MAY 198[illegible] £1·50

TELEVISION

SERVICING·PROJECTS·VIDEO·DEVELOPMENTS

Build this Signal Tracer

Also: Solid-state Image Sensors
Laser Power Meter Test Report
DX-TV • Grundig's Satellite TV Rx
VCR Clinic • TV Fault Finding

05
9 770032 647009

TELEVISION

May 1989 — **Vol. 39, No. 7 Issue 463**

On sale April 19th

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.

INDEXES
Indexes to Vols. 36 and 37 are available at 80p each from the Editorial Office (address above).

SUBSCRIPTIONS
An annual subscription costs £18 in the UK, £21 overseas (by surface mail). Send orders with payment to Quadrant Subscription Services Ltd., Oakfield House, Perrymount Road, Haywards Heath, Sussex, RH16 3DH.

BACK NUMBERS
Subject to availability, copies of issues published during the last 12 months are available at £1·80 each from Television, Vouchcheck Services, Unit A6, Poplar Business Park, Prestons Road, London E14 9LR. Please make cheques/postal orders payable to IPC Magazines Ltd.

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. Correspondents 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

OUR NEXT ISSUE DATED JUNE WILL BE PUBLISHED ON MAY 17

P. V. TUBES

104 ABBEY STREET, ACCRINGTON, LANCS BB5 1EE.
Tel: 0254 36521/32611/390936
Telex: 635562 Griffin G (For P.V.)
Partners S. & B. Cucknell
24hr. answering service

TRADE COUNTER OPEN MON-SAT 9am-5pm

New Fax No. 0254 395361

HOW TO ORDER

Up to 1K ADD 87p per order P+P (U.K.) Heavier parcels e.g. cable, service aids, degausing coils please allow £3.25 P+P (U.K.). Export orders charged at cost. First Class Mail is used whenever possible. Add 15% VAT to total except where it states zero rate. Bulkier items will be sent by carrier £7.50 + VAT up to 25K (except tubes)
We do not despatch on Saturdays.

THERE IS VAT ON P+P.

BOOKS AND MANUALS ARE ZERO V.A.T.
Goods are despatched on the day we receive your order. If for any reason we are out of stock we will try to inform you as quickly as possible. We try our best to give a speedy, fair and efficient service. V.A.T. invoice on request. Give us a ring – we'll give you service. Please ask if what you need is not listed – we will try to help. Prices are subject to change without notice. In some cases we may have to supply an equivalent.
We need expiry dates for credit card orders

VIDEO SPARES

WE ARE SOMETIMES ABLE TO SUPPLY TO TRADE ONLY EX. RENTAL, WORKING VIDEO RECORDERS. PLEASE RING FOR PRICE AND AVAILABILITY.

SPECIAL PRICES ON 5+ MIX VIDEO HEADS

PLEASE ASK!

REPLACEMENT VIDEO HEADS

AMSTRAD

"	4500/5200/9000	
	PSF1 (VIP1000)	25.00
"	4600 PSF2	25.00
"	7000 SHSSR	25.00

AKAI

VS1	3HSSA	19.50
VS2	3HSSA	19.50
VS3	3HSSA	19.50
VS5	3HSSA	19.50
VS10	3HSSA	19.50
VS77	3HSSA	19.50
VS88	3HSSA	19.50
VS7100	3HSSA	19.50
VS7200	3HSSA	19.50
VS9300	3HSSA	19.50
VS9500	3HSSA	19.50
VS9700	3HSSA	19.50
VS9800	3HSSA	19.50

FERGUSON

3V00	3HSSV	18.00
3V01	3HSSV	18.00
3V06	3HSSV	18.00
3V16	3HSSV	18.00
3V22	3HSSV	18.00
3V23	3HSSV	18.00
3V24	3HSSV	18.00
3V29	3HSSV	18.00
3V30	3HSSV	18.00
3V31	3HSSV	18.00
3V35	3HSSV	18.00
3V36	3HSSV	18.00
3V42	3HSSVA	24.00
3V43	3HSS4VD	49.00
3V45/6	3HSSVA	24.00
3V47	3HSSVA	24.00
3V48	3HSS4VC	47.00
3V52	3HSSVA	24.00
8903	3HSSV	18.00

HITACHI

VT6500	3HSSHA	25.50
VT7000	3HSSHA	25.50
VT8000	3HSSHA	25.50
VT8040	3HSSHA	25.50
VT8100	3HSSHA	25.50
VT8500	3HSSHA	25.50
VT8700	3HSSHA	25.50
VT9000E	3HSSHA	25.50
VT9300	3HSSHA	25.50
VT9500S	3HSSHA	25.50
VT9700	3HSSHA	25.50
VT9900	3HSSHA	25.50
VT4000	3HSSH	25.50
VT4200	3HSSH	25.50
VT5000	3HSSH	25.50
VT5500	3HSSH	25.50
VT11E	3HSSHB	25.50

ORION

VH1	3HSSN	18.00
VH2	3HSSN	18.00

TOSHIBA

V31	PS3BT	30.00
V33	PS3BT	30.00
V55	3HSSV	18.00
V57	3HSSV	18.00
V5470	PS3BS2	25.00
V9600	PS3BT	30.00

JVC

HRD110	3HSSV	18.00
HRD111	3HSSV	18.00
HRD120	3HSSV	18.00
HRD121	3HSSV	18.00
HRD220	3HSSV	18.00
HRD225	3HSSV	18.00
HR2200	3HSSV	18.00
HR3300	3HSSV	18.00
HR3320	3HSSV	18.00
HR3330	3HSSV	18.00
HR3350	3HSSV	18.00
HR3360	3HSSV	18.00
HR3660	3HSSV	18.00
HR3860	3HSSV	18.00
HR4000	3HSSV	18.00
HR4100	3HSSV	18.00
HR7200	3HSSV	18.00
HR7600	3HSSV	18.00
HR7610	3HSSV	18.00
HR7650	3HSSV	18.00
HR7700	3HSSV	18.00

NEC

PV760	PS3BS	19.00
PV764	PS3BS	19.00
PV774	PS3BS	19.00
N830	PS3BS	18.00
N831	3HSSV	18.00
N832	3HSSV	18.00
N833	3HSSV	18.00
PV2300	PS3BS	19.00
PV2400	PS3BS	19.00

SONY

SLF1	PS4B2S	29.95
SLC5	PS3BS	19.00
SLC6	PS3BS	19.00
SLC7	PS3BS	19.00
SLC8	PS5B3S	39.95
SLC9	PS5B3S	39.95
SLC20	PS4B2S	29.95
SLC24	PS4B2S	29.95
SLC30	PS4B2S	29.95
SLC33	PS4B2S	29.95
SLC40	PS4B2S	29.95
SLT50	PS5B3S	39.95
SLF60	PS5B3S	39.95
SLK95	PS5B3S	39.95
SL200	PS5B3S	39.95
SL3000	PS3BS2	25.00
SL8000	PS3BS2	25.00
SL8000	PS3BS2	25.00

SANYO/FISHER

FVHP615	3HSSSF	35.00
FVHP910	3HSSSF	35.00
5000	PS3BSF	29.95

PHILIPS

DV462	3HSSU1N	25.99
6460	3HSSU1N	25.99
6520	3HSSU1N	25.99
2558	6462/3/4 6560 6660	45.00

NATIONAL PANASONIC

NV100	3HSSU1N	25.99
NV230	3HSSU2N	36.97
NV250	3HSSU2N	36.97
NV270	3HSSU2N	36.97
NV280	3HSSU2N	36.97
NV300	3HSSN	18.00
NV322	3HSSN	18.00
NV330	3HSS3N	35.99
NV333	3HSSN	18.00
NV340	3HSSN	18.00
NV366	3HSS4NA	43.40
NV370	3HSSU1N	25.99
NV380	3HSSU1N	25.99
NV390	3HSSN	18.00
NV450	3HSSU2N	36.97
NV470	3HSSU2N	36.97
NV480	3HSSU2N	36.97
NV600	3HSS3N	35.99
NV730	3HSS4NB	41.95
NV777	3HSS3N	35.99
NV861	3HSSN	18.00
NV2000	3HSSN	18.00
NV3000	3HSSN	18.00
NV7000	3HSSN	18.00
NV7200	3HSSN	18.00
NV7500	3HSSN	18.00
NV7800	3HSSN	18.00
NV7850	3HSSN	18.00
NV8170	3HSSN	18.00
NV8200	3HSSN	18.00
NV8400	3HSSN	18.00
NV8600	3HSSN	18.00
NV8620	3HSSN	18.00

SHARP

110	3HSSSP	26.95
381	3HSSSP	26.95
383	3HSSSP	26.95
384	3HSSSP	26.95
385	3HSSSP	26.95
386	3HSSSP	26.95
387	3HSSSP	26.95
388	3HSSSP	26.95
481	3HSSSP	26.95
482	3HSSSP	26.95
2000	3HSSSP	26.95
3300	3HSSSP	26.95
9100	3HSSSP	26.95
9300	3HSSSP	26.95
9400	3HSSSP	26.95
9500	3HSSSP	26.95
9600	3HSSSP	26.95
9700	3HSSSP	26.95

ALL REPLACEMENT HEADS ARE NEW AND GUARANTEED

GENUINE HEADS

Sony 8900UB	49.39
Sony SLC9	49.39
Sharp 3300/9700	56.00
Toshiba 9600 (upper assy)	14.50
Hitachi VT336 GEC 4004	35.62
Sanyo 9300/9435/9500	53.00
Philips V2000	64.00
Philips 1700	71.00
Amstrad 7000	40.00

BELT KITS

		no of belts	
VK1	Akai VS9300/9500/9800 JVC HR3300/3320/3330/3360 TCE 6989/SV00/SV16/SV22	7	2.40
VK2	Nat Pan NV70008/7200B	5	1.45
VK3	Sony SLC5/7	6	2.25
VK4	Sony SL8000/8500/8600	6	3.60
VK5	Sony SL3000UB	7	2.10
VK6	Nat Pan. NV3000B	6	1.99
VK7	Sanyo 9300P	4	2.75
VK8	Nat. Pan. NV2000B	6	1.73
VK9	Nat. Pan NV8600B/8610/V011	7	1.50
VK10	Toshiba V8600	6	1.45
VK11	Sharp VC7300	5	1.50
VK13	Sanyo VTC5000	2	1.50
VK14	Sanyo VTC5300	5	1.85
VK15	JVC HR7650/3V31	3	2.00
VK16	Hitachi 5000		1.90
VK17	Sharp 8300	6	1.76
VK18	Sharp 9300	5	1.47
VK19	Hitachi VT8000/8300/8500	3	1.05
VK20	Hitachi VT11/33	6	1.50
VK21	Hitachi 9500	3	1.12
VK22	Sony SLC6	6	1.90
VK23	Sanyo 5500	3	1.05
VK24	Nat Pan. NV300/NV333	6	1.55
VK25	Toshiba V7540	5	1.90
VK26	JVC/HR 7700/3V23	2	0.96
VK27	Thorn 3V29	4	1.75
VK28	Amstrad 7000	3	1.45
VK38	Amstrad 4500/9000		3.25
VK39	Amstrad 4600/5200		5.19
VK29	Nat Pan NU777	4	1.00
VK30	Sony T9	6	2.20
VK31	Toshiba 9600	4	1.20
VK32	Sanyo 1100-1300-1500		0.75
VK33	Ferguson 3V35-36		0.69
VK34	Ferguson 3V42-3-4-5-8		0.90
VK35	Fisher FVHP710-716-722		1.20
VK36	Panasonic NV370-430		1.20
VK37	Hitachi 9300		0.85

TAKE UP IOLER ASSY/CLUTCH ASSY

VHS (general purpose) Thorn/JVC etc	4.95
Sharp 381/383/386/9100/9300/9500/0005/GEZZ	2.20
Sharp 0006/GEZZ VC300/387/481/2/3 6/496/581/5/8581	2.20
Sanyo Reel Drive Pulley 143-0-662 T0202/TD1282	5.10
Hitachi F/F Idler 6886971 (UT11E/UT33E)	2.90
Philips VHS Idler 4822 522 203 34 4822 528 784 84	3.50
Fisher/Siemens 143-0-4904 00900	3.95
Fisher/Siemens 143-0-4204 00300/400	4.50
Sanyo 5000 RLR.ASS 1430741T 20001	1.85
Idler (Alba 4000 Sentra GX8000)	3.20
Idler Samsung VI 511, 520, 610, 611, 620	1.75

PINCH ROLLERS

Amstrad 4500/4600/5200/9000	3.75
Amstrad 7000	3.75
Nat Pan. NV7000	3.75
Sanyo VTC9300/VBS7000	3.75
Sony C7/J7/SL17	3.75
JVC TCE3V00/01/06/16	3.75
JVC 23/24	3.75
JVC HR2200/3320/3330/3V22	3.75
JVC 3660/1100/7700	3.75
Akai VS9700	3.75
Hitachi VT5000	3.75
Sharp VC6300/6500	3.75
Sony T C. General	3.75

MOTORS

VHS Drum Motor	25.50
VHS Capstan Motor	25.50
Sanyo 5000 Reel Motor	12.95
Sharp Reel Motor	19.50

VIDEO CARE

Video Cleaning Tape VHS	8.23
Universal Copying Kit	7.50
Head Cleaner	0.96
Beta Eccentricity Gauge	57.92
Chamois Cleaning Sticks	0.25

AMSTRAD SPARES

VIDEO RECORDER VCR4600/5200

1750	Pinch Roller (also 4500)	3.75
1226	Clutch (also 4500)	4.25
1227	Gear Holder (also 4500)	10.53
1231	RF Clutch	5.80
7593	Belt Kit	5.19
1981	Cass. Lamp (also 4500)	1.80

VIDEO RECORDER VCR 7000

MD150143	Dew Sensor	1.91
MD150148	Loading Motor	6.02
MD150293	Reel Break Unit	12.50
MD150287	Video Head (Genuine)	40.00
	Video Lamp	0.45
1759	Pinch Roller	3.75
1059	Idler	1.80
7550	Belt Kit	1.45
1950	Cass Lamp	0.45

VIDEO RECORDER VCR 9000

1758	Pinch Roller	3.75
1225	RF Clutch (also 4500)	4.00
1226	Clutch	4.25
1227	Gear Holder	10.53
1981	Cass Led (also 4500)	1.00
7592	Belt Kit (also 4500)	3.25
MD150821	Drive Belt	1.25
MD150820	Main Belt	1.25
	Video Head (PSFI)	25.80

NAT. PANASONIC VIDEO SPARES

VXP0243	Play Idler NV8600/8610	1.10
VXP0401	Idler Unit NV333/366	1.08
VXP0344	Idler Unit NV7000/7200/7800	1.22
VXP0331	Idler Unit NV3000	1.28
VDG0141	Cam Gear NV370/430/730/830/850	1.00
VXP0521	Idler Arm Unit NV370/430/830/850	4.08
VXP0325	Loading Gear NV333/2000/3000/7800	1.83
VXP0520	Load Gear Unit	1.36
VDG0016	Action Gear NV333/2000/3000	0.58
VDG0017	Interim Gear NV333/2000/3000	0.62
Direct Rep	Video Bulb	1.30
VXP0433	Play Idler Unit NV333/336	5.50

HITACHI/GEC SPARES

VCR GEC 4000H/HITACHI 8000

Belt Counter (122) V6354241	0.63
Belt Loading V6354921	0.58
Belt Take-up (239) V6354401	0.40
Idler FF/RWD V6413663	2.68
Lamp Tape Sensor V5762281	0.87
Play Idler Assy V6414221	5.04
Pressure Pinch Roller V6383762	6.96
Pulley FF/RWD V6383531	0.70
Relay V5641204	3.42

VCR GEC V4100/HITACHI VT11E

Belt 312 V6355601	0.47
Belt 313 V6355591	0.40
Belt 317 V5357531	0.63
Belt 318 V5355581	0.54
Capstan Motor V5577355/6	29.94
Clutch Assembly	8.47

SERVICE MANUALS

GEC-V4004 Hitachi-VT33E	9.69
GEC-V4005H Hitachi-VT63	6.43

VCR GEC 4001H/V4002H HITACHI 9300/9500E

Belt (259) V6355291	0.63
Belt (289) V6355282	0.63
Belt Take-up (213) V6354231	0.40
Capstan Motor V5577324	30.00
Idler FF/Rewind V6861471	2.43
Lamp Tape Sensor V5767131	0.65
Play Idler Assy V6861482	5.02
Pulley FF/Rewind V6345173	0.40
Remote Control Handset V7084733	13.40

VCR GEC V4004/HITACHI VT33E

Belt (302) V6355561	0.40
FF/Rewind Arm V6886971 (Gen Hitachi Idler)	2.90

SUNDRIES

Vertical Output Module GEC-C2286 Hitachi-CPT2226 GEC-2067 GEC-2069 Y2370551	6.21

VIDEO LAMPS

Nat. Pan. VHS Bulb (also Sharp)	1.30
General Purpose VHS Bulb	0.50
3V23 with Plug	1.59
3V29 with Plug	1.59
Amstrad 7000	0.45
Amstrad 4500/4600/5200/9000	1.00
Hitachi 9300/9500	0.65

IDLER TYRES

	O DIA	*I.DIA*	*WIDTH*	
Sony	23 7	17.4	4.9	0.50
Sony	24.2	18	5.1	0.50
Hitachi	31 8	25	4.9	0.50
Nat Pan	37 0	29	3.9	0.52
Nat Pan.	31.2	25	3 1	0.56
Akai	26 0	20	3.9	0.50
JVC	39.3	32.8	3.9	0.56
JVC	33.0	23.9	4.0	0.56

Please send large SAE (30p stamp) for our complete catalogue

ORDERS WELCOME FROM SCHOOLS, COLLEGE, GOVERNMENT ESTABL.

