G11 8 touch button unit replaces old 6 P B U £24
Tube base + base unit for 820 Euro chassis £4.00
GEC Line O/P Trans. & Rec Stick for Portable £3.00
CVC 20/25/30/35/40 decoder panel £10
CVC 20/25/30/35/40 decoder panel (untested) £5
CVC 40/45 IF panel £5
40K Transducer 50p
PHILIPS NE511N £1.20
I M337M Reg. 30p
20 GEC Black Spark Gaps £1.00
KT3 Front Panel Control Assy £2.50
BTW 30/50 50p

TELETEX DECODER

I.C. SAA 5051 K30
I.C. SAA 5042
I.C. SAA 5030
I.C. SAA 5020 etc. £8.00
BTW 92/800R £3
25A473 PNP C/P 10p

Rank T20 Z136 Panel £6
NEW Pack THORN 17 off Manual £5.00
NEW 1617 THORN Chassis with ICs & AU113 £5.00
30V Power Supply 500M/A 4×2¼ £2.50
Pye 731 Power Panel £13
6 Diode Universal Triplers £4.00
NEW PYE 725 line O/P panel with L.O.P.T. & Tripler £10.00
NEW GEC 20AX Power Supply Switch Mode £12.00
Complete new GEC portable chassis M1201H/M1501H with P.B.U./v.cap/LOPTI £10
Field + Jungle panel for GEC 3133/3135 £1.50
GEC 2110 line panel with transformer £7.00
GEC 2110 tuner unit + IF Panel £12.00
Pye/Chelsea Line op panel £12.00
Pye 205 T/unit £3.90
Pye 205 Line op panel £7.50
Pye 713 IF panel and tuner £7.00
Pye 713 Chroma £10.00
Pye/Chelsea Timebase panel with LOPTI £10.00
Pye 731 Frame Panel £5.00
Pye 731 Convergence Panel £5.00
Pye 731 Chroma £10.00
Pye 731 IF panel + tuner £10.00
Pye CDA/205 panel £6.00
GEC portable chassis + LOPTI 2114 New £4.00
Thorn 1613/1713 chassis 9.75
G9 Power Panel £6.00
Mono RANK Chassis 127A NEW £10.00
NEW G9 Frame Panel £10.00
NEW G11 IF Panel £7.00

G8 Tuner Unit + Panel £4.00
G8 Power Supply £5.00
G8 6 Sloping PBU £8.00
G8 IF & Chroma £6.00
G8 Chroma £3.00

G11 IF Detector £3.00
G11 Selector gain module £3
Complete CVC 825 Chassis (both panels) £40.00
AEC V/Cap Resistor Unit UHF with IC SAS660 SAS670 £3.00
Z714 RANK IF Panels 6MHz 1 I.C. SL437F £3.00
Z909B RANK IF Panels Export 5.5MHz 2 I.C.'s TBA1205B TCA2705Q £2.50
K35 IF £6.00
Z743 RANK IF Panel Export 5.5MHz 3 I.C.'s TBA750+SC9504P+SC9503P £1.50
Pye G11 Front panel with transducer, pots, tuner pots, 6 pb switch+lead £5.00
Pye 6 button switch portable £1.00
GEC V/cap VHF/UHF tuner and IF+ sound O/P PC 706B3 (Export) £12.00
GEC Line O/P PC 659B3 £6.00
2110 GEC Power Panel £8.00
GEC Power Supply (Export) £10.00
G11 dynamic correction panel £6
CVC 20 Front panel with sliders + mains input panel £4
CVC 40 PUSH BUTTON ASSY with sliders: complete with lamp assy + pots £9.00
CVC9 slider pots panel 50p
CVC 5 Mains on/off + 5 pots £2
Universal Focus. Fits Pye, Thorn and Decca Units.
T147 Rank tube base on panel £1.00
Z718 Focus Unit £1.50
T20 Focus Unit £1.00
Large Type 75p
Decca Small 75p
KT3 Focus Unit 75p
K30 Focus Pot 75p
K30 Tube base on panel £1.00
TX10 Focus Units £7.00
CVC 32 Focus Unit 75p
Fedility Focus Unit 14R–14S 30p
3500 Thorn Focus Unit £1.00
ITT Small for use with Split
Z718 Bush Focus £2.00
Diode 50p
TV11 50p
Remo TV12SP 50p
1600 Thorn EHT Rec and Lead 50p
TV13 50p
TV14 50p
TV18 60p
TV20 £1.00
TV45 50p
Thorn 14/1500 rec stick 5p