SATELLITE TV

ARE YOU READY?

Please ring for prices on

Sakura Remote Controlled Satellite Dish £215

We also have

Signal Strength Meter **£45**

Compass **£6**

RG59BU Cable (for short to medium runs 100 metres) **£19.95**

TR100 Cable 100 metres (for longer runs) **£29.95**

Screw on F connectors **35p** (suitable for both types of cable)

F connectors crimp on (RG59) **24p**

F connectors crimp on (TR100) **18p**

Crimping tools **£19.95**

Top grade crimping tools **£29.95**

See 'Aerial Equipment' for Wall Brackets, Masts, etc.

NEW PRODUCTS

Nat. Pan. Service Manuals

TC261G	£3.50
TC262GA, TC275G	£3.50
TC361G, TC4816R	£3.50
TC8626	£3.50

New Ferguson Service Manuals

3V35	£29
3V38 Supp.	£1.50
3V39 Supp.	£1.50
3V48	£9.95
3V53	£9.95
3V54/5	£10.20
3V58	£10.95
3V59	£13.50
3V64/5	£13.00
FV10D	£7.95
FV11R	£3.95

VIDEO TAPES

SKC	E120 (VHS)	2.30
	E180 (VHS)	2.45
	E240 (VHS)	3.45
Scotch	E60 (VHS)	3.05
	E120 (VHS)	2.89
	E180 (VHS)	3.50
	L750 (BETA)	3.65

REMOTE HAND SETS

AMSTRAD

TV/Video – TVR-1-MD1511910	15.00
CTV 1409 – MD1409221	15.00
VCR 5200 – MD151175	17.00
VCR 7000 – MD150583	10.00
VCR 9000 – MD150878	10.00

DECCA

80/100 Non-Txt US8511	19.50
101 Series Non-Txt US 8513	23.50
Tatung 145/150	17.50

FIDELITY

CTV 20R/22R/140R	
4 Button IR8876	13.75
IS 500 12 Button FD09820	13.81
F14R 12 Button FD09156	13.81
AVS 14 Button FD09111	13.75
Txt 32 Button IR8983	15.90

G.E.C.

4001/Hitachi 9300	9.93
GC56520831/C1404H-C1658H-IR8314	31.80
GCA 512220/C1653	22.00
GCA 512230/C2086H-C2087H	
GCA 514620/C2089H-C2090H IR8823 C2290H, C2889	23.50
GCA 510710/C2067H-IR8456	23.50
GCA 510870/C2069-C2269H-IR8877	27.50

GRUNDIG

RTP05/VRC IR138 – TP8-120-120E	13.50
TTP06/IR107N – TP160-160E	13.50
RTP07/IR380N – TP200-300-390	13.50
RTP20/VRC112 – TP16-21-21VHR	13.50
RTP400/401 IR401 – TP400VT-500VT	13.50
VRC 204 U.S. – TP12	13.50
IR 8613 TXT. – TP400TT	13.50

GRANADA

Universal IR8450	16.50

I.T.T.

CVC 32 – RG15-US8573	25.00
CVC 45 – RG5-US8262	25.00
RG 305 – With Mute IR8649	29.04
RG 306 – With Fine Tune IR8650	22.65

J.V.C.

TP 843/Txt IR170	13.50

PHILIPS

G11 Txt IR8435/IR170/843	13.50
G11 Txt US 31 Button 691-17181	29.42
G11 Non Txt US 8263	21.50
G11 2 Function US 8518	18.75
KT3/K30 Non Txt IR8331	15.85
KT3/K30 Txt Ir8420	17.90
KT3/K30/K35/K40 Txt/Non Txt (Replaces RC5 Series)	13.95

SONY

SLC5 – RM 75T	29.04
SLC6 – RM 72	22.62
SLC7 – RMT 200	49.87
SLC9 – RMT 213	45.00

THORN/FERGUSON TV REMOTES

The following TV remotes are exact replacements for Thorn sets and cover a wide range of chassis inc TX9/10 90/100 Please state model number of set or original hand set number

Type	*Order Type*	
T651	M739	All One
T652	M738	Price
T653	M737	
T716	M737	13 00
T717	M737	
T718	US8517	
T719	M737	
T720	M739	
T721	M737	
T723	M737	
T724	M739	
T725	M750	
T731	M738	
T732	M739	
T733	M738	
T734	M734	
T736	M739	
T737	M737	
T738	M738	
T739	M739	
T740	M740	
T742	M742	
T748	M748	
T750	M750	
T769	M739	
T770	M739	
T772	M742	
T773	M740	
T775	M739	
T778	M738	

SAME DAY DESPATCH
FAST – FAIR – EFFICIENT SERVICE

JUST ASK!!

We cannot advertise our complete range of products Please ask if you require something which is not listed, ie Stationery, Styli, Axial/Radial Electrolytics, Mixed Dialectric Caps, Polyester Caps, Carbon Resistors, Wirewound Resistors, Filament Lamps, Thermistors, LEDs, IC Sockets, Floppy Discs, Computer Cassettes, Thorn New Life Tubes (collection only), New Mono Tubes, Crystals Cables (post charges extra), Aerial Equipment, Electrical Plugs/Sockets, Components for Sinclair, Amstrad Security Products, Satellite Dishes and Accessories

THORN VIDEO REMOTES

3V23 I.R. 8817	14.95
3V31 I.R. 8945	14.95
3V35 I.R. 8946	14.95
3V43 I.R. 8947	19.12

P.R.C. 6000

Programmable remote control unit will operate most infra-red equipment. 60.62

REMOTE REPAIR KITS

Includes Foil/Buttons/Inst.

KT3/K30 Without Txt	8.95
KT3/K30 With Txt	8.95
RC 5352 Range	9.25

REMOTE CONTROL TESTER 29.24

MAGIC MIRRORS

a new device which tests infra red equipment 8.00

AERIAL EQUIPMENT

GENERAL LASHING KITS/ACCESSORIES

6" Pressed Bracket	0.86
6" Bracket with Kit (lashing kit)	2.18
9" Welded Bracket Chimney	2.53
9" Bracket with Kit	2.90
Double Brackets	2.77
Double Brackets with Kit	5.29
13, 5" Cradle Bracket	2.25
13, 5" Cradle Bracket with Kit	4.25
Standard Repair Pack	1.27
Double Repair Pack (2)	2.56
Corner Plates	0.08
Lashing Wire	0.85
Lead Wall Nails (100)	6.17
Rawlbolts	0.60
Cable Clips (Pk 100)	0.91
Coax Plugs	0.18
Coax Plug Female	0.75
Line Connectors	0.16
Attenuators	1.80
Tape Sm 0.32 Lg	0.60
Wood Screws	0.08

WALL BRACKETS

6" Welded	1.30
12" T&K	3.74
9" Welded	2.41
Gutter Brackets	1.00
18" T&K	4.65
24" T&K	5.35

CLAMPS

1" × 1"	0.85
2" × 2"	1.33
1" U Bolts	0.20
J Bolts	0.20
1 25 U Bolts	0.20
2" U Bolts	0.28

UHF TV AERIALS

10 Element State Group A, B, CD, WB	2.14
18 Element	4.12
DIY Aerial Pack	
10 Ele, 3ft Mast, Coax Fittings	9.50

VHF/FM AERIALS

3 Element	6.70
4 Element	8.03
Omni Directional (Round)	8.93

MASTS

3 ft Crank L or S Shape	1.20
6 ft 1"	1.79
10 ft 1 5"	7.00
12 ft 1 5"	8.50
16 ft 2"	14.41

BACK BOXES

Plastic Single	0.68
Plastic Double	1.09
Metal Single	0.45
Metal Double	0.88

OUTLET BOXES

Surface Single	0.80
Surface Twin	1.10
Y Splitter	0.85
Flush Single	0.95
Flush Twin	1.20

LEADS

2M Fly M/M See Special Offers	0.60
2M Fly M/F See Special Offers	0.60
4M Fly M/M See Special Offers	1.20
10M Fly	1.90
FIG 8 Mains Leads	0.62
Computer to TV	1.10
5 Pin Din to 5 Pin Din	0.98
TA81 Car Battery Thorn 1691	4.47
TA51 Car Battery Thorn 1615	4.35
Car Battery Philips	3.95
Scart Leads 2M (Open End)	2.50
Scart Plugs	1.95
Scart Sockets	0.85
Scart to Scart Lead	4.95
Scart Lead Kit	6.44
Test Lead Kit	3.75

CABLES

Antiference Coax 100m S540	33.70
75R Coax Cable (100m) Low Loss	13.50
75R Coax Cable (250m) Low Loss	32.75
4 Core Security Cable (100m)	5.55
6 Core Security Cable (100m)	7.94
8 Core Security Cable (100m)	10.31
4 Core Telephone Cable (100m)	9.99
6 Core Telephone Cable (100m)	13.28
3402 3 Core Round 13amp (50m)	28.21
3162 3 Core Round 3amp (100m)	15.75
2242 2 Core Round 6amp (100m)	15.47
4 Core Flat Cable (100m)	20.82
Twin Core Cable Screened (100m)	11.50
6491X Earth Cable Green/Yellow 1sq mm (100m)	7.00
46199 Single Screened Microphone (100m)	5.35
F041 2mm Loudspeaker Cable (100m)	5.53
CCPU2 Twin Pick Up 100m	9.95
81C 8 Core Ivory – All Cores Colour Coded (100m)	4.00
3183Y 3 Core 15amp upt 3kw Flexible 1 5 sq mm	49.70
3183Y 3 Core 10amp upto 2kw Flexible 1 0 sq mm	36.40
6491X Earth Green/Yellow 6mm	39.60
6181Y Lighting Red/Grey 1mm	14.50
6242Y Grey Lighting Twin/Earth 1mm	21.00
6242Y Grey Ring Main 2 5 Mil	38.20

CABLE TIES

Up to 25mm Diam (100)	0.84
Up to 55mm Diam (100)	2.11

TV WALL BRACKETS

P5245 Teletwist (12"-20")	24.16
P6045 Designer Twister	27.00
P6041 Little Twister	14.08
P5218 Swivel and Tilt Bracket	24.67

Heavy or bulkier items such as cable will be sent by overnight carrier at £7.50 + VAT

LABGEAR

CM7261	P.U.	12.39
CM7262	P.U	13.50
CM7065	UHF/VHF WB	16.18
CM7066	UHF/WD	14.74
CM7260	VHF H Gain A/B/CD	17.57
CM7253	Behind Set (Mains)	15.81
CM7243	Second Set Amp	14.73
CM7093	Three Set Amp	18.55
CM7063	Dist. Amp VHF/UHF	25.77
CM7108/7298	8 + 1 Dist Amp	49.96
CM9700	27MHz CB Suppressor	4.90
CM6011	Outdoor Splitter	8.63
CM9003/00	Flush Sing. Outlet	1.95
CM9003/01	Flush Sing Out Isolat	2.36
CM9010	Flush Twin Outlet	2.47
CM9034	UHF Filters A/B/CD	8.89
CM9033	6 Way Pass Split	11.72
CM7042	TV Games Combiner	3.24
CM9009	Flush TV/FM Emulator	3.88
CM9006	VHF/UHF Diplexer	4.17
CM7122	Televerta Up VHF to UHF	41.90
CM7057	Televerta Down UHF/VHF	49.70
CM7294	Dist. Amp, UHF/VHF	24.96
CM7274	4 Way Dist Amp	26.15
CM7082	UHF/VHF Dist Amp	74.14
CM7080/10	UHF MHA	16.89
CM7271	UHF Wideband `5 db	9.09
CM5004	4way Video Dist. Amp	60.20

ANTIFERENCE

Universal No 1 Clamp	1.30
SB11 Splitter	2.50
CS200 Combiner/Splitter	3.94
CO811 Outlet	0.96
PU1240 Power Unit	11.65
PU1300 MHA	9.09
Diplexers	0.68
Matched Transformer	2.83
XS2 Xtraset	14.46
XS04 4 Way DA	22.50
XS 4/6	43.13
Super Set Top Aerial	6.50
Caratenna Aerial	7.20
Traveller Aerial	11.50
Silver Sensor Aerial	7.40
XG8 High Gain Aerial	21.00
Power Sensor Aerial with Amp	24.95
Mercury Set Top Aerial	2.30
Loop Aerials	1.00
Coax Cable S540 100m	33.70

SPECIAL OFFERS

Laco Plug Tops 13 Amp Box of ten	3.80
Little Twister T.V. Bracket	12.95
SKCE 180 VHS Video Tape Box of ten	21.95
BY127 Pack of ten	0.75
9 volt cassette motors CW	3.50
2 metre M/M Fly leads	0.45
2 metre M/F Fly leads	0.50
4 metre M/M Fly leads	1.00

ELECTRICAL PLUGS SOCKETS

Safe Block Mains	8.50
FC3W 3 Pin 10A Flex Connector	1.50
TS1 13A Single Trailing Socket	1.40
TS2 13A Twin Trailing Socket	2.65
4 Way 13A Mains Connector	6.75
13Amp Plugs	0.48
Surge Protector Plug	12.50
320A Single Gang 13A Socket	1.30
320B Single Switched 13A Socket	1.95
320C Two Gang 13A Socket	2.53
320D Two Gang Switched 13A Socket	3.92
International Travel Plug	3.50
320E One Gang/One Way Switches	0.80
320G Two Gang/Two Way Switches	1.78
3 Way Mains Adaptor	3.80
13 Amp Screwless Plug Tops	0.70

COMPUTER ACCESSORIES

DISKS

Goldstar 5 25" Floppy Disks	
2DD OS/QD (Box 10)	5.66
Goldstar 3½" Diskettes	
HF 2DD DS/DD (Box 10)	8.30
Unbranded 3½" Diskettes	
DS/DD (Box 10)	7.70
Amstrad 3" Disks	20.00

STORAGE BOXES

3½" Library Case (10)	1.95
Lockable Box Holds	
(40 × 3½") (20 × 3")	8.50
5¼ Disk Box	9.37

COMPUTER CASSETTES

C15	0.30
C20	0.34

Special Prices on 20 or more

AUDIO CASSETTES

Altai C90	0.25
TDK D60	0.70
TDK D90	0.90

MORE NEW PRODUCTS

CASSETTE HEADS

Redifusion Mark 4 Remote Text	16.95
Mitsubishi Remote Text	16.95
Mitsubishi Non Text	16.95
Phantom 240 Extrernal IR Detector	41.25
Castle Petite 5 Zone Digital Security Panel	49.95
Hitachi VT11E Clutch Assembly	8.47

EXPORT ORDERS WELCOME

INTEGRATED CIRCUITS

COMPUTER IC'S/TRANS

40028	13.45
HAL16L8CN	5.24
HN613128P	POA
LM1889	1.75
MAB8049	3.49
MC1377	1.55
MC1376	1.15
MC1488P	0.75
MC1489AP	0.77
MC68008	17.97
ZX81 Rom	4.00
Spec 48K Rom	5.00
ULA2C210E ZX81	3.95
Spec 128K + 2 Rom	6.51
QL Rom 256K	12.43
QL Rom 128K	7.20
SCH92880P I/F 1 Rom	3.00
TC74HC04	0.86
TMS1000	8.95
TMM23128P-1951	10.66
ULA6C001E (Spec)	6.50
ULA2G007 (M/D)	3.24
ULA1H035E (Ram Pk)	2.58
ULAZX8302 (QL)	7.30
Z80A CPU	1.70
ZX8401/PCF1304	4.50
2N7400E	11.25
20RA043	11.25
SN7438N	2.00
74LS00	1.12
74LS32	0.90
74LS157	0.78
74LS132	0.63
74LS260	0.83
Ram 2114	2.31
251641-02	POA
2732	3.30
2764	3.75
27128	4.95
27256	5.90
Ram 4118	2.92
Ram 4116-4	1.10
Ram 4116-2	1.10
8249	3.00
8247	3.50
8271	60.00
BBC UID ULA	15.00
4164/4564-15	2.00
41256-15	8.95
6502 Commodore	3.50
6522	4.00
6264 Commodore	7.50
6510 Commodore	7.07
6526 Commodore	5.11
6561 Commodore	7.74
6569 Commodore	21.25
6581 Commodore	7.79
8360 Commodore	19.61
8701 Commodore	5.46
906114 Pla Comm	4.51
901225 Cha Rom Comm	3.37
901226 Bas. Rom Comm	8.71
901227 Ker Rom. Comm.	6.63
ZTX182/BC182	0.07
ZTX213	0.15
ZTX214	0.17
ZTX313	0.24
ZTX510	0.39
ZTX551	0.39
ZTX650/1	0.27
ZTX750	0.38
IS 2472	0.31

We have not listed our full range IC's. These are a few of our new types. Please ask for catalogue for full list of ICs and Semis.

AN5620	4.87
AN6320N	2.88
LA7800	3.75
STK5326	6.35
STK5481	6.50
STR5412	8.45
STR6020	5.80
TAD100	2.62
TBA673D	2.50
TBA2800	1.60
TDA1670	3.60
TDA1870	6.46
TDA2005	2.94
TDA2150	2.47
TDA3565	3.95
TDA3576B	3.99
TDA3651	3.50
TDA3651AQ	3.95
TDA3653AQ	3.95
TDA3654	3.95
UPC577	2.46
UPC1378	2.50
UPC5743	3.75
UPD8048	0.93

DON'T FORGET WE HAVE A FULL RANGE OF SECURITY PRODUCTS INCLUDING NEW CASTLE CONTROL PANELS. ASK FOR CATALOGUE

P.V. TUBES

TEL: 0254
36521 24 hour
32611 answer
390936 phone
TELEX: 635562
GRIFFIN G (for P.V.)
FAX No. 0254 395361

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

G.G.L.COMPONENTS

PO BOX 72, UNIT 7, SOUTH JOHN STREET, CARLISLE, CUMBRIA CA2 5AL
PHONE (0228) 39693/20358 FAX (0228) 515127

BUY WITH

CAPACITORS

1UF at 250V ... 20
4.7UF at 250V ... 25
10UF at 250V ... 35
22UF at 250V ... 40
33UF at 250V ... 55
47UF at 250V ... 65
100UF at 250V ... 1.25
(All Single Ended PCB Type)

DIODES

TYPE	PRICE
BY127	10
BY133	20
BY179	65
BY223	1.25
BY227	20
BY229/800	95
BY299	25
BYX55/600	30
1N4007	07
1N5408	20
SKE5F3/10	1.50

ZENER DIODES
BZX61C (1.3 Watt) 3V3, 4V7, 5V1, 5V6, 6V2, 6V8, 7V5, 8V2, 9V1, 10V, 11V, 12V, 13V, 15V, 18V, 20V, 24V, 27V, 30V, 33V, 36V, 47V, 56V, 62V, 75V, 100V, 110V, 120V, 130V. Pkts of 5 per value ... 1.00

E.H.T. TRAYS

Continental 20AX Focus 8.95
Continental 30AX Focus 8.95
DECCA 80 ... 7.20
DECCA 100 ... 7.35
DECCA 120/130 ... 7.95
ITT CVC20/25/30/32 ... 6.95
ITT CVC45 ... 7.50
PHILIPS G8 550 ... 7.90
PHILIPS KT3 ... 7.95
RBM T20/22A ... 7.35
THORN 9000 ... 8.00
UNIVERSAL ... 5.70

FUSES

20mm A/S: (Pkts of 10) 250MA, 315MA, 400MA, 500MA, 630MA, 800MA, 1A, 1.25A, 1.6A, 2A, 2.5A, 3.15A, 4A, 5A, 6.3A, 8A ... 1.20
20mm Q/B: (Pkts of 10) 500MA, 630MA, 800MA, 1A, 2A, 2.5A, 3.15A ... 60

INTEGRATED CIRCUITS

TYPE	PRICE (£)
AN303	3.75
AN305	3.50
AN318	6.95
AN5620	4.95
AN7145M	2.95
HA1339A	2.95
HA1366W	1.85
HA1366WR	1.85
HA1374	2.45
HA1377	2.95
HA1392	2.95
HA1397	3.95
HA13001	4.50
HA13008	12.95
LA1201	1.25
LA1230	2.95
LA1365	2.45
LA4440	2.75
LA4445	2.45
LA4460	2.45
LA4461	2.45
LA7800	1.95
LA7801	2.90
MC13002	3.95
MC14497P	4.50
SAA1250	3.85
SAA1251	4.95
SAA3027	3.95
SAA5000A	3.95
SAA5010	4.95
SAA5012	4.95
SAA5030	5.95
SAA5050	6.95
SAF1039P	2.75
SL470/1DP	2.95
SL480	2.85
SL490	2.90
SL1430	1.95
SL1431	1.95
SL1432	1.75
SN76660N	65
STA471C	6.95
STK077	6.95
STK2129	11.95
STK433	5.95
STK4332	5.95
STK435	5.95
STK437	6.95
STK439	7.50
STK459	8.55
STK461	9.95
STK463	9.95
STK465	11.95

TYPE	PRICE (£)
STK5421	4.95
STK5481	8.95
STK7308	8.95
STR4090	8.95
STR40090	7.95
STR50103A	6.50
STR4211	3.95
STR441	4.95
STR451	5.35
STR454	4.95
STR5412	6.95
STR6020(KIT)	5.75
TA7193P	4.50
TA7205AP	1.40
TA7222P	1.85
TA7227	2.95
TA7270	3.25
TA7609	3.35
TBA120AS	1.00
TBA120U	1.00
TBA800P	85
TBA810S	1.25
TBA820	1.50
TBA820M	1.25
TBA920S	1.95
TBA950/2X	2.25
TBA1440G	2.95
TDA440	2.95
TDA1020	2.75
TDA1035T	2.40
TDA1037	1.95
TDA1044	2.95
TDA1151	1.25
TDA1170S	1.80
TDA1180P	2.65
TDA1190Z	2.85
TDA1470	3.25
TDA1506	4.35
TDA1510	3.80
TDA1512	3.50
TDA1515	4.50
TDA1670A	4.20
TDA1770A	3.70
TDA1870	6.95
TDA1908A	1.95
TDA1950A	3.95
TDA2002	1.50
TDA2003	1.55
TDA2004	2.90
TDA2005	2.55
TDA2020	3.20
TDA2030	1.80
TDA2170	2.95
TDA2270	2.95
TDA2525	2.95

TYPE	PRICE (£)
TDA2530	2.00
TDA2532	2.10
TDA2540	1.70
TDA2541	2.70
TDA2560	1.95
TDA2576A	3.25
TDA2577	2.95
TDA2578A	2.95
TDA2579	3.75
TDA2581	2.00
TDA2582	1.95
TDA2591/3	1.95
TDA2594	2.95
TDA2595	4.95
TDA2600	6.35
TDA2611A	1.50
TDA2653A	3.50
TDA2655B	5.95
TDA3190	1.95
TDA3330	3.95
TDA3540	2.95
TDA3541	2.95
TDA3560	4.95
TDA3561A	4.95
TDA3562A	5.50
TDA3565	4.95
TDA3571 B/Q	3.95
TDA3650	4.75
TDA3651	1.95
TDA3651AQ	3.80
TDA3652	2.95
TDA3653AQ	4.95
TDA3654AQ	4.75
TDA4500	3.95
TDA4503	4.65
TDA4600/2	2.85
TDA4600/2D	3.30
TDA7270	3.35
TDA8180	6.95
TDA8190	2.80
TDA9503	2.95
UPC1031H	2.60
UPC1181H	1.70
UPC1182H	1.70
UPC1185H	2.50
UPC1230H	4.35
UPC1365C	4.20
UPC1378H	3.70
UPC1382	4.35
UPC1394C	2.95
Z80ACPU	1.75

I C SOCKETS

16 Pin Dil-Dil ... 16
16 Pin Dil-Quil ... 35
18 Pin Dil-Dil ... 18
24 Pin Dil-Dil ... 25
28 Pin Dil-Dil ... 30
40 Pin Dil-Dil ... 40

LINE O/P TRANS

DECCA 100 ... 8.30
FERGUSON 1690/1 ... 9.95
FERGUSON 1790/1 ... 7.95
FERGUSON TX9 ... 23.50
FERGUSON TX90 (14") 19.75
FERGUSON TX90 (20") 19.75
FERGUSON TX100 90 ... 20.95
FERGUSON TX100 110 20.95
FIDELITY ZX2000 14"/20" (Inc. Mod.) ... 12.50
FIDELITY ZX3000 14"/20" ... 11.50
FIDELITY ZX 22"/26" ... 22.95
HINARI CT4/5 ... 21.95
ITT CVC20 ... 8.50
ITT CVC25/30/32 ... 8.50
ITT Compact 80 ... 21.95
PHILIPS G8 ... 9.95
PHILIPS G11 ... 18.95
PHILIPS KT3 ... 12.95
PHILIPS K30 ... 19.95
PHILIPS CTX 14"/16" ... 17.95
PHILIPS CTX 20" ... 17.95
RBM T20/22A ... 9.95
SHARP C1410 ... 23.95

ON/OFF SWITCHES

Decca 80/100 ... 1.00
Ferguson TX9/10 (Rem) . 1.75
Ferguson TX90 (Rem) ... 1.75
Fidelity AVS Series ... 1.50
Fidelity CTV140 ... 1.50
Fidelity CTV14R ... 2.95
Fidelity CTV14S ... 2.95
Grundig CUC731 ... 3.50
Hitachi CPT2650 ... 1.95
Philips G8 ... 1.35
Philips G11 ... 1.35
Philips G11 (Rem) ... 1.75
Philips KT3 ... 1.50
Philips KT/CTX (Rem) ... 1.75
Pye G11 (Rem) ... 1.75
RBM T20/22A 3K3 Vol ... 2.45
Sony KV1612 (Rem) ... 3.95
Sony KV2022 (Rem) ... 3.95
Tatung 160/161 ... 1.75
Tatung 165 ... 1.75
Thorn Universal ... 1.00

TRANSISTORS

TYPE	PRICE
BC107	15
BC147	10
BC148	10
BC307	12
BC327	11
BC328	12
BC337	11
BC338	12
BC360	35
BC546	10
BC547	10
BC548	10
BC557	10
BC558	10
BC639	25
BC640	25
BD131	50
BD132	50
BD222	50
BD225	50
BD237	40
BD238	40
BD278A	70
BD437	40
BD438	40
BD677	65
BD701	95
BD707	95
BD807	95
BF337	28
BF338	30
BF422	35
BF423	35
BF458	35
BF460	95
BF470	50
BF757	70
BF871	80
BR103	75
BR303	1.95
BT151/800	1.15
BU126	1.50
BU205	1.40
BU208A	1.45
BU208D	1.95
BU326A	1.45
BU407	1.25
BU407D	1.50
BU426A	1.35
BU500	1.95
BU508A	1.75
BU508D	1.95
BU526A	2.50
BU536	2.75
BU705	3.95

TYPE	PRICE (£)
BU807	1.30
BU826A	2.25
BU907	2.95
BU908	1.95
BUT11AF	2.95
BUW81A	3.95
BUX84	80
R2540	2.35
R4050	1.38
SG613	8.95
SG264A	5.95
T6071V(KIT)	5.75
T9053V	3.50
T9054V	3.50
T9064V	1.95
TIP29E	70
TIP31C	45
TIP32C	45
TIP41C	45
TIP42C	45
TIP112H	75
15/80H	2.45
15/85R	2.45
2SC867A	3.20
2SC1034	3.95
2SC1114	5.95
2SC1413A	2.95
2SC1942	2.90
2SC3156	3.50
2SD725	4.95
2SD870	6.50
2SD1398	2.35
2SD1453	2.95
7805	50
7812	50
7815	70
7824	70

TUNERS

ELC 1043/05 ... 8.50
ELC 1043/06 ... 9.95
ET548 ... 14.20
U321 ... 8.75
U322 ... 8.80
U341 ... 7.95
U343(coax skt) ... 14.95
U343 (phono) ... 16.95
U344C ... 9.95
U411 ... 11.95
UE5-B31F ... 28.95

TV ELECTROLYTICS

DECCA 80 (400/800) ... 4.50
FIDELITY ZX(220/385) ... 3.95
PHILIPS G8(600/300) ... 3.95
PHILIPS G11(470/250) ... 2.20
RBM T20A(220/400) ... 2.50
THORN 1690 (4700/25) ... 1.35
THORN 9000(400/400) ... 2.90

FERGUSON TV SPARES

TX9/10
Focus Unit TX10 ... 8.50
Line O/P Trans TX9 ... 23.50
Line O/P Trans TX10 ... 29.95
On/Off Switch (Remote) ... 1.95
Push Button TX9 ... 16.95
Push Button TX10 ... 16.95
RFI Choke TX9 ... 2.95
Tuner ... 14.95

TX90/100
Line O/P Trans TX90 14" ... 19.75
Line O/P Trans TX90 20" ... 19.75
Line O/P Trans TX100 90° ... 19.95
Line O/P Trans TX100 110° ... 20.95
Mains Trans. (TX90) ... 17.95
On/Off Switch (Remote) ... 1.75
Push Button TX90 ... 12.95
Tuner ... 14.35

FERGUSON VIDEO SPARES

3V00/16/22
Capstan Motor ... 24.95
Drum Motor ... 24.95
Pinch Roller ... 3.95
Take-Up Clutch (Small) ... 5.65
Take-Up Clutch (Large) ... 5.95
Video Head ... 17.95

3V29/30
Capstan Motor ... 37.95
Loading Motor ... 8.70
Pinch Roller ... 4.50
Pilot Lamp ... 80
Reel Idler ... 2.85
Take-Up Clutch ... 2.45
Take-Up Idler ... 1.40
Video Head ... 17.95

3V35/36
Capstan Motor ... 22.95
Cassette Housing ... 25.95
Mains Trans. ... 21.95
Reel Idler ... 2.85
Take-Up Clutch ... 2.45
Take-Up Idler ... 1.40
Video Head ... 17.95

3V44/45
Capstan Motor ... 37.95
Cassette Housing ... 28.95
Loading Motor ... 8.95
Take-Up Clutch ... 1.95
Video Head ... 32.95

GEC/HITACHI SPARES

HM3232 ... 5.95
HM6251 ... 4.70
HM9032 ... 5.95

VIDEO SPARES

V4000/VT8000
Capstan Motor ... 31.95
FF/Rew Idler ... 2.65
FF/Rew Pulley ... 85
Pinch Roller ... 3.95
Play Idler ... 4.50
Video Head ... 22.95

V4001/VT9300/9500
Capstan Motor ... 31.95
FF/Rew Idler ... 1.95
FF/Rew Pulley ... 85
Pinch Roller ... 3.95
Play Idler ... 3.95
Video Head ... 22.95