G11 drawer ASS 3 pots Mains switch and lead £2.00

K30 Drawer Ass with pots cable forme £1.00

Line O/P panel GEC 2217/2218/2213/2214/2226/2227/2228 £10

DISPLAYS

4040 Clock £1.00
7seg Red LED 50p
2 digit LED 8.8 50p
2 digit LED ÷1.8 with panel + MC14511 £1.00
4700/63 £1.50
250/64 10p

1/250AC 20p
1/100 5p
1/100 × 10 30p
22/100 10p
4.7M/100 5p
470/100 20p
2000/100 70p
4700/100 75p
47/160 10p
300 300/300V 80p
800/160 50p
.1/250 Pulse 5p
2.2 250v 10p
3n3/250 A.C. 10p
.33/250V 20p
.39/250V 15p
4n7/250 tested 5KV 25p
22/250 15p
47/250 10p
100/250 20p
G11 470/250V £1.75
GEC600/250 60p
700/250 £1
300+300 MFD 350v £1.00
800/250 40p
32/300 20p
4/350 5p
8/350 8p
4.7M/350v 10p
33/350 20p
220/350 30p
300/350 40p
400/350 50p
10/375 10p
22/375 15p
220/385 (ITT) 75p
330/385 CVC 820ITT 60p
0.1/400 15p
KT3 E/W .39/400 20p
56K/400v 20p
4700pf/400 10p
.22/400 10p
8/400 15p
33/400 20p
400/400 40p
394K/400V 20p
220/450 40p
.47/500 25p
0.1/600 15p
0.1/1200V wire end 20p
0.1/450 A/C wire end 20p
.047/600 15p
0.047/1000 10p
0.01/1000 10p
0.1/1000 10p
.47/1000v 65p
.47/250V A.C. 10p
.001K/1250 10p
0.0047/1500 10p
.005/1500 10p
.0105/1500 10p
1n8/1500 15p
2n0/1500 10p
2n2/1500 15p
.01/1600 15p
G11.8200/2KV 15p
0.1/2KV 20p
10n/2KV 15p
3n9/2KV 15p
0.0015/2KV 10p
5n2/2KV 10p
6n2/2KV 15p
2n0/2KV 15p
2n2/2KV 15p
470pf 4KV 10p
7500pf/2KV 10p
3000PF/3000V 10p
4n7/2KV 15p
8n2/2KV 15p
0.0082/2500 15p
150/3500 10p
1800/4KV 5p
4.7nf/5KV 10p
170/8KV 10p
180/8KV 10p
210/8KV 10p
1000/10KV 10p
.47/100V 80p

CVC 20-25-30 Mains Switches 75p
Infra Red and Ultrasonic G11 Teletext Decoder Panel £30
RANK & ITT Mains Remote On-Off Switch (720R) £1.50
RANK & ITT Mains Remote Switch 2865 ohm £1.50
RANK & ITT Remote Switch 2800 ohm £1.50
G11 Mains Switch 50p
4 amp Mains Switch 25p
GEC Mains Switch 4 amp 30p
KT3 Mainswitch £1.00
THORN Rotary Mains Switch 50p
G8 Mains Switch 75p
Thyristor 600/4 amp C106/2 24p
G11 Preh Red LED P/Button for C.H. Change 20p
RANK TOSHIBA Transductors TPC-2011 50p
Mains Switch ITT Long Type Print 75p
Mains Switch Philip Long Type TAG 75p
Mains Switch GEC Long Type TAG 75p
Thorn 12 or 24 volt battery convertor for portable colour T/V £6.00