V4100/VT11E/VT33E
Capstan Motor (VT11E) ... 23.95
Capstan Motor (VT33E) ... 29.95
Clutch Assy ... 7.95
FF/Rew Idler (Genuine) ... 2.50
Pinch Roller ... 3.95
Video Head ... 22.95

V4005/VT63E
Capstan Motor ... 15.95
End Sensors (Pair) ... 1.95
Pinch Roller ... 4.95
Video Head ... 49.95

PANASONIC VIDEO SPARES

NV333/366
Complete Maintenance Kit (Genuine) ... 13.75
Cassette LED ... 1.95
Pinch Roller ... 3.95
Play Idler (Genuine) ... 4.95
Reel Idler (Genuine) ... 1.25
Reel Motor (Genuine) ... 14.95
Video Head ... 17.95

NV370/380
Complete Maintenance Kit (Genuine) ... 12.95
Pinch Roller ... 3.95
Reel Idler (Genuine) ... 2.95
Video Head ... 21.95

NV730/770
Complete Maintenance Kit (Genuine) ... 12.95

NV2000/2010
Complete Maintenance Kit (Genuine) ... 21.50
Cassette Lamp ... 70
Pinch Roller ... 3.95
Play Idler (Genuine) ... 1.25
Reel Idler (Genuine) ... 1.25
Video Head ... 17.95

NV7000/7200
Complete Maintenance Kit (Genuine) ... 14.95
Cassette Lamp ... 70
Pinch Roller ... 3.95
Play Clutch (Genuine) ... 4.95
Reel Idler (Genuine) ... 1.25
Video Head ... 17.95

REMOTE CONTROLS

Ferguson TX9 U/S Basic ... 14.50
Ferguson TX9/10 N/Text ... 12.95
Ferguson TX9/10 Text ... 12.95
Ferguson TX Stereo Text ... 12.95
Ferguson TX100 Text ... 15.95
Ferguson 3V23 Video ... 14.95
Ferguson 3V31 Video ... 16.95
Ferguson 3V35 Video ... 16.95
Fidelity CTV14R/S ... 12.95
Grundig TP200 ... 12.95
Grundig TP400TT ... 12.95
ITT FS9/FS10 Text ... 15.95
ITT RG301/305 Text ... 14.50
ITT RG306 Text ... 14.50
Panasonic NV7200 Video ... 15.95
Philips G11 U/S Full Rem. ... 15.95
Philips G11 U/S Text ... 15.95
Philips G11 I/R Full Rem. ... 12.95
Philips G11 I/R Text ... 12.95
Philips KT3/30 N/Text ... 12.95
Philips KT3/30 Text ... 12.95
Philips RC5 (Genuine) ... 12.50
Philips AV5600 Video ... 15.95
Redifusion Mk.4 Text ... 15.95
Sony RM604/605/606 ... 14.50
Sony RM613/615 ... 14.50
Sony RM630/632/635 ... 14.50
Tatung RTP40/43/45 ... 15.95

REPAIR KITS

Philips KT3/30 N/Text ... 6.50
Philips KT3/30 Text ... 6.50

SANYO/FISHER VIDEO SPARES

VTC5000/5300
Loading Roller ... 1.25
Pinch Roller ... 8.50
Reel Idler (Genuine) ... 5.70
Reel Motor (Genuine) ... 7.95
Video Head ... 35.00

FVHP615
Gear Idler Assembly ... 5.95
Pinch Roller ... 4.50
Reel Idler ... 5.95
Video Head ... 24.95

SERVICE MANUALS

(All Genuine)
Ferguson TX9 Complete ... 27.95
Ferguson TX10 Complete ... 38.95
Ferguson TX85 ... 9.95
Ferguson TX90 ... 14.95
Ferguson TX100 ... 18.95
Ferguson 1790/1 ... 1.95
Fidelity AVS1600 ... 5.95
Fidelity AVS2000 ... 5.95
Fidelity CTV14R ... 5.95
Fidelity CTV20R ... 5.95
Fidelity CTV20T ... 5.95
Philips CF1 ... 6.95
Philips CTX-E ... 2.50
Philips CTX-S ... 2.50
Philips G11 ... 4.50
Philips KT3 ... 4.50
Philips K35 ... 3.50
Philips KT4/40 ... 5.95
Philips 2A ... 6.95

VIDEO RECORDERS
Ferguson 3V35/36 ... 28.95
Ferguson 3V44/45 ... 11.95
Ferguson 3V46/47/52 ... 11.95
Ferguson 3V54/55 ... 11.95
Ferguson 3V59 ... 11.95
Ferguson 3V65 ... 11.95
Ferguson FV11 ... 9.95
Ferguson FV12 ... 9.95
Philips VR6460 ... 6.50
Philips VR6462 ... 6.50
Philips VR6467 ... 6.50
Philips VR6520 ... 6.50
Philips VR6542 ... 6.50
Philips VR6560 ... 6.50
Philips VR6660 ... 6.50
Philips VR6760 ... 8.95

SHARP VIDEO SPARES

VC8300
Cassette Lamp ... 70
Channel Bank ... 7.95
Pinch Roller ... 3.95
Rewind Idler ... 3.50

VC9300/381
Capstan Motor ... 29.95
Cassette Lamp ... 1.95
Pinch Roller ... 3.95
Reel Idler (Genuine) ... 3.95
Reel Motor (Genuine) ... 17.50
Unlock Assembly ... 35
Video Head ... 23.95

VC481
Capstan Motor ... 22.95
Pinch Roller ... 3.95
Reel Idler (Genuine) ... 3.95
Reel Motor (Genuine) ... 18.50
Video Head ... 23.95

SONY SPARES

Capstan Motor C7 ... 27.95
Pinch Roller C5/6/7 ... 3.95
Pinch Roller C9 ... 5.95
Rewind Kit C5/7 ... 4.65
Rewind Kit C6 ... 3.45
Video Head C5/6/7 ... 19.50

VIDEO BELT KITS

Akai VS1/2/3/5 ... 1.95
Amstrad VCR4500 ... 1.95
Amstrad VCR7000 ... 1.50
Ferguson 3V00/16/22 ... 2.50
Ferguson 3V23 ... 1.75
Ferguson 3V29/30 ... 1.80
Ferguson 3V35/39 ... 1.95
Ferguson 3V44/45 ... 1.95
Fisher FVH520/615 ... 1.95
Panasonic NV333 ... 1.95
Panasonic NV370 ... 1.95
Panasonic NV730 ... 1.95
Panasonic NV777 ... 1.95
Panasonic NV2000/2010 ... 1.95
Panasonic NV7000/7200 ... 1.95
Sanyo VTC5000 ... 1.00
Sanyo VTC5300 ... 1.95
Sharp VC7300 ... 2.50
Sharp VC8300 ... 2.45
Sharp VC9300 ... 2.45
Sony C5/7 ... 2.50
Sony C6 ... 1.95

VIDEO PILOT LAMPS

Ferguson 3V23 (Plug) ... 80
Ferguson 3V29 (Plug) ... 80
Panasonic NV2000/7200 ... 70
Sharp VC8300 ... 70
Sharp VC9300 ... 1.95
Universal ... 50

VIDEO HEADS

Alba 4000 ... 24.95
Amstrad VCR4500 ... 22.95
Amstrad VCR4600 ... 23.50
Amstrad VCR7000 ... 24.95
Amstrad VCR9000 ... 24.95
Ferguson 3V00/22/29/39 ... 17.95
Ferguson 3V32 ... 47.50
Ferguson 3V42/44/45/55 ... 26.95
Fisher FVH520/615/720 ... 24.95
Hitachi 8000/9300/9500 ... 22.95
Hitachi VT11/33E ... 22.95
Panasonic NV230 ... 29.95
Panasonic NV333 ... 17.95
Panasonic NV366 ... 39.95
Panasonic NV370/380 ... 21.95
Panasonic NV430 ... 24.95
Panasonic NV730 ... 39.95
Panasonic NV777 ... 29.95
Panasonic NV2000/7000 ... 17.95
Panasonic NVG7/9 ... 24.95
Panasonic NVG10/11/15 ... 29.95
Panasonic NVG20/21/25 ... 39.95
Philips VCR6460/6520 ... 21.95
Philips VCR6462/6560 ... 37.50
Sanyo VHR1100/1300 ... 29.95
Sanyo VHR1500 ... 42.95
Sanyo VTC5000/5500 ... 35.00
Sentra 8000 ... 24.95
Sharp VC9300/381/481 ... 23.95
Sharp VC581/583/682 ... 27.50
Solavox 1000 ... 24.95
Sony C5/6/7 ... 19.50
Sony C20/30 ... 22.95
Toshiba V9600/V31B ... 24.95
Toshiba V55/57 ... 17.95

ORDERING

Please add 75p for p/p U.K. Add 15% VAT to this total. Service Manuals £1.00 p/p each. Export Orders p/p charged at cost. Delivery by return on stock items.

BARCLAYCARD VISA

EAST CORNWALL COMPONENTS

Access

1989 CATALOGUE, NEW, LARGER, MORE VARIED, NOW READY (includes Credit Tickets (3), Special Offer sheets, Order Form & Pre-Paid envelope) only £1.00 or free on application with any order over £15. Prices in new catalogue and advertisement may vary as material for advertisement is prepared 6/8 weeks before issue of Television.

PLEASE NOTE – ALL PRICES NOW INCLUDE 15% VAT

PRIORITY CATALOGUE ORDER

Name ....

Address ....

I enclose £1.00 cheque/P.O./cash for catalogue

MAY SPECIAL OFFER

AVO 8 MULTIMETER

Complete with Leads & Batteries.

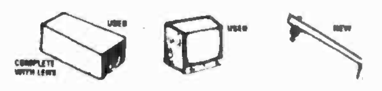
PRICE ONLY £45.00

USED — FULLY TESTED.

"CLOSED-CIRCUIT" TELEVISION SYSTEM

PRICE £160.00

Comprising: 1 × CAMERA 1 × MONITOR 1 × CAMERA BRACKET



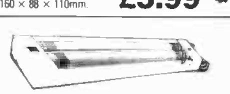
Illustrations not to scale. For guidance only — actual items supplied may vary from those illustrated

QUARTZ-HALOGEN SPOTLIGHT

Hand held or hanging. Heat resistant poly-carbonate housing, highly polished reflector. Protective lens cover, doubles as base stand. With On/Off switch and 12ft curly cable terminating in cigar lighter plug. Produces 250,000 candle power – 5 times the intensity of average car headlamps.
Power: 12Vd.c. 4.5A 55W Dims: 160 × 88 × 110mm.

£5.99

12V Twin Fluorescent Lamp



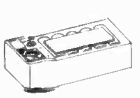
12" Double Tubes

Attractive white fitting, ribbed perspex diffuser. On/off switch. 3ft cable. Transistorised circuitry. Keyhole fixing. 12V D.C. 8W Tubes. Dimensions: 368 × 67 × 43 mm.

Ideal for Caravans, Boats, Vans etc.

	1+	10+	50+
PRICE	£5.99	£4.99	£4.50

12 VOLT RECHARGEABLE UNIT

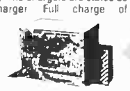


10 × D × Size Ni-Cads (4 Ah) encapsulated in a black plastic case. Fuse holder. Gives 12 volt output when charged. Ex equipment. Fully guaranteed. Dimensions: 245 × 75 × 75mm.

£9.19 each + P&P £1.85 + VAT
£8.34 for 10 + P&P £4.50 + VAT

CHARGING UNIT FOR THE ABOVE 12V UNIT

Manufactured by Saft, these chargers are suitable for the above battery packs (as advertised in the May issue of "WHAT VIDEO" — Page 6). The chargers are stated as we have modified them to a standard charger. Full charge of the packs is obtained after 10-12 hours (overnight) charging. Supplied complete with main lead and charging lead fitted with a 4-pin plug (6-pin plug version available upon request). Although ex-equipment, these chargers are fully tested and guaranteed. Dimensions 335 × 260 × 150 mm



4-PIN £11.50 6-PIN £11.50 + £1.85 P&P + VAT

OSCILLOSCOPES

COSSOR CDU150. Dual Trace. 35MHz Delay Sweep. Dual State Portable 8 × 10 Display with Manual.

Price £190.00 each

Carriage £12.00 each — Plus V.A.T.

Other types of Oscilloscopes arriving all the time – telephone for info' on latest stock.

SIGNAL GENERATORS

Marconi TF2002AS	72MHz, A.M. & F.M.	£100.00
Marconi TF2002B	88MHz, A.M. & F.M.	£120.00

CARRIAGE £10.00 + VAT

RESISTORS — CARBON FILM

1/4W 1R0 to 10M (E12 Range)	2p each. 15p/10.	£1.00/100
1/2W 2R2 to 10M (E12 Range)	3p each. 20p/10.	£1.50/100
1W 10R to 2M2 (E12 Range)	6p each. 50p/10.	£3.00/100
2W 10R to 2M2 (E12 Range)	10p each. 80p/10.	£6.00/100

RESISTOR KITS – each value individually packed

1/4W pack 10 each value E12 – 10R to 1M 610 pieces	5.10
1/4W pack 5 each value E12 – 10R to 1M 305 pieces	3.75
1/4W pack Popular – 10R to 10M 1000 pieces	6.99
1/2W pack 10 each value E12 – 2R2 to 2M2 730 pieces	8.75
1/2W pack 5 each value E12 – 2R2 to 2M2 365 pieces	5.40
1/2W pack Popular – 2R2 to 10M 1000 pieces	10.75
1W pack 5 each value E12 – 2R2 to 1M 365 pieces	15.25
2W pack 5 each value E12 – 10R to 2M2 317 pieces	25.00

ADDITIONAL KITS

DISC CERAMIC 50V	125 pieces	£3.99
ZENER DIODES 5ea	55 pieces	£3.99
ELECTROLYTICS CAPS. RADIAL	100 pieces	£8.50
FUSES Q/BLOW 20mm	80 pieces	£4.75
FUSES T/DELAY 20mm	80 pieces	£8.50
PRE-SET POTS.Hor.	120 pieces	£7.75
PRE-SET POTS Vert.	120 pieces	£7.75

SERVICE AIDS

Goldklene Degreasing Solvent	2.19	Super 40	2.25
Switch Cleaner Lub	1.50	Silicone Grease-Tube	2.25
Supa Freeze-it	1.88	Silicone Grease-Spray	1.85
Foam Cleanser	1.50	Heat Sink Compound	1.45
Video/Tape Head Cleaner	1.30	Solda-Mop	
Plastic-SCal	1.75	Light Guage 0.08mm	0.98
Aero-Klene	1.38	Standard Gauge 1.2mm	0.96
Anti-Static Spray Mist	1.50	Industrial Reel 1.2mm	3.65
Excel Polish	1.36	Drive Cord	2.99
Elece. Condutive Paint	3.55	Super Glue	0.99
Aero Duster	1.99	Insulating Tape 25p/1 20p.ea/10	
		Parcel Tape 99p/1 85p.ea/10	

VALVES

Type	Price (£)	Type	Price (£)	Type	Price (£)
DAF96	1.20	EF86	2.13	PCF87	0.69
DF96	0.92	EF91	2.36	PCF200	2.30
DK96	3.10	EF95	1.95	PCF800	1.44
DY86/87	1.32	EF183	1.09	PCF801	1.30
DY802	1.15	EF184	1.22	PCF802	1.30
CV850	2.93	EH90	1.15	PCF805	2.36
CV4015	3.28	EL34	3.97	PCF806	1.44
E88CC	4.43	EL36	2.30	PD500	3.39
EABC80	1.20	EL84	2.76	PFL200	2.04
EAF42	1.78	EL86	1.44	PL33	1.78
EB91	1.55	EL509	9.05	PL82	0.92
EBF80	1.09	EL519	9.20	PL95	2.36
ECC81	1.20	EM80	1.04	PL504	1.67
ECC82	1.09	EM84	2.08	PL508	3.16
ECC83	1.20	EM87	4.48	PL519/509	6.09
ECC84	0.98	EY51	1.09	PL802	6.38
ECC85	1.15	EY86/87	0.92	PY81/800	1.32
ECC86	3.28	EY88	0.92	PY88	0.98
ECC189	1.04	EY500A	2.93	PY500A	2.59
ECF80	1.44	EZ41	3.28	PY80	0.86
ECF82	1.15	GY501	1.67	UABC80	1.04
ECF83	2.24	GZ32	1.44	UAF42	1.50
ECH35	4.37	GZ34	3.90	UBC41	5.00
ECH84	1.78	PC88	1.67	UBC81	1.78
ECL80	0.92	PC92	3.51	UCC85	0.92
ECL85	0.92	PC900	1.67	UCF80	1.44
ECL86	2.07	PCC88	0.98	UCH42	6.50
EF80	0.92	PCC89	0.92	6BA6	1.22
		PCC189	1.04	6BE6	1.22
		PCF80	1.15	6X4	1.78
		PCF82	1.15	6VG7	1.82
		PCF86	1.45	6SJ7	2.59

FULL RANGE OF TRANSISTORS, I.C's, CMO's

See our catalogue

Electrolytic Capacitors	Thick Film Capacitors
Disc Ceramic Capacitors	Polyester Capacitors
Metal Film Capacitors	Polystyrene Capacitors
Metal Oxide Capacitor	Mylar Capacitors

SAFEBLOC

MAINS VOLTAGE QUICK TEST £7.99

LOGIC PROBE £9.90

BLACK STAR FREQUENCY COUNTERS

Meteor 100 100 Mhz	115.00
Meteor 600 600 Mhz	149.00
ALL NEW — Carriage	2.50

BT APPROVED EQUIPMENT

Master Socket (Flush)	£3.30	Wiring Tool	0.35
Master Socket (Surface)	£3.25	Plug 431A	0.35
Secondary Socket (Flush)	£2.05	Slimtel Phone	£19.95
Secondary Socket (Surface)	£2.50	Betacom Flamingo Phone	£9.95
B.T. Cable (per metre) 15 100M	£12.00	Cordless Phone - Freeway	£89.95
Line Jack Cord with Plug	£2.20	Conversion Kit & Wiring Diagram	£9.90
Extn. Lead 5 metres	£4.30		

SOLDERING SECTION

Soldering Station complete with 30W or 40W Iron (state which)	72.50	Antex 18W iron	7.65
XS25 W Iron kit/complete with stand, 1m lead & plug attached	10.85	Antex 25W iron	7.85
CS17 Iron Kit	10.75	Antex elements	3.75
C15 Iron Kit	10.75	Antex bits	1.60
Antex 15W iron	7.65	Antex stands	2.99
		Soldersucker	3.44
		Spare nozzles for Soldersucker	0.69

ORVX PORTASOL GAS SOLDERING IRON

PRICE £18.75 each. SPARE TIPS – 1, 2.4, 3.2, 4.8mm £5.50 each

SOLDER: 60% TIN 40% ALLOY

22g Non corrosive Multi-core Solder.	500gm Reel £5.75 each.
18g Non-corrosive Multi-core Solder.	500gm Reel £5.75 each.

20mm FUSES

QUICK BLOW – 80mA, 100, 125, 160, 200, 250, 315, 400, 500, 630, 800, 1A, 1.25, 1.5, 1.6, 2, 2.5, 3.15, 4, 5, 6.3 — 45p/10
TIME DELAY – 50mA, 60, 80, 100, 125, 160, 200, 250, 315, 400, 500, 630, 800, 1A, 1.25, 1.6, 2, 2.5, 3.15, 4, 5, 6.3, 10 — 1.20/10

1" DOMESTIC MAINS FUSES

2A, 3A, 5A, 13A — £1.20/10

1 1/4" QUICK FUSES

500mA, 1A, 1.25A, 2A, 12A — 50p/10

NI-CAD BATTERY CHARGER

Universal	1+	£4.99 each
PRICE	10+	£4.75 each
4 × AA Charger		£4.95 each

NI-CAD BATTERIES

AAA	£1.50 ea	£1.30 ea/10
AA	95 ea	.85 ea/10
C	£1.95 ea	£1.80 ea/10
D	£2.00 ea	£2.20 ea/10
PP3	£3.90 ea	£3.75 ea/10

HELPING HANDS WITH MAGNIFIER

GLASS LENS	6.50
PLASTIC LENS	4.50

VERO - VERO - VERO - VERO

17.9" × 3 3/4"	£6.75
3 3/4" × 3 3/4"	£2.36
5" × 3 3/4"	£1.99
Easiwire Kit	£15.00
Verobloc	£6.71

ATTENTION RETAILERS — Trade prices available on full Vero range — minimum order £25.

FM TRANSMITTER

Very High Quality 'MINI-BUG' – Ideal for Baby Alarm etc.!!

A Very good range is obtainable – we have obtained over 1/2 mile, but it does depend on conditions.
Simply remove cover – insert battery – and you're ready to go.
Reception can be obtained on any F.M. Radio.
Frequency: 105-109 MHz F.M.
Power: PP3 9V Battery (not included)
Dimensions: 4.25" × 2.25" × 0.75"
Order Code – SO/034

Price: **£9.78**

PINCH ROLLERS

AKAI 1EG/2EG/3EG/5EG/6EG/9EG/SC15EG	£3.99
VS9700	£4.35
FERGUSON 3V00/3V24	£3.99
3V29/3V32	£5.25
HITACHI ALL	£3.99
J.V.C. HR2200/3300/3330/3660/4100/7700	£3.99
N.E.C. N830/N833	£4.75
ORION VH-1/2	£3.99
PANASONIC NV100/180/332/333/366/600E/777/778	£4.95
2800/230/3000/370/430/460/465/7000/7200/730/740/810/8200/830/8400/850/8600/8610/870/890	£3.99
PHILIPS VR6 460	£3.99
VR6 560	£5.25
SANYO VTC3000	4.20
VTC5000/5150/5300/5350/5400/5500/6000/6500/9100/9300/M10/11/20/21/30/31/M50	£4.25
SHARP 200/381/384/385/386/388/390/3300/2300/6000/6200/6300/7300/7700/7750/8000/8300/9300/9500/9700	£3.99
SONY SL-C5/6/7	£4.20
TOSHIBA V55	£4.75

IDLERS

FISHER	143-0-4204-00400	3.85
FISHER	GEAR IDLER 143-0-4904-00900	6.00
FERG/JVC	TAKE UP IDLER PU51402/A	1.70
HITACHI	6886971	1.99
PANASONIC	VXP 0344	1.00
PANASONIC	VXP 0521	2.50
SANYO	REEL DRIVE PULLEY VTC 5150 143-0-6621-01201	6.50
SHARP	NIDL 0005 GE22	1.90
SHARP	NIDL 0006 GE22	2.10
THORN/JVC	PU48967B	2.99

BOOKS

DATA VOLUME 1 – Trans. data & drawings A-BUY	£9.99
DATA VOLUME 2 – as above C-Z	£10.75
DATA VOLUME 3 – 2N 2N6735	£10.20
Set of 4	£42.00
DATA VOLUME 4 – 2SA & on	£13.50
DIODES VOLUME 1	£10.75
DIODES VOLUME 2	£10.65
Both Volumes	£20.60
I.C. CMOS	£8.95
I.C. TTL	£19.50
I.C. LIN VOLUME 1	£6.95
I.C. LIN VOLUME 2	£6.99
Both volumes	£13.00
THYRISTORS A to Z	£10.45
TRANSISTORS A to Z	£6.90
TRANSISTORS 2N-3N	£7.00
Both volumes	£13.00
Full range of BABANI Books on TV/RADIO/AERIALS Etc. e.g. INTRODUCTION TO SATELLITE T.V.	£5.95
Fane Loudspeaker enclosure Design & Construction 54 pages	£3.99

TRIPLERS

TRIPLER Universal	5.50
PHILIPS KT3	8.50

MOTORS

Reel Motor SANYO VTC 5150 4.529V-10800	9.20
Reel Motor SHARP VC9300/9800 RMOTV 1008 GE22	18.95
Capstan Motor FERG-JVC 3V35 PU55371V/M	27.50
Audio Motor Recorder 12V CW 34mm	4.20
Audio Motor 9V CW 34mm	4.20

MAINS SWITCHES

PB3008 Decca/GEC	0.99
SONY (Universal)	4.05
PB5030 Rank Remote	1.50
PB3003 Philips G8 Plastic	0.95
PHILIPS KT3 (Remote)	1.99
5031 PHILIPS G11 Remote	1.40
285/1 ITT CVC5/CV20	1.40
PB3005 PHILIPS G11	0.95
THORN TX90 ODE2 158 001	0.95

VIDEO BELT KITS

AKAI		3.99
FISHER	MOST	2.50
HITACHI	VT5000E 5500/3000	2.75
	VT7000/8000/8500/9300	
	VT/9500/9700	1.50
	VT11/VD88	3.75
JVC/FERG	3V00/3V22	2.75
	3V29/3V30	2.00
JVC/THORN	3V35/3V39	2.35
JVC	3300/3330/3360	2.75
	7200	2.00
	7600/7610/7650/7655	2.25
NAT PAN	NV7000/7200/777/7800	1.75
	NV2000/3000/332/333/366	2.75
	NV8600/8610	3.75
SANYO	VTC5150/5000/5000	1.20
	VTC9100/9300	1.75
SHARP	VC/200/2300/381/384/385/386/390/9300/9500	2.00
	VC7300/7700/7750	1.75
	VC8000/8300	1.99
	VC6300	2.35
SONY	SL C5 and 7	2.60
	SL C6	2.30
	SL-C8000	2.30
TOSHIBA	V31 & 33	6.30
	V55 & 57	2.35
	V66/67/9600	1.20

VIDEO HEADS

AKAI	
VP-77	£19.99
VP-88	£19.99
VP-7100	£19.99
VS-1	£19.99
VS-2	£19.99
VS-3	£19.99
VS-5	£19.99
VS-10	£19.99
VS-77	£19.99
VS-9300	£19.99
VS-9500	£19.99
VS-9700	£19.99
VS-9800	£19.99
FERGUSON	
3V00	£19.99
3V01	£19.99
3V16	£19.99
3V22	£19.99
3V23	£19.99
3V24	£19.99
3V29	£19.99
3V30	£19.99
3V31	£19.99
3V35	£19.99
3V36	£19.99
3V38	£19.99
3V39	£19.99
8903	£19.99
FISHER	
FVE-P615	£40.50
FVE-P910	£40.50
FUMAI Full range now available	PHONE FOR PRICE
GRUNDIG Full range now available	PHONE FOR PRICE
HITACHI	
VT11	£29.99
VT14	£29.99
VT33	£29.99
VT34	£29.99
VT3000	£29.99
VT4000	£29.99
VT4200	£29.99
VT5000	£29.99
VT6500	£29.99
VT7000	£29.99
VT8000	£29.99
VT8500	£29.99
VT9000	£29.99
VT9300	£29.99
VT9500	£29.99
VT9700	£29.99
VT9900	£29.99
ITT Full range now available	PHONE FOR PRICE
JVC	
HRD110E	£19.99
HRD110EG	£19.99
HRD111	£19.99
HRD120	£19.99
HRD121	£19.99
HRD225	£19.99
HR2200	£19.99
HR3300	£19.99
HR3660	£19.99
HR4100	£19.99
HR7200	£19.99
HR7600	£19.99
HR7610	£19.99
HR7650	£19.99
HR7700	£19.99
KENWOOD Full range now available	PHONE FOR PRICE
LOEWE Full range now available	PHONE FOR PRICE
MARANTZ Full range now available	PHONE FOR PRICE
METZ Full range now available	PHONE FOR PRICE
MITSUBISHI Full range now available	PHONE FOR PRICE
NEC	
N830	£19.99
N831	£19.99
N832	£19.99
N833	£19.99
PVC-2300	£21.95
PVC-2400	£21.95
NATIONAL PANASONIC	
NV100	£29.99
NV230	£42.50
NV300	£19.99
NV322	£19.99
NV330	£42.50
NV333	£19.99
NV340	£19.99
NV366	£49.99
NV370	£29.99
NV380	£29.99
NV430	£27.99
NV450	£42.50
NV470	£42.50
NV480	£42.50
NV730	£48.95
NV2000	£19.99
NV3000	£19.99
NV7000	£19.99
NV7200	£19.99
NV7500	£19.99
NV7800	£19.99
NATIONAL (Cont.)	
NV7850	£19.99
NV8170	£19.99
NV8200	£19.99
NV8400	£19.99
NV8600	£19.99
NV8610	£19.99
NORMENDE Full range now available	PHONE FOR PRICE
ORION	
VH-1	£19.99
VH-2	£19.99
PALLADIUM Full range now available	PHONE FOR PRICE
PHILIPS	
VR-6460	£29.99
VR-6520	£29.99
SABA Full range now available	PHONE FOR PRICE
SANYO	
VTC 3000	£29.99
VTC-5000	£45.00
VTC-5500	£45.00
SHARP	
VC200	£30.99
VC300	£30.99
VC381	£30.99
VC384	£30.99
VC385	£30.99
VC386	£30.99
VC387	£30.99
VC388	£30.99
VC481	£30.99
VC482	£30.99
VC3300	£30.99
VC9100	£30.99
VC9300	£30.99
VC9400	£30.99
VC9500	£30.99
VC9600	£30.99
VC9700	£30.99
SIEMENS Full range now available	PHONE FOR PRICE
TELEFUNKEN Full range now available	PHONE FOR PRICE
THOMSON Full range now available	PHONE FOR PRICE
TOSHIBA	
V31	£35.00
V33	£35.00
V55	£19.99
V57	£19.99
V5470	£29.99
V9600	£35.00

REMOTE HANDSETS

AMSTRAD	
CTV1409	£17.50
CTV2200	£17.50
CTV2210	£17.50
TV/VID-TVR1	£17.50
VCR5200	£20.00
VCR7000	£12.00
VCR9000	£12.00
DECCA	
80/10-NON TEXT (RCI)	£24.50
101-NON TEXT	£27.50
FERGUSON	
TX9/10 NON TEXT	£15.95
TX9/10 TEXT	£15.95
TX9/10 TEXT/STEREO	£15.95
FIDELITY	
FD09193 TEXT	£15.95
FD09141 CTV14S	£15.95
GRUNDIG	
TP400 TELETEXT	£15.95
TP400 NON TEXT	£15.95
ITT	
RG305	£15.95
RG306	£15.95
JVC	
3V23	£15.95
3V31	£15.95
3V35	£15.95
PHILIPS	
G11 TEXT	£15.95
KT3/K30 TEXT	£15.95
KT3/K30 NON TEXT	£15.95
RC5 STD	£15.95

CASSETTE LAMP

– **UNIVERSAL**

High quality 12 Volt Universal Video Cassette Recorder Lamp and Head Lead length Approx. 30cm
ORDER CODE: VID/LAMP
PRICE – 60p

FULL RANGE OF CASSETTE PLAYER DRIVE BELTS: 19mm to 57mm **25p**, 60/94mm **29p**, 100/110mm **35p** each

TURNTABLE DRIVE BELTS: 121/210mm — £1.99 each

CASSETTE DRIVE BELTS: 68/78mm — 45p each; 81/95mm — 50p each

CASSETTE DRIVE BELTS: (WALKMAN TYPE) — 30p each

EAST CORNWALL COMPONENTS
119 HIGH STREET
WEM
SHROPSHIRE SY4 5TT TEL: 0939 32689
TELEX: 35565
FAX: 0939 33800

ORDERING: All components are brand new and to full specification. Please add £1.00 postage/packing (unless otherwise specified) to all orders. 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 catalogue - only £1.00 per copy). Delivery by return on ex-stock items. All prices subject to change without notice. RETAIL shop open Mon-Sat 9.00-5.00. Sat 9-12.00. REMEMBER ALL PRICES NOW INCLUDE VAT

TELEVISION

The Broadcasting Debate Continues

When the government published its white paper on the future of broadcasting last November it invited comments on the proposals and options outlined in the paper. The deadline was early March, and by that time some 2,500 responses had been received. Those that attracted most attention in the press were the submissions made by the ITV Association and the IBA. They would be the ones to have most to say, since the white paper's proposals relate mainly to changes in the ITV sector.