Tube Thermpath 167 £1.00
Rank Secam Decoder Panel UHF & VHF TH5A £13.00

Multi-Caps

220 MFD Sprague 385V 50p
4,700/75 6 amp Rip £2.00
350V 300M + 300M £1.00
400V 400M 60p
350V 400M 60p
Thorn 3500
175/100/100/350v £1.00
KT3/200/25/25/385v £1.00
200+200+75+25M 325V £1.00
300+300+150+100+50MFD 350V £2
G11 CAP 470/250 £1.50
47/220/350v 60p
150/150/100/100/100/320v £2.00
2500/2500/63v 50p
150/200/200/300v 70p
400/400/200v £1.70
300/100/100/16/275v £1.50
100/200/325v 40p
150/150/100/375v £1.50
200/200/75/25M 325V £1
300/300/100/32/32/300v 2.00
1500/2000/30v 50p
Jelly pot Thorn 00D4/013 £3
150/150/100/100/320v £2.00
100/350 + 300/200/100/16/275v £2.00
225+25/380 GEC 70p
200/100/100/350v £1.50
500/500/25v 50p
150/150/100/300v 75p
200/150/150/300v 1.00

ITT 8 and 6 Push Button £1.00
Pye 725 LOPTs £6.00
Pye 731 LOPTs £6.00
Thorn 8500-8800 LOPTs £5.00

CMD 800 Chassis. No tuner £20.00

TAG 226/600 50p
BD 650 50p
UPC 574 30p
BSS 38 30p

G11 £1.50
1 I.C. Receiver Panel

3 I.C. Power Supply G11 Full Remote Receiver Panel £3

Teletext Receiver Model T1 £95
Fits on top of TV with handset.

FET Power VN88AF 50p

PHILIPS SBC 469 Stereo Microphone £23.00
Meters Hills 520 £17.00
Meters Hills 420 £15.00
Infra-red Tester Handset £12.00

Infra Red Hanset Tester

Works at 24 feet – Sound repeater.
Works off 9 volt battery £8.00
Fits in top pocket.

Repaired Handsets

Philips K4-K35, RC5350-RC5300, RC5370, RC5375, repaired same day £10.00
RC4001 Full Remote KT3 K30 Teletext Handsets exchanged £9.00

GEC Full Remote Infra-red, 1983 models £15.00

Timers, 60 mins, small £1.00

G11 Touch Unit Full Remote £13
G11 Ultrasonic Teletext Handset £24.00
8 C.H. Ultrasonic GEC Full Remote C2014H/C2219H £15.00
New Replacement for G11 Ultrasonic Full Remote £12.00
Thorn 4000 insert with 7 buttons £5.00
Decca RC 11 £14.00
Decca RC 12 £14.00
G11 Infra-red full teletext £24.00
Dynatron-Full remote CTV 62, 63, 64 £19.00
Hitachi infra red handset £18
Philips full remote KT3, 16C928/20C934; 7228/7324; K12 26C 797 1ST 66K 1826 £12.00
G11, Full remote top button assy. £12.00
G11, Full remote repair service (exchange unit) £12.00
Philips infra red full remote 9 channel for 60 CP2605 £6.00
Philips infra red full remote 12 channel for 60 CP2605 £12.00
K35
KT3/K30 T Text £15.00
KT3/K30 Full remote £15.00
KT3 Power supply £4.00
Hitachi 8 button unit with resistor unit. Last year mod. £7.00
GEC infra-red 2236-2026 £4.00
GEC push pad handset button blobs 10p each
Pye & Philips handset KT3-K30 chassis. No RC5150-RC5176-RC5171-RC5177.
Special Price £13.00
ITT hand set with TV-Teletex-VCR £12.00
RC4001 KT3 and Teletex £14.00
IT CVC 32 handset repaired £15.00

We have all parts for Philips Handsets

SENDZ COMPONENTS

63 Bishopsteignton, Shoeburyness, ESSEX SS3 8AF
SAME DAY SERVICE
All items subject to availability.
No Accounts : No Credit Cards
Postal Order/Cheque with order
Add 15% VAT, then £1 Postage
Add Postage for overseas
Callers: To shop at 212 London Rd., Southend. Tel. 0702-332992
Open 9-1/2.30-6. GVMT + school orders accepted on official headings add 10% handling charge.

Tuner Units

G8 Tuner V/Cap. New	£2
G8 6 Button Unit	£9
V/Cap Rank UHF Z776T/Unit	£6
V/Cap Rank VHF Z773T/Unit	£5
NEW G8 Tuner V/Cap	£3.50
T20 6 Push Button Unit	£7
ELC2000 on Panel	£2.50
GEC 6 Push Button Unit	£6
ITT 6 Push Button Unit	£6
DECCA 6 Push Button Unit	£6
GEC or Hitachi 6 push button unit 2110 Conversion	£8
GEC 2110 V/Cap	£5
ELC1043 (Ex Panel)	£3.75
ELC1042 NEW	£5.50
ELC2000 NEW	£4.00
ELC2004 NEW	£8.00
ELC2006 NEW	£6.00
GEC Tuner V/Cap Hitachi After 1979 ET548, ET547, ET546, ET541B	£8.00
ASTEC UM1183	£10.00
V314 (VHF)	£5.00
V317 (VHF)	£5
V334 (VHF)	£5
U321	£6
U341 UHF	£7.00
U342 (UHF)	£5
U411 UHF	£7.00
U.V. 411 Tuner	£10.00
U.V. 415	£7.00
U.V. 417	£7.00
Small V/Cap Mitsumi UHF	£4.00
VHF	£3.00
Portable & rotary Tuners Sanyo & Mitsumi UHF	£5.00
NSF-UHF/VHF Varicap (old type)	£8.00
Mosfit UHF/VHF (new type)	£8.00
UE2-B31 Fidelity V/Cap T/Unit	£6
UHF-VHF V/Caps on panel	£3.00
Thorn Tuner PANEL with 6×100K pots + cursors NO TUNER	£1.00
HITACHI 20 Turn Pot	40p
U321 on panel	£6.00
Tuner unit VHS Sylvania GTR Videon MTS 900	£2.50
Mullard Video Modulator. Application. video tape recorders, TV cameras, video games, closed circuit T/V, C.C.I.R. system. Data supplied.	£10.00
VT 100 Sound Tuner Kit. TV. Viosound. The latest design in low noise fitted with DNR, RF output and audio	£30.00
Sylvania UHF F4720B	£6.00
Sylvania VHF 900	£6.00
Small Tuner DX 175-220MHz	

Auto Changeover	£5.00
9000 Thorn Tuner on Panel	£7.00
THORN 1400 4P.B. Mech. Tuner	
THORN 1500 4P.B. Mech. Tuner	
THORN 1590 4P.B. Mech. Tuner	
THORN 3500 4P.B. Mech. Tuner	
THORN 8000 4P.B. Mech. Tuner	
THORN 8500 Mech. Tuner	
All new & boxed.	£4.00 each
Delay Lines	
DL20A 80p DL600	£1.00
G8 (Old Type)	£1
DL600	£1.00
DL700	£1.00
UDL11	30p
KT 3 Luminence	75p
Luminance Delay Line (CVC 45)	
10×630ma fuse	25p
10×500mA	80p
10×1 amp	80p
Co-Ax Joint	15p
Co-Ax Belling Lee Plug	12p
Co-Ax Splitter	£1.00
UHF Modulator CCIR	£3.00
Infra Red Emitting Diode	20p
NE286H Small Neon Lamps GEC & Philips	5p
Mullard 5 Watt Amps. LP1162 New	75p

T.V. Tubes

12"/110° 31/510 with coils Post £2.50	£5
4.5" tube NEC 120ANB4	£8
12" A31/300 Hitachi	£10
15" A38/170W Hitachi	£8
18" Hitachi PIL tube with scan coils 470 KCB22-TC03	£25
10" Black and white tube scan coils & line trans	£6.00