Also naturally enough the main question that exercised the minds of those who prepared these responses was the method of awarding franchises for ITV or, as we must learn to call it, Channel 3. A great deal of ingenuity has gone into working out ways of assessing franchise applications. Let's hope that some good comes of this, though the fact will remain that no system can satisfy everyone. The IBA has itself been highly critical in the past of the burden placed upon it each time the franchises have come up for renewal, and of the difficulties involved in making a rational choice. The tendency has been to renew existing franchises — few holders have ever had their licences taken away. There is logic in this: after all, at least there's a track record on which to base a decision. It has nevertheless always involved an element of guesswork and chance. This is inevitable however: one could never be sure that group A will make a better job than group B of providing a complex service over a number of years. It's a matter of compromise and will remain so whatever is done.

The government's original view seems to have been that to shift the criteria for assessment of the worthiness to fulfill the responsibilities of holding an ITV franchise to primarily financial ones — who's prepared to pay the most for the right to broadcast — would at least have the merit of being simple, understandable and unambiguous. But there is more to broadcasting than having a deep pocket, so the white paper provided for an initial assessment of suitability to run a service. The argument now is mainly about how all this should be done, with some very sophisticated schemes being put forward. George Russell, the IBA's chairman who was appointed to supervise the transition from the ITA to the new Independent Television Commission, has made a considerable impact on the debate by threatening to resign if the awarding of ITV franchises is made too much of an auction.

Instead, the IBA has suggested an alternative that involves setting, with the help of City advice, a minimum lease price for each licence, to be paid in annual instalments. In addition the applicant would bid by offering to pay a specific percentage of its net advertising revenue. The aims here seem to be (a) to establish an applicant's financial standing and (b) to satisfy the government's wish to see an element of bidding for franchises introduced. Applicants would be required to submit their plans in two main ways. An open dossier to be made public would contain details of the company's structure and programme plans. A sealed bid would include a confidential business plan. In addition the applicant would be required to post a bond for a substantial amount as an indication of serious commitment to pay the minimum lease price.

All very clever. The IBA says: "We consider that the applicant with the soundest business plan by these criteria would yield the highest value to the Independent Television Commission/Exchequer in terms of the tender and corporation taxation over time and also have the necessary staying power to provide a programme service of the requisite quality serving viewer's interests." Well yes, one hopes that the scheme would do so. But is this elaborate procedure really likely to be any better than the present system? It meets the government's wish to make programme contractors pay more for the priviledge of running a broadcasting service, but whether the public will be any better served is another matter.

The government's initial reaction has been to welcome these ideas. One can't help feeling that the government originally simply concluded that change was essential but then, despite setting up the Peacock Committee to report on the possibilities, failed to think the problem through and in its white paper produced a rather feeble alternative. So it could well be that the IBA will, in one last dying flourish, get its way in laying down how its successor is to go about the job. One hopes that it will get its way in other respects. What the IBA's regulation of commercial broadcasting has been all about has been the quality of broadcasting and the diversity of programmes offered to the public, in particular an insistence on public service obligations. The government seems to have thought that this approach was unduly patronising, and that simply by deregulation and extra competition the public will be given the service it really wants. Perhaps, but it doesn't necessarily follow. There will always be the temptation to fill the airways with the sort of trivial video wallpaper that is acceptable to the undemanding. Without some sort of schedule supervision it's hard to see that standards will be maintained and money spent of programme making, whether for general or specialist audiences, when cheap imports can be used to fill the hours.

One has an uneasy feeling that at the end of the day an awful lot of people will have wasted an awful lot of time on this exercise to please the government, and that things will end up much as they are at present only marginally worse.

Meanwhile the government's plan to increase its income from the ITV companies by moving the levy from profits to advertising revenue could again be to the detriment of standards. Put simply, less revenue means less to spend on making programmes. An understanding of the delicate balance that underlies successful broadcasting is something this government lacks.

COVER PHOTO

This month's cover photograph shows David Botto's operational amplifier based signal tracer on the bench. See article on page 506-9.

Long-distance Television

Roger Bunney

The excellent tropospheric conditions of January continued into early February, but the main factor this month has been the increased sunspot activity. It made February 1989 an exciting month for really long-distance TV reception. Fortunately many of these long-distance signals have been identifiable. They show that with appropriate conditions really long-distance reception can be achieved using relatively simple equipment. Band I signals from distant parts of the USSR (at plus 8 hours GMT), from Malaysia, Iran and Dubai were seen in the UK during the month.

A slight tropospheric lift on the 6/7th produced reception of West German and Benelux signals and on the 19th RTE (Eire) stations were received. Auroral reception was noted in Scotland on the 13th and 17th and there was a certain amount of SpE reception during the month, the SpE log being as follows:

5/2/89 TVE (Spain) chs. E2, 3.
8/2/89 TVE E2, 3.
13/2/89 TVE E2.
14/2/89 RTP (Portugal) E3; TVE E4.
15/2/89 TVE E2, 3.
16/2/89 TVE E2; TSS (USSR) R1 (during an F2 period, but definitely SpE).
19/2/89 RUV (Iceland) E3, 4.
26/2/89 TSS R1.
27/2/89 RAI (Italy) IA.

There was improved F2 reception on many days during February, the signals sometimes being exceedingly strong. The most dramatic day was the 26th, which was fortunately a Sunday, enabling many enthusiasts to participate. The first signs of F2 improvement occurred on the 10th, when unidentified ch. E2 signals were present after 0900. Things then developed, as follows:

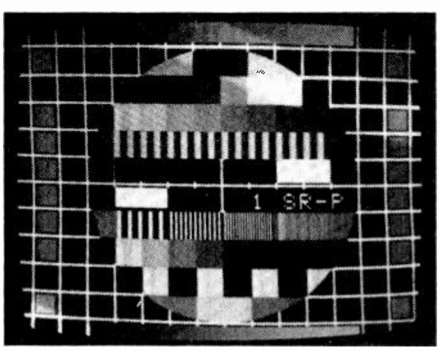
12/2/89 RTM (Malaysia) ch. E2 received in Sussex at 1030-1040 GMT.
13/2/89 Iran ch. E2 received in Derby, using the FUBK test pattern. Arabic mobile radio noted at above 48MHz.
14/2/89 Iran ch. E2 FUBK pattern received again.
15/2/89 TSS (USSR) R1 plus floater signals, very strong; variation to TSS programme material or maybe TSS-2 or China; Dubai E2 with EBU bar pattern; Iran E2 with FUBK pattern again; unidentified African ch. E2 signal received from due south at 1220.
16/2/89 Unidentified E2 signal plus TSS R1 from the east at 0900.
17/2/89 Similar to the 16th.
18/2/89 TSS R1; Iran E2; Dubai E2; unidentified colour bars seen on ch. E2 at 0940.
19/2/89 Iran ch. E2; unidentified ch. E2 signals.
20/2/89 Unidentified teletext pages going on to the PM5544/34 test pattern, 0920-0940 – thought to be Dubai.
21/2/89 TSS R1; unidentified E2 signal at 0815.
22/2/89 TSS R1.
25/2/89 TSS R1 – very strong; unidentified E2 signal at 0900.
26/2/89 The peak day for F2 reception during the period. Details as follows:

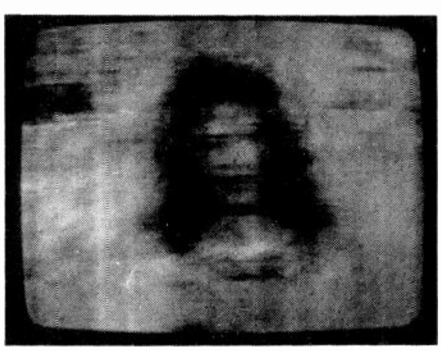
0830-0930 Iran E2 with later an unidentified female oriental presenter, the latter co-channel with Dubai teletext pages then Dubai going on to programme at 1200 (local time). Additional Arabic programme at 0930-0950. Arabic signals present this day until approximately 1400 GMT. Keith Hamer reports an E2 end of programme at 1145, not Arabic but with the announcer bowing (in sitting position), the following male announcer also bowing to the camera. Could this be RTM (Malaysia)? Information from overseas readers please to confirm one way or the other. Thoughts are that this could be RTM with a possible third network transmitter on ch. E2. Simon Hamer's log at midday notes several programmes including Dubai on teletext, a panel game with white contestants, Arabic news, advertisements and at 1220 a logo with an eagle/bird on top! At 1500 GMT Simon logged weak ch. A2 525-line signals from the west, probably Canada. Typically, yours truly was away working in London over this period.

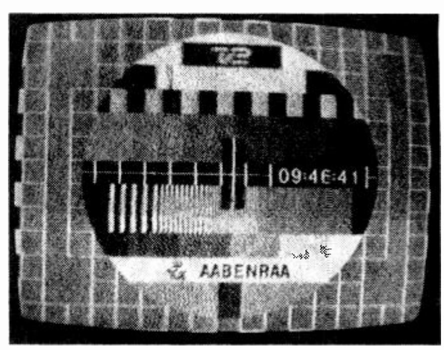
F2 conditions have fallen off somewhat since the 26th, and although the m.u.f. has approached 48MHz no video has been seen since then (at the time of writing, March 3rd).

Ryn Muntjewerff writes to tell us of his tropospheric reception on the 2nd with TVP-1 (Poland) chs. R8, 9, 10, 12, TVP-2 R29 and TSS (USSR) R8, 9, 10, the former two being from Latvia and the latter the old 0249 monoscope pattern but the origin unknown. Ryn noted good F2 reception on the 15th, with TSS R1 and Dubai E2.

A letter just to hand from Anthony Mann (Perth, Australia) reports reception of Norway and Sweden ch. E2 on a scanner, between 0715-0930 GMT on the 25th. From 0805-0819 Sweden was received on a TV receiver with the PM5534 test pattern followed by programme material. More details next month.







Left: The new Czechoslovakian test pattern, with CST-1 identification. Photograph courtesy Karel Honzik. Centre: F2 reception on January 15th at 0840 GMT. A ch. E2 signal possibly from Malaysia. Photograph courtesy Garry Smith, Derby. Right: Denmark TV-2 Hedensted ch. E27, received by Tim Anderson (St. Leonards) during the January tropospheric opening.

My thanks to the following for sending in reception reports: Peter Schubert (Rainham), Tim Anderson (St. Leonards), Garry Smith and Keith Hamer (Derby), Roger Fussell (Torpoint), Simon Hamer (Powys), Iain Menzies (Aberdeen), Ryn Muntjewerff (Holland) and Anthony Mann (Perth, W. Australia).

Paul Barton (Harrogate) writes that he has been experimenting with a couple of Datong AD370 active aerials in shortened form spaced four feet apart, giving a forward pickup lobe and two rear lobes, the latter being perhaps 3dB down. The gain is higher than a dipole. The system is mounted in the loft and is aligned towards the south east, giving coverage from east to south with the main lobe and one lobe directed towards N. America. In conjunction with an outside discone aerial this system provided excellent F2 reception on the 25/26th. We would be interested in hearing from anyone who is using any form of active aerial.

Dalibor Frkovic (Sisak, Croatia, Yugoslavia) writes to tell us about the new Czechoslovakian test pattern (see accompanying photograph) which carries the identification 1SR-P for the first programme or 2SR-P for the second. It replaces the familiar EZO test pattern. CST Bratislava still uses the PM5544. The FUBK pattern is also still in use, with identification DDK 3 for the first network and DDK 1 for the second. Dalibor often receives Band III/u.h.f. signals from CST, also TVP and Bulgaria BT-1 ch. R30 and BT-2 chs. R36, 46. He mentions that TV Zagreb and TV Beograd (the latter chs. E12, 30) have for over a year been transmitting a third programme experimentally at low power. Contents have included a film festival and various downlinked satellite TV programmes including at different times Super Channel, Sky, RAI-1, 3-SAT and even TSS-1 and CNN.

David Martin of Aerial Techniques tells us that his company can now supply what he describes as the ultimate VHS multi-standard VCR, the National Model NV-G500EM. It has a multi-band tuner and can process PAL B/G/I, SECAM B/G/D/L and NTSC M signals with colour coverage of PAL, SECAM, MESCAM, and NTSC at 3·56 and 4·43MHz. The sorts of features you would expect in an upmarket machine, such as variable speed (up to eight hours playing time) and bar code scanning, are included. Cost of the machine is £685 inclusive of VAT. For the address see the accompanying advertisement.

News Items

France: Local TV channels have been set up in Toulouse, Lyons and the Mont Blanc area. The contracts provided by the National Committee for Communications are for eight year periods. The TF1 and La 5 networks have been fined substantial amounts for failure to observe French regulations on the length of advertising and the European content of programmes.

Spain: Further local commercial TV operations are to be started in San Roque, Algeciras and Los Barrios.

Denmark: Hadsten ch. E26 at 600kW e.r.p. is amongst the increasing number of TV-2 transmitters now in operation. Further planned openings for this year are listed in Table 1.

Belgium: Canal Plus Belgium, a cable operation, is to start in late September with coverage restricted to French speaking areas. A commercial cable operation Vlaamse Televisie Maatshappij provides a service in Flemish speaking areas. During non-programme hours Telebruxelles transmits colour bars with its own name as an inlay identification. RTBF has stopped using the Antiope teletext system: there's a suggestion that the UK teletext system may be adopted.

Ireland: Further ATV licences in the 434-440MHz band are to be issued. By the end of 1988 six operators had been licensed.

Satellite TV

The Japanese Yuri 2B DBS craft may end its transmissions earlier than expected as a result of a telemetry

Table 1: Planned Danish 1989 TV-2 Openings

Transmitter	*DR-TV*	*TV-2*	*E.R.P.*	*Date*	*Area*
Nibe	E29	E35	600kW	1 April	Nordjylland
Tolne	E57	E37	22kW	1 April	Nordjylland
Varde	E53	E33	500kW	15 May	Ribe
Jyderup	E51	E48	600kW	1 July	Vestjylland
Vordingborg	E42	E58	600kW	15 August	Storstrom
Nakskov	E34	E52	100kW	15 August	Storstrom
Ro	E59	E56	800kW	1 October	Bornholm

encoder fault. The same fate took Yuri 2A out of operation.

A new satellite radio distribution system known as Radikal-3V is to be brought into operation in the USSR this year, with downlinking in the 11GHz band. It will provide for up to twenty radio programmes.

Thirteen new domestic satellites have been authorised in the USA, bringing the number to 42. NBC is now scrambling its C band (4GHz) network feeds though its 11GHz feeds remain clear. A satellite dealer in Cartersville, Georgia has been fined $3,000 with a suspended jail sentence and forfeiture of equipment for selling illegal satellite TV decoders.

Galavision is now well established, providing a Mexican originated service targeted mainly at Spain via the Atlantic beam of the ECS satellite at 13°E. Uplinking is via Miami and transponder 19 on PanAmSat 1 at 45°W to the London teleport.

Ian Waller reports that the new Moroccan TV service "2M International" is now on test via the Intelsat craft at 53°W in band C, using Canal Plus type scrambling. The signal is very strong and the programme content appears to be compiled from RTM (Morocco), TF1 and Videotron (Canada).

The 405-line Society

Andrew Emmerson (71 Falcutt Way, Northampton NN2 8PH) has started a club for those interested in 405-line TV equipment, programmes, etc. The first newsletter will be available as a free sample (send a large stamped s.a.e.) and membership is expected to be about £5 a year. The club is to operate on informal lines, the policy being to discuss, inform and propagate news on 405-line TV. It's worthy of support.

Finally if anyone has any 405-line equipment for disposal please write in – good homes can be found. In addition to TV sets test equipment, telerecordings, films, magazines, servicing data and anything else relating to the early days of UK TV is required.

Test Report: Leader Laser Power Meter

Nick Beer

Several new items of test equipment have appeared on the market over the last few years to facilitate servicing the ever increasing range of brown goods available. Over the next few months I will be discussing some of these units and reviewing selected examples. The first to come under the spotlight is the laser power meter. Its applications are obvious enough – there aren't many manufacturers of consumer electronics products who don't now market compact disc players, and the market is a steadily growing one.

The meter chosen for review is the Leader LPM8000, simply because it appears to be the most widely available one from the usual electronics parts/test gear suppliers.

The LPM8000 is able to measure the output from gallium arsenide or helium neon lasers, being calibrated for both with selection by means of a switch. There are three ranges, 0·3mW, 1mW and 3mW. The sensor probe is separate from the meter itself, connection being via a lead with a fairly sturdy plug of d.c. connection type at one end. No battery is required to power the meter: as soon as the protective cover is removed from the sensor you can see the needle move – provided one of the two lower ranges is selected – as the sensor picks up various ambient light frequencies. The sensor should never be pointed at direct light sources other than laser radiation of the type the meter is intended to measure. This means sunlight and artificial indoor lighting. So the protective cover should always be put back on the sensor when it's not in use.

The whole assembly fits into a case that appears to be too big. It's certainly flimsy, and as a result the securing popper is virtually impossible to do up. This may well improve as the case becomes more supple. The overall impression is that a fortune hasn't been spent on the cosmetic features of the meter: in addition to the poor case the meter's cabinet appears to have been designed for something else – there's a battery cover that isn't used, being just glued shut. Being a typical engineer I tried to open this without first reading the instruction book. It was while subsequently looking through the book that I realised the cover shouldn't open!

The meter performs the tasks required of it very well, though the durability of the case under typical workshop conditions is suspect. Some manufacturers now insist that a workshop has a laser power meter before they will appoint a CD player dealership, but unless you handle a massive number of players I don't personally see the need for one. An experienced engineer can evaluate the optical pickup unit by looking at the r.f. waveform – anyone other than an experienced engineer shouldn't be working on these players. If the r.f. waveform is of low amplitude the optical unit needs replacement – turning up the output to provide compensation staves off replacement for only a very short time. Buying a laser power meter will however undoubtedly speed up CD player fault finding. You always have at the back of your mind the possibility that the laser's output could be low, and a laser power meter will provide quick confirmation one way or the other.

I suspect that many smaller service departments will be able to list more urgent calls upon an investment of some £200. But if you do handle CD players in any numbers a meter will save time by quickly condemning the laser unit or confirming its innocence. It's a fact that a surprising proportion of disc playability faults, particularly where the optical unit seems to drift off alignment, are due to faulty lasers. This sort of thing can cost you precious time and money as you try setting up the servos for skipping, slow access times, etc., and can sometimes result in a callback only a couple of weeks later for the same trouble. A check with the meter will establish the root cause of the problem first time.

Availability

The test meter was kindly supplied by Willow Vale Electronics Ltd. of 11 Arkwright Road, Reading, Berks RG2 0LU. It's available from them under order code 12-800 at a trade price of £174 plus VAT.

For further information on laser unit servicing, see Joe Cieszynski's article on page 520.

MINIATURE PASSIVE INFRA-RED SENSOR RP33

ONLY £23.95 + VAT
Quantity discounts start at 3 units

Detects Intrusion up to 12 Metres Away

Size: only 80×60×40mm. Wide 85° coverage. Switchable detection indicator.

This advanced intrusion detector operates by detecting the body heat of an intruder moving within the detection field whilst ignoring ambient changes. Easily installed in a room or hallway, the unit provides reliable detection of any intrusion. Operating from a 12V supply and recurring only 15mA, it is ideal for use with the CA 1382 or any equivalent high quality control unit. Supplied with full instructions its performance compares with detectors costing more than twice the price.

SECURITY

SYSTEMS, MODULES, COMPONENTS

SAVE £££'s

BY INSTALLING YOURSELF

TELEPHONE OR SEND FOR FREE LITERATURE TODAY

CPU 9000 SELF-CONTAINED ALARM SYSTEM

Immediate Security Without Installation

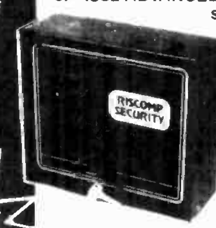
For Homes, Storerooms, Clubhouses, Caravans, etc.

■ Detects intruders up to 30ft. ■ Penetrating 103db Siren with auto reset ■ Compact size only 203×180×76mm ■ Easily extended for coverage of additional rooms or large areas.

This exciting new System which contains a Passive Infra-Red Sensor, Control Unit and Power Supply, together with a high output Siren all housed in the one compact steel case, provides immediate protection of a chosen area without the need for costly wiring and expensive installation costs. Operating from a standard 240V supply, provision has been made to incorporate a re-chargeable 12V battery which is capable of operating the System for up to 10 days before re-charging becomes necessary, and which is carried out by the built-in charger. Where protection of more than one room is required, additional sensors may be wired to the main unit. An external siren unit may also be fitted to warn neighbours. Supplied with 2 keys and full operating instructions, the unit is fully guaranteed for 12 months. Immediate protection for only

Priced £67.72 + VAT

CA 1382 ADVANCED CONTROL UNIT that's simple to install and operate.

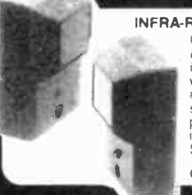


- Fully automatic siren re-set
- Audible entry/exit warning
- Alarm sounded memory
- 2 separate loop inputs + 24hr circuits
- Built-in electronic siren driver
- Easily installed, full instructions supplied

The latest control panel provides effective and reliable control for all types of security installations. Its advanced circuitry checks the loop circuits every time it is switched on, preventing incorrect operation. Using a simple 'on/off' key switch, it is easily operated by all members of the family. In addition it provides 24hr. personal attack protection. Housed in a steel case, it is supplied with full operating instructions.

Only £44.95 + VAT — Available in kit form with fully-built electronics, £39.95 + VAT.

INFRA-RED SYSTEM IR 1470



Consists of a separate transmitter & receiver, the system provides an invisible modulated beam which when broken operates the built-in relay. For use with security systems, but also ideal for photographic purposes and industrial applications.
Size: 80×50×35mm.

Only £25.61 + VAT

CA 1250 LOW COST ALARM CONTROL MODULE

This tried and tested control unit represents the finest value for money in control systems, providing the following features:
• Built-in electronic siren drives 2 loudspeakers • Provides exit and entrance delays together with fixed alarm time • Battery back-up with trickle charge facility • Operates with magnetic switches, pressure pads, ultrasonic or I.R. units • Anti-tamper and panic facility • Stabilised output voltage • 2 operating modes full alarm anti tamper and panic facility • Screw connections for ease of installation • Separate relay contracts for external loads • Test loop facility.

Price £19.95 + VAT

DIGITAL ULTRASONIC DETECTOR US 5063

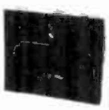
This advanced module uses crystal control transmitter and digital signal processing to detect movement at distances of up to 20ft or more. With built-in timing and 12V operation, it is ideal for a wide range of security applications.

Only £13.95 + VAT

Suitable steel enclosure complete with necessary mounting pillars and fixings.

Only £2.95 + VAT

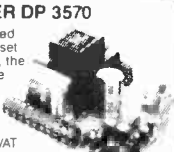
HW 1250 – ATTRACTIVE HOUSING plus HARDWARE FOR CA 1250



An attractive steel case designed to house the Control Unit CA 1250 together with the appropriate LED indicators and key switch (available separately). Supplied with the necessary pillars, fixings, and punched front panel, the unit is given a professional appearance by the adhesive silk screened label. Size 200×180×700mm.

Only £9.50 + VAT

LIGHTING CONTROLLER DP 3570



This versatile module provides timed switching of loads up to 3A for pre-set times between 10 secs and 5 mins, the timed period being triggered by the opening or closing of an external loop or switch. The built-in 12V 250mA power supply is available for operating external sensors. Suitable plastic enclosure £2.85 + VAT

Only £13.95 + VAT

RISCOMP LIMITED

Callers by Appointment. Office hours Mon–Fri 9am–5pm

Dept. TV5, 51 Poppy Road, Princes Risborough, Bucks HP17 9DB

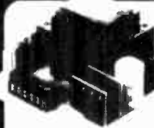
The Security Specialist

ORDER BY MAIL OR TELEPHONE

BARCLAYCARD VISA — Access

P&P U.K. Orders 75p per order
Export add 10%
Tel: (084 44) 6326
Fax: 08444 7102

POWER SUPPLY & MAINS SWITCHING UNIT PS 1265



In addition to providing 12V stabilised output of 700mA, this module may be used to provide a switched 240V output for operating security lighting etc., when used in conjunction with the CA 1382, CA 1250, CPU 9000 etc.
Suitable plastic enclosure £2.85 + VAT

Priced at £12.95 + VAT

NOTICE

TO ESSEX TV TRADERS

NEW WAREHOUSE
Ex-rental TVs and VCRs plus new manufacturers 'B' graded goods available now!

- ★ Fully serviced, ready for the showroom
- ★ VCR toploaders/front loaders
- ★ TVs — Ferguson, Philips Professionals, TX stereo, National Panasonic, Grundig, Decca, Toshiba, JVC, Samsung and a lot more

SAMSUNG Electronics — JVC — PHILIPS — HITACHI — FERGUSON

Phone Paul on 0375 640800 (2 lines)

GRAB SOME ACTION NOW — *Strictly TRADE ONLY*

CLEARVISION

30A CORRINGHAM RD.
STANFORD-LE-HOPE, ESSEX
OPEN MON-SAT 9AM-6PM

APPROX. 5 MINS FROM DARTFORD TUNNEL
TAKE A13 TILBURY ROAD FROM JUNCTION 30/31. M25

VIDEO HEADS AT UNBEATABLE PRICES

AKAI VS109/201/202/203/301.303 (Just Arrived)	£25.00
AMSTRAD VCR4500/4600/5200/9000	£21.00
AMSTRAD VCR7000	£22.00
FERGUSON/JVC/AKAI UNIVERSAL 3HSSV	£15.50
FERGUSON 3V32/JVC HR7655	£40.99
FERGUSON 3V42/44/45/46/47/50	£22.00
FERGUSON 3V48/JVC HRD565	£40.99
FISHER UNIVERSAL FVHD720/520/530 ETC	£21.00
HITACHI VT4000/5000	£21.00
HITACHI VT6500/7000/8000/8500/8700/9000 ETC	£21.00
HITACHI VT11/14/33/34/330/340 ETC	£21.00
PANASONIC NV333/2000/7000/8600 UNIVERSAL 3HSSN	£15.50
PANASONIC NV370/NV380/NV100-PHILIPS VR6460	£24.00
PANASONIC NV777/NV330 3 HEAD	£27.00
PANASONIC NV230/NV250/NV260/NV270/NVG-9/10/11	£34.50
PANASONIC NV430/NV460	£27.00
PANASONIC NV366 4 HEADS	£39.50
PANASONIC NV730 4 HEADS	£39.50
PANASONIC NV180 4 HEADS	£42.00
PANASONIC NVG-21 (Just Arrived)	£42.50
SAISHO VR605/705/805/905	£21.00
SHARP VC300/381/382/9300/9500/9600/9700/9800 ETC	£20.00
SHARP VC500/581/582/583/584/651/681/682 ETC	£21.00
SONY UNIVERSAL 1 PIN C5/6/7 AND 2 PIN ETC	£17.00
SONY SLF-1/C20/30/40/F40/SLT20ME/30ME	£20.00
SONY SLC-8/9/60/80/SLF60/SLT50/SLF60/SL200	£27.00
TOSHIBA V9600	£22.00

VIDEO MOTORS

CAPSTAN MOTOR JVC/FERG PU55371V	£19.50
DRUM MOTOR JVC/3V22 PU46414P	£19.50
REEL MOTOR SHARP RMOTV-1008-GEZZ ORIGINAL	£15.00
REEL MOTOR SANYO VTC5000 4-529V-10600 ORIGINAL	£7.50
REEL MOTOR PANASONIC NV333-366 MYN13V5L ORIGINAL	£14.00

SONY ORIGINAL MAINS SWITCHES

1-554-966-11 26MM PLAIN BRKT REMOTE	£2.90
1-554-965-11 26MM THREADED BRKT REMOTE	£2.90
1-552-588-00 21MM THREADED BRKT NON-REMOTE	£2.40

MATSUSHITA CASSETTE MOTORS
2400 RPM 25MM LOW PROFILE TYPES

12V CLOCKWISE	£2.50
12V COUNTER CLOCKWISE	£2.50
9V CLOCKWISE	£2.50
9V CLOCKWISE	£2.50

ALL ABOVE HEADS ARE BRAND NEW AND OF JAPANESE ORIGIN
ALL EX-STOCK ITEMS DESPATCHED SAME DAY. NO MINIMUM ORDER VALUE.
PLEASE ADD £1.00 P&P PLUS V.A.T. TO ALL PRICES
ORDERS BY ACCESS AND VISA ACCEPTED

EXPORT & OVERSEAS ENQUIRIES WELCOME.

OMEGA ELECTRONICS

252A HIGH STREET
HARLESDEN, LONDON NW10 4TD
Tel: 01-965 5748 Fax: 01-963 0351

Letters

THE TECHNOLOGY JUNGLE

Anyone who has worked in a high-tech company will be familiar with the salesmen who knock on the door almost daily, an IBM under one arm and a "new" software package under the other. The basic reason for this seems to be the endless output from those little geniuses who grew up on keyboards whilst playing Space Invaders. The belief is around that what we need is ever more graphics, CAD, word-processing and accounting packages. Engineers, scientists and managers alike are being baffled by the daily inception of new acronyms.

There's nothing new about this. In the TV world copywriters thirty of forty years ago were quoting features like APC in sales literature in the hope of impressing prospective purchasers. Unfortunately today the punter expects to be impressed. We need improved technology, but we also need it to be described in a language understood by all. That way the danger of purchasing incompatible equipment might be avoided. To give one example. Three years ago we bought a very good CAD package. The following year evaluation of a desk-top publishing (DTP) package was entrusted to the same employee who, in retrospect, was obviously inexperienced and reluctant to admit being blinded by science. The result was that we purchased the DTP system and then experienced considerable problems with transferring graphics from the original CAD system – complex drawings were often lost, wouldn't convert or lost the text originally placed upon them. Here was a fine example of a software expert without experience of the real world creating a finished product that caused problems. Both systems were extremely good in their own way, but the incompatibility factor ended up by providing ammunition for management politics with the result that the whole system was shelved.

Returning to TV, we had perhaps the best system in the world with 405 lines. If it had been given f.m. sound it would today have been the system to which the world converted. Why? Because it was economical of bandwidth. But, I hear you say, the definition was inferior. The horizontal definition was in fact very good, comparable (with a good set) to modern 625-line receivers. One way of making the coarse line structure less visible was to use spot wobble. Some Ekco models featured this, but viewers, who had no idea what the toggle switch was for, invariably switched it off permanently. Besides, the average viewer was happy with his 17in. box until somebody told him he was missing something.

Pictures can now be digitally reprocessed within the receiver. Yet we are still threatened with a multiplicity of systems. The Japanese HDTV system offers over 1,100 lines and 60 fields per second, which overcomes interlace flicker, but it's incompatible with existing systems. MAC offers compatibility (via a converter) but retains the interlace flicker. Meanwhile we are getting PAL signals from Astra, again via a converter. Soon we'll need another converter for BSB. When you sit back with a sigh of relief after getting that lot someone will be telling you that you are missing something because the new wide-screen TV sets are in the shops.

There are several lessons to be learned. In particular that customers don't want to be baffled by science — they just want to watch Coronation Street. Here's an example. I was called to a set one day to correct a no-picture fault, then readjusted it and left. Next day I was called back for slight hiss on sound. It was almost imperceptible and was resolved by slightly reducing the setting of the treble control which I'd inadvertently left at maximum. The user had no idea what the control was for! Here'a another example. The purchaser of an expensive (for its day) VCR, the Ferguson 3V23, was asked why he'd paid £750 when he used it only to watch videos from the local video shop and to make the occasional off-air recording. He replied that he'd come into some money and wanted the "latest thing". Totally confused by the search tuning and remote control handset, he'd no intention of using the assemble edit, freeze frame, variable slow motion or even the Dolby noise reduction. He just wanted a video!

There's a great danger in technology for the sake of it. Will the ultimate user want or understand it? If current predictions are fulfilled and our children inherit our property and blow the proceeds on new gadgets, perhaps they'll have the time to gen up. But will the service engineers of the day?

Malcolm Burrell,
Romford, Essex.