Integrated Circuits

AC76003	£1.50
AM25LS23PC	10p
BAV40	40p
BFR79	15p
BFR81	15p
BFR87	10p
BFS60	10p
BFT42	20p
BFT57	20p
BSD215	50p
MR1366	20p
BRC-M-200	40p
BRC-M-300	50p
BRC 1330	75p
BRC 3064	£1.00
BTT822	£1.00
BTT6016	£1.20
BTT6018/ML237B	£1.50
BTT6218	£1.50
BTT8124	£1.00
BTT8224	£1.00
BUP22A	£1.00
CA270AE	50p
CA270CW	50p
CA270CE	50p
CA920AE	£1.00
CA1310	50p
CA3046	50p
CA3065Q	50p
CA3094AE	50p
CA3123	40p
CA3146	£1.00
CA3189	40p
CBF16848	50p
CD4510	30p
DM7492	50p
HA1196	40p
HA1370	£2.00
HA11223	40p
HEF4001	10p
HBF4011AF	10p
HEF4053B	30p
HEF4066	20p
HEF4528	20p
HD3890C	£3.00
K5731D 1001012	£1.00
LA3220	50p
LM1011N	£1.00
LM8361	£3.00
M913	£2.00
M1024=SAA	£2.00
M1025=SAA	£2.00
MC476p	£1.00
MC1307	75p
MC1312	
MC1330	75p
MC1349	50p
MC1352	£1.00
MC1358	£1.00
MC14002	15p
MC14013	25p
MC14016	25p
MC14066	30p
MC14514	50p
MC1748	80p
MEM4956	£1.00
ML231	£2.50
ETT6016	£2.00
ML232	£2.00
ML236E	£1.00
ML237B	£1.00
ML238B	£4.00
ML239	£2.00
ML926	£1.00
MM5387	£1.00
MM5611	£1.00
MM5840	£3.00
K35 Philips Receiver IC	
M58401I-84	£6.00
MM5290N-4	75p
MM53108N	£4
MR1366	20p
N64100	£1.00
NE555P	60p
NE555	60p
HD38980C	£3.00
IL-1	20p
OPT600	20p
OPT601	20p
SAA611	£1.00
SAA661	£1.75
SAA1020	£4.00
SAA1021	£4.00
SAA1024	£2.50
SAA1025	£2.50
SAA1073	£3.00
SAA1074	£3.00
SAA1075	£3.00
SAA1124	£2.00
SAA1130	£2.50
SAA1174	£3.00
SAA1176	£3.00

SAA1250	£3.00
SAA1251	£4.00
SAA1272	£3.00
SAA1276	£3.00
SAA3027P	£4.00
SAA5000A	£1.50
SAB3013	£2.00
SAB3210	£2.00
SAB4209	£2.00
TBO0124	£1.00
SAA5000A	£1.50
SAA5010	£2.20
SAA5012A	£5.00
SAA5020	£3.50
SAA5030	£5.00
SAA5040	£3.50
SAA5040A	£3.00
SAA5043	£4.00
SAA5050	£3.50
SAF1032p	£2.50
SAF1039	£2.00
SAS560	£2.00
SAS560T	£1.00
SAS570T	£1.00
SAS660	£1.00
SAS670	£1.00
SAS580	75p
SAS590	75p
SAS3210	£2.00
SL437F	£4.00
SL901B	£4.50
SL918	£4.50
TA7122	£1.15
TAA320A	50p
TAA470	£1.50
TAA570	75p
TAA611B	£1.00
TAA621	£2.00
TAA661	£1.00
TAA641	£1.50
TA7108P	£1.00
TA7117	50p
TA7120P	50p
TA7315AP	50p
TA7607AP	40p
TA7609P	50p
TBA120A	40p
TBA120AS	50p
TBA120SA	40p
TBA120B	40p
TBA120SB	40p
TBA120T	50p
TBA120SQ	£1.00
TBA120U	75p
TBA120Q	30p
TBA120C	40p
TBA1441	£1.00
TBA231	75p
TBA395Q	50p
TBA396Q	£1.00
TBA396	75p
TBA440P	£1.00
TBA1440C	£1.00
TBA480Q	£1.00
TBA520	£2.00
TBA530	£2.00
TBA540	£1.00
TBA550Q	£1.75
TBA560CQ	£1.00
TBA570	£1.50
TBA625	50p
TBA641	£2.00
TBA651	£2.00
TBA673	£1.00
TBA720A	£1.50
TBA750Q	£1.50
TBA780	£1.50
TBA800	50p
TBA810AP	60p
TBA810S	60p
TBA820	60p
TBA820M	25p
TBA890	£1.00
TBA920	£1.50
TBA920Q	£1.50
TBA950	£1.50
TBA990Q	£1.00
TMS1000NL	£2.00
TMS1943 N2L (clockchip)	£1.00
TMS9980	£4.00
TMS9901	£1.00
TMS2708JG45	45p
TMS2716JL	£1.00
TMS3529	£1.00
TMS3720ANS	£3.00
TMS4014	70p
TX-012	£1.00
TMS9902	£1.20
ULN2216	75p
UPC566H	£1.00
UPC585C	£1.00
UPC1031H	£2.00
UPC1353C	£1.00
UPC1363C	£2.75
UPC1366C	£1.00
UPC1514C	£3.00
UPC2002	35p
UPD8049HC	£2
SN29848	50p
SN29770BN	£1.00
SN29771BN	£1.00
SN29772BN	£1.00
SN7402N	£1
SN7472N	£1
SN74107	£1.00
SN74167	70p
SN7472N	20p
SN75108AN	£1.00
SN76001	£1.00