ELECTRON COMPUTER PROGRAM

Owners of Acorn Electron computers will probably wish to try out J.T. Beaumont's program for satellite dish alignment (March issue). Although written for BBC B series computers which use the same BASIC language as the Electron, because of certain electronic differences between the two machines the part of the program that relates to drawing an ellipse won't work. The following modifications and additions to this excellent program will enable Electron users to get going.

```
1200 GCOL 1,3
1210 PROCellipse
1220
1230
1240
1870
1890 DEFPROCellipse
1900 x=620:y=800:xrad=400:yrad=150
1910 FOR n=0 TO 360 STEP 10
1920 a=RAD(n)
1930 X=SIN(a)*xrad+x:Y=COS(a)*yrad+y
1940 IF n=0 MOVE X,Y ELSE DRAW X,Y
1950 NEXT
1960 ENDPROC
```

D.R. Isham,
Buckingham, Bucks.

TROUBLES WITH NICAM?

ITV and Channel 4 have been broadcasting NICAM stereo test transmissions from Crystal Palace since the beginning of March. During the morning of March 4th I noticed that the music seemed to be interspersed with occasional random loud clicks (decoder switching?). This has continued since the start of the tests but doesn't seem to occur with the BBC's NICAM transmissions.

A call to IBA Engineering at Winchester on March 13th confirmed that I was not the only one to hear this noise, and that the phenomenon had been reported by viewers with JVC, Sony, Panasonic and Ferguson equipment. I was told that the IBA engineers were scratching their heads! These might be teething troubles and I don't want to be alarmist, but it was inferred that the trouble could be caused by the decoder chip in current use.

There must be quite a lot of homes now with expensive VCRs and TV sets fitted with NICAM decoders. The thought of them all requiring modification or new chips is cause for concern. Can anyone shed more light on this matter?

Andrew H. Sykes,
Sutton, Surrey.

REMOVING HARDENED PVC

The PVC sheath covering wires with single or multistrand cores will harden when subjected to heat over a period of time. If you have to strip such wire, try the following method. Place the wire to be stripped against a hard surface – see Fig. 1 – then press the body of the bit of your soldering iron on top of the PVC sheath, at a suitable distance from the end to be stripped. Leave for a couple of seconds then, while applying pressure with the iron, pull the wire from the other end so that it passes under the bit. This will remove part if not all of the PVC sheath without damaging the core.

M.K. Hayter,
Moseley, Birmingham.

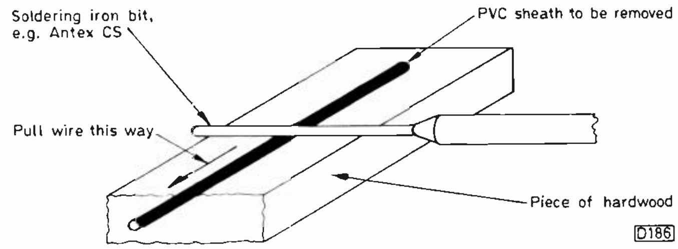


Fig. 1: Method of stripping hardened PVC wire covering.

USEFUL TIPS

Here are some tips which I have used myself. I hope the ideas will prove of use to other readers.

(1) A degaussing coil would probably cost you £20 or more, yet many engineers carry one with them without realising it. I refer to the "instant heat gun" many of us carry in our kits. It does a first rate job and can be even better than a degaussing coil in stubborn cases. Always check the degaussing posistor and the continuity of the circuit of course.

(2) Rather than carry a large bottle of isopropyl or whatever you use for cleaning upper drum assemblies try this tip. Cut half a dozen kitchen towels into quarters (24 pieces) and completely soak them in the cleaning fluid, then put them in a plastic bag to prevent evaporation. It can save a lot of room in the rool case.

(3) If you want a cheap 30V supply for fault finding (tuners etc.) and you have a scrap Rediffusion Mark 3 chassis, the little PCB mounted mains transformer 6T1 (Hinchley type 21861) on the power supply panel is ideal. Fig. 2 shows a suitable circuit.

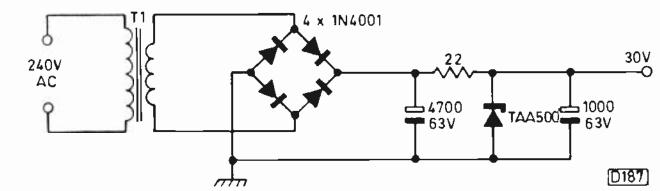


Fig. 2: Simple stabilised 30V supply circuit.

(4) A budget variable stabilised power supply giving 1-2A at 5-15V can be built easily using a 7805 regulator secured to a good-sized heatsink and a mains transformer obtained from a scrap monochrome portable. Fig. 3 shows a basic circuit – the 10kΩ potentiometer sets the output. For a higher output voltage use a 7812 regulator with a higher-voltage transformer.

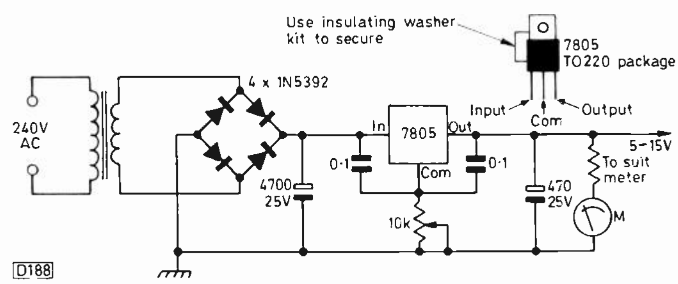


Fig. 3: Simple 5-15V regulated power supply circuit.

(5) There have been some excellent articles in the magazine on converting Sony sets from GCS to transistor operation in the chopper and/or line output stage. I recently carried out such a conversion with a 20in. set and noticed that the output transistor was getting excessively hot. After trial and error the perfect device was found. Instead of a BU208A, use an R2540 (the Syclops transistor in the Thorn 9000 chassis). It runs as cool as a cucumber! This transistor is also an excellent replacement for the rather expensive 2SC1942 regulator used in the Sony KV1612UB colour portable.

Graham Richards,
Rochdale, Lancs.

SATELLITE TV ALIGNMENT TOOL

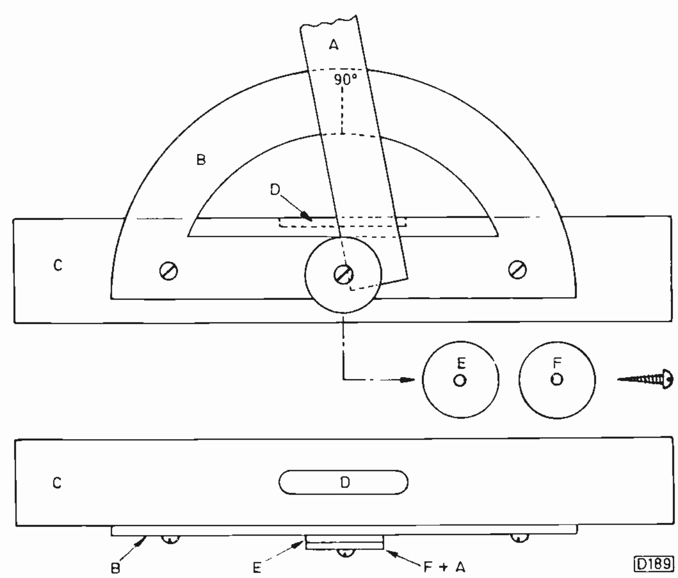


Fig. 4: Simple satellite dish alignment tool.

The "poor-man's" satellite TV alignment tool shown in Fig. 4 can be made at very little cost. It consists of a straightedge A which can be of any material with a good edge (look around you local DIY store); a protractor B which can be obtained from W.H. Smith for about 45p; a wooden base spirit level C or a suitable piece of machineplaned wood with a bubble D attached (from DIY stores or Maplin order no YP56L, £2·80 plus 50p post and packing on orders below £5); a friction washer E–rubber etc.); a washer F suitable for glueing to material A (steel etc.); and three woodscrews.

To use for elevation alignment, move the straightedge to the degree reading required, placed the straightedge on the face of the dish and adjust the dish until the spirit level is centred. The straightedge should be of suitable length for the job.

J. Johnson,
Gloucs.

Editorial note: Would Mr. Johnson please send us his full address so that payment can be made for this contribution?

HELP WANTED

I'm seeking a replacement mains transformer for an Elizabethan LZ32 open-reel audio tape recorder. As far as I'm aware the secondary windings are 6·3V to supply the heaters and 240V isolated to feed a bridge rectifier. The one fitted is a Grundig Netztrafto 9078-003 – unfortunately the primary winding is open-circuit. Any help in obtaining a new or ex-scrap machine transformer would be appreciated.

Brian Renforth, 174 Helmsley Road,
Sandyford, Newcastle-upon-Tyne,
Tyne and Wear NE2 1RD.

Can anyone supply a circuit diagram for the Thandar (formerly Sinclair) DM450 multimeter?

G. O'Brien, 105 Roxborough Road,
Harrow HA1 1NT.

Can anyone supply a line output transformer for an Orion Plustron Model CTV55?

R. F. Maynard, 7 Phillips Avenue,
Exmouth, Devon EX8 3HY.

Small portables seem to be ever more popular yet their owners often make very little use of them. I have two in for repair. Both have seen little use and their cabinets are perfect, yet I have to tell customers that such sets are scrap as the parts are no longer available. As a last ditch, can anyone help with the following? First an AN239Q chip for a Panasonic model. Secondly a line output transformer for a Contec Model KT8135.

Richard Hammon, 17 Knightcote Drive,
Leamington Spa EV32 5FA.
Telephone 0926 428 534.

WIDE-RANGE CAPACITANCE BRIDGE

Several readers have written to me about the wide-range capacitance bridge (March 1988). The following notes cover the various points raised.

Ranges D and E will not operate correctly unless the power factor control VR4 is of the type that shorts out *completely* to zero ohms. Use a 100Ω control of the type that has a positive shorting out position. A suitable control can be obtained from Forester's National Radio Supplies, 36 Ashley Road, Boscombe, Bournemouth, Dorset BH1 4LR (telephone 0202 302 204). Order as an "open wirewound panel mounting pot meter 100Ω of type that shorts out completely at the end positions". The price is £1·95 cash with order (includes post, packing and

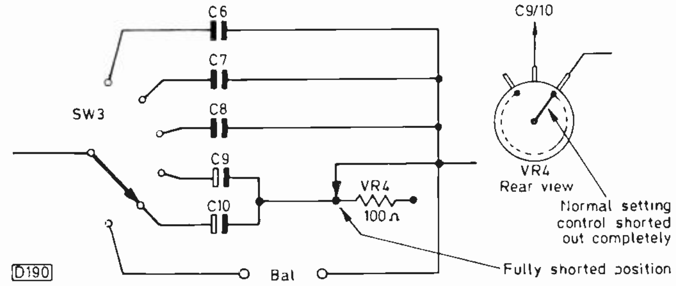


Fig. 5: Use of the correct type of power factor control in the wide-range capacitance bridge is important.

VAT). The lower value than originally specified (1kΩ) gives a better power factor balance with large-value capacitors. In normal use, i.e. when measuring capacitance values, VR4 is turned fully anti-clockwise so that it is completely shorted out (see Fig. 5). C9 and C10 should be ordinary small electrolytics as originally specified, connected with the polarity shown in Fig. 5.

As stated in the article, it's important to ensure that the leads from the secondary winding of transformer T1 to VR1 are twisted together (like twisted flex) and that there is no unwanted coupling between the connecting leads.

Set the gain control VR3 as low as possible. You don't need a lot of sound, just a clear, sharp balance.

Range A (C6, 100pF 1% standard) should give a clear, sharp balance with capacitors down to a few pF in value. Don't change the specification for C6 (RS silver mica type 124-780). The range switch SW3 should be a good quality type, e.g. the RS Components type specified.

Make sure that there is no direct coupling between the squarewave oscillator circuitry and the audio amplifier section. All leads should of course be as short as possible.

If these simple points are observed you should get many years of useful service from your wide-range capacitance bridge.

David Botto,
Poole, Dorset.

INCORRECT COLOURS

So Les has also been caught out by a Ferguson TX9 (April issue) – I refer to the set that needed the RGB leads to be swapped around. Next time the set comes in and you've put all the leads back in their original positions, check the thermistor in the degaussing circuit and all the connections here! I had the same thing happen some months ago, during the snooker finals. It made the programme more interesting though – they were getting breaks of 500 or more!

On the cost of spares etc., I've just received from Philips a small sponge-rubber cap to go over a camcorder microphone, priced at £18·69. Is this a record or can anyone beat it? Go on, surprise me!

Chris Plaice,
Swansea, Glam.

Some years ago I had two or three cases of the type described by Les in the April issue – sets with interchanged colours. They were all Grundig models. When the first set came in a check with colour bars suggested that swapping the leads around would cure the fault. This turned out to be so and I assumed that the set had been incorrectly assembled. It came back a few days later however, again with the colours interchanged. Restoring the leads to their original positions put matters right. It then began to dawn on me: I switched the colour-bar generator to give a red raster and found that there were impurity patches. The dual-posistor in the degaussing circuit was charred, with its guts loose.

For years I've identified with Les – even in the cases of seductive ladies, two in pyjamas, one after insisting on a 9 a.m. call by the senior engineer. . . Also over 60 now, I too suffer from loss of memory and concentration and often add to my difficulties by carefully arriving at wrong conclusions.

J.R. Armagh,
Craigavon, Co. Armagh.

Teletopics

SONY LAUNCHES VIDEO WALKMAN IN UK

The Sony Video Walkman Model GV-8E is now available in the UK at a suggested price of around £800. It's a remarkable piece of equipment, incorporating a full-feature VCR, an LCD colour TV display and a tuner/timer in a package measuring approximately 5in. in width, 2¾in. in height and 8⅜in. in depth, the weight being 1·5kg. There's a comprehensive range of input/output sockets – for video in and out, audio in and out, camera and external speaker. Playing time is 90 minutes in the SP mode and a maximum of three hours in the LP mode. The TV screen has a diagonal measurement of 3in. and has 92,160 pixels, driven by a thin-film transistor active matrix. Consumption is 7·1W at 6V and the Walkman comes with a battery pack, an a.c. power adaptor and a lithium battery. There's a built-in telescopic aerial and the timer setting is for one event/24 hours. The aim is to give the user a TV/VCR facility no matter where he is. For full video capability there's a partnering camera, Model GV-8E, that weighs just 455g with optical viewfinder and 400g without. It has a three-position focus lens and microphone. No price for this item has been announced.

To coincide with the UK launch of the Video Walkman Sony has released a new package of prerecorded software – over thirty movies ranging from recent feature films to special items for children and music lovers. Some titles are for rental only but most are available for purchase.

There are also two new camcorders, Models CCD-V88 and CCD-F335. The CCD-V88 is claimed to be the world's smallest and lightest full-feature camcorder, measuring approximately 12 × 4¼ × 4½in. and weighing 0·9kg. The CCD-F335 is a replacement for the CCD-F330. It incorporates a number of extra features including a high-speed shutter (up to 1/4,000sec.). The suggested price is around £800.

BBC STEREO TV SOUND SERVICE

Regular BBC-1 and BBC-2 stereo TV sound transmissions are to start in the autumn of 1991, using the BBC-developed Nicam 728 digital stereo system. Test transmissions from Crystal Palace started on July 18th 1986 and will continue, with programme sound originated in mono or stereo on the digital sound channel. The following main stations and many of their dependent relays, covering 60-70 per cent of the population, will carry stereo sound at the start of the service: Black Hill, Crystal Palace, Emley Moor, Pontop Pike, Sutton Coldfield, Wenvoe and Winter Hill.

SATELLITE TV AERIALS

Sir Clive Sinclair's company Cambridge Computer Ltd. showed the smallest aerial yet designed for reception from the Astra satellite at the recent Cable and Satellite Exhibition. The new aerial is a 45cm square (approximately 17in.) device with a depth of 12·75cm. Deliveries are expected to start in the autumn.

The new aerial was being shown alongside Cambridge Computer's previously announced 60cm square aerial. Sir Clive commented that "the original 60cm aerial/receiver design has performed significantly better than expected, and for this reason