SN76003	£1.00
SN76018	£1.00
SN76003	£1.00
SN76008	£1.00
SN76023N	£1.50
SN76110N	£1
SN76115AN	50p
SN76131	50p
SN76141N	£1.00
SN76226	£1.00
SN76227N	£1.00p
SN76228N	£1.00
SN76270	£1.00
SN76532N	£1.00
SN76544N	£2.00
SN76545N	£3.00
SN76546	£1.00
SN76550	30p
SN76552	30p
SN76570	£1.00
SN76620	50p
SN76650	50p
SN76660N	40p
SN76620AN	50p
SN76666	£1.00
SN76705N	£2
SN76707N	75p
SN76708AN	75p
SN76720	£1.00
SN76709N	£2.00
UA783P3C	40p
BT100A/02	40p
BT138/10A	70p
BT146	30p
TBA540Q	£1.50
TCA270	£1.00
TCA270Q	£1.00
TCA640	£1.00
TCA660	£1.00
TCA270S	£1.00
TCA270SQ	£1.00
TCA740	£1.00
TCA800	£5.00
TCA830	£1.00
TCA940	£1.00
TCEP100	£2.25
TCE120CQ	£1.00
TDA440Q	£1.00
TDA1003A	£1.00
TDA1010	£1.00
TDA1012	£1.00
TDA1060A	£1.50
TDA1035T	£3.50
TDA1035SB	£1.00
TDA1072	£1
TDA1151	30p
TDA1170	£1.00
TDA1190	£1.00
TDA1200	75p
TDA1270	£1.50
TDA1327A	£1.00
TDA1365	£3.00
TDA1512	£2.00
TDA2002	£1.00
TDA2003	£1.50
TDA2004	£2.00
TDA2008	£2.00
TDA2010	£1.00
TDA2020	£1.00
TDA2030	£2.00
TDA2140	£3.50
TDA2160	£1.00
TDA2320	50p
TDA2525	£1.00
TDA2545A	£1.00
TDA2600	£5.20
TDA2640	£2.00
TDA2522	£1.00
TDA2530	£1.50
TDA2532	£1.00
TDA2540	80p
TDA2541	£1.00
TDA2546	£3.00
TDA2560	75p
TDA2571AQ	£2.50
TDA2575A	£1.00
TDA2577	£2.00
TDA2579	£2.00
TDA2581	£2.00
TDA2590	£1.00
TDA2591	£1.00
TDA2593	£1.00
TDA2560	50p
TDA2611A	£1.00
TDA2611AQ	£1.00
TDA3651A	£1.00
TDA3652	£2.50
TDA2653	£4.00
TDA2640	£2.00
TDA2680	£1.00
TDA2690	£1.00
TDA2593	£1.00
TDA3190	£1.00
TDA3560	£4.00
TDA3561	£3.00
TDA3571A	£2.75
TDA3590	£3.00
TDA3591	£1.00
TDA3650	£3.50
TDA3651AQ	£3.50
TDA3654Q	£2.00
TDA3710	£3.50
TDA4600	£3.00
TDA9403	£3.00
TDD1610S	50p
TEA1039	£2.00
TEA5114	£1.00
UPC1365	£3.00

UPC1363C	£1.50
TDA3300B	£6.00
SN74LS 125AN	30p
SN74LS 248	50p
SIL4516	50p
SN16861NG	50p
SN16862AN	£1.00
SN16964AN	50p
SN29764AN	£1.00
UA721	40p
UA7300	40p
RGP30G	10p
MPS43A	25p
MJ13005	30p
MJE51T	25p
MJE340	28p
SONY IC 109	£3.00
MJE660	25p
MJE661	25p
MJE3055	£1.00
MJE2801	30p
MJE2955	50p
MJE13005	50p
Sanikron Diode	30p

Philips Cartridges

GP412	£6.00
GP412/11	£6.00
GP406	£6.00

Transistors

A1222	25p
A1223	25p
AC106	25p
AC121	25p
AC124	25p
AC128	25p
AC137	25p
AC151	25p
AC131	25p
AC138	25p
AC152	25p
AC153K	25p
AC142K	25p
AC169	25p
AC176	25p
AC176K	25p
AC178K	25p
AC179	25p
AC186	25p
AC187K	25p
AC188	25p
AC188K	25p
ACY21	25p
AD143	50p
AD149	50p
AD161/162	pair 40p
AF17A	25p
AF139	25p
AF181	£1.00
AF239	25p
AF367	25p
AL102	£1.75
AU110	£1.50
BLY49	50p
BF115	20p
BF121	20p
BF127	20p
BF137	20p
BF157	20p
BF160	20p
BF161	20p
BF164	60p
BF179	30p
BF180	20p
BF181	20p
BF182	20p
BF184	20p
BF194	10p
BF195	10p
BF196	10p
BF197	12p
BF198	10p
BF199	10p
BF200	20p
BF222	10p
BF224	15p
BF238	20p
BF240	16p
BF244	40p
BF245b	20p
BF255	20p
BF256	20p
BF257	20p
BF258	25p
BF262	15p
BF263p	25p
BF264	15p
BF271	10p
BF273	10p
BF274	10p
BF324	25p
BF337	50p
BF355	30p
BF362	20p
BF363	15p
BF367	15p
BF391	15p
BF394	10p
BF419	30p
BF422	15p
BF423	15p
BF448	30p
BF450	20p
BF458	30p
BF459	30p
BF460	30p
BF469	30p
BF470	20p
BF480	50p
BF494	30p
BF594	10p
BF597	10p
BF760	30p
BF819A	20p
BF858	30p
BF869	30p

BF694	10p
BF758	30p
BF760	30p
BFT34	15p
BFT43	10p
BFT84	8p
BFW11	20p
BFX29	30p
BFX84	25p
BFY50	15p
BFY52	20p
BFY90	25p
BLY49	25p
BPW41	25p
BRC116	25p
BRX43	15p
BRX48X	10p
BRY56	30p
BSS68	10p
BSY79	10p
BSY95a	10p
BTY80	20p
BSX19	17p
BSX20	17p
FT3055	30p
TCE82	30p
2N930	5p
2N2221	8p
2N2222	8p
2N2906	10p
2N3055	40p
2N3566	10p
2N3702	10p
2N3711	10p
2N3583	50p
2N3904	15p
2N4355	10p
2N4442	£1.00
2N4444	£1.00
2N5296	40p
2N5983	30p
2N6099	40p
2N6109	40p
2N6130	50p
2N6133	20p
2N6348	20p
2N6399	10p
2X 2N6099 on heat sink	50p
2SA437	20p
2SA992	10p
2SB407 Sanyo TO3	30p
2SB474	10p
2SB566	10p
2SC381	10p
2SC458	50p
2SC515	10p
2SC732	10p
2SC733	10p
2SC940	£1.00
2SC1030	£1.00
2SC1520	25p
2SC1546	20p
2SC1725	20p
2SC2068	20p
2SC2073	8p
2SC2122A	£1.00
2SC2229	15p
2SC2688	20p
2SC7350	15p
2SD180 TO3 80v/6A	15p
2SD200	£2.00
2SD787	30p
2SD880	30p
2SD1576	£1.00
2SK30A	10p

BC107	10p
BC108	10p
BC109	5p
BC113	10p
BC114	10p
BC115	10p
BC116	10p
BC117	20p
BC119	20p
BC125	10p
BC126	10p
BC139	10p
BC140	30p
BC141	25p
BC143	25p
BC147	10p
BC148	10p
BC149	10p
BC153	10p
BC154	10p
BC157a	10p
BC158	10p
BC159	10p
BC160/16	25p
BC171	10p
BC172	10p
BC173	10p
BC174	10p
BC183	10p
BC184	10p
BC204	10p
BC207	10p
BC212	10p
BC213	10p
BC214	10p
BC237	10p
BC238	8p
BC239	10p
BC250	8p
BC251	10p
BC252	10p
BC262	10p
BC263b	20p
BC294	30p
BC298	10p
BC300	30p
BC301	30p
BC303	30p
BC307	7p
BC308	7p
BC309	10p
BC327	10p
BC328	10p
BC328/338 pair	15p
BC337	10p
BC338	10p
BC347	10p
BC349b	10p
BC350	20p
BC365	10p
BC368	10p
BC384	10p
BC394	10p
BC413	10p
BC414	10p
BC416	10p
BC440	30p
BC454	10p
BC455	10p
BC456	10p
BC460	25p
BC462	10p
BC463	10p
BC478	10p
BC527	10p
BC532	10p

BC546	10p
BC547	10p
BC548	10p
BC556	10p
BC557	10p
BC558	10p
BC559	10p
BC635	10p
BCX31	25p
BCX32/36 Pair	75p
BCX32	25p
BD116	25p
BD124	30p
BD124 (metal)	30p
BD130Y	25p
BD131	30p
BD132/238	30p
BD135	25p
BD136	30p
BD138	30p
BD140	30p
BD176	25p
BD182	£1.00
BD183	70p
BD202	60p
BD204	60p
BD207	60p
BD221	20p
BD222	30p
BD228	30p
BD226	20p
BD233	30p
BD235	30p
BD238	30p
BD239	15p
BD240	50p
BD243c	30p
BD244	30p
BD250a	50p
BD252	20p
BD253B	30p
BD331	20p
BD373b	20p
BD416	25p
BD433	20p
BD437	25p
BD438	30p
BD439	30p
BD544	40p
BD678	30p
BD681	30p
BD682	30p
BD507	50p
BD509	30p
BD510	30p
BD517	30p
BD519	30p
BD534	30p
BD535	30p
BD544D	30p
BD562	30p
BD610	40p
BD646	50p
BD676A	30p
BD807	20p
BD826	30p
BD948	30p
BDX75	20p
BDX32	£1.25
BDU64B	50p
BF761	30p
BF769	30p
BF819A	30p
BF858	30p
BF871	30p
BFR39	15p
BFR52	7p

Thyristors

IR106A	30p
BT151/800R	80p
BT106 Plastic	30p
BT106 Metal	£1.20
BT119	£1.00
BT120	£1.00
BRC4443	75p
G11 Thyristor	60p
Decca 80-100	60p
2N4444	£1.00
MCR72-6	25p
OT112	£1.00
TF320M	£1.00
HC0441	£2.00
17052	£2.00
17088H	£2.00
17089R	£2.00
17053R	£2.00
SP2M	50p
MCR72/6	50p

Thermistors

G8 Degausing	35p
Philip type VA1104	70p
ITTP7266312	15p
PTH451 AOR	15p
PT37P Fits Pye & PT34	20p
Degausing Thermistor (fits most sets)	20p
GEC Double Thermistor	25p

Filters

5-5MHz	15p
6MHz	30p
I.C. Heat Sink	20 for £1
20×TO5 Heat Sink	£1.00
CVC 9 power supply board	£1.50
CVC 20/2 mains panel	£2.00
ITT Mains Filter .1/250v/ CVC 5 to CVC 45 3 pin type	20p
Pots 10 k with Switch	25p
Mullard Surface Wave Filter RW 153P Colour TV Filter	40p
Mullard Surface Wave Filter RW 154 Colour TV Filter	40p

TV Crystals

4MHz	
4.433-619	
6MHz	
8.867238	
11.059.000	30p
Large or small	50p each
NEC 4730312	£3.00
Line Tran Tripler in Case	
Antistatic Isolators Disc Type Black	10p
RCA 1693	£1.00

I.C. Holders

DIL - DIL		DIL - QIL	
40 Pin × 4	£1.00	16 Pin × 10	£1.00
42 Pin × 5	£1.00	18 Pin × 10	£1.00
28 Pin × 5	80p	28 Pin × 4	£1.00
16 Pin × 10	70p	AB Mains Switch u/v	30p
24 Pin × 5	75p		
14 Pin × 10	70p		
18 Pin × 10	80p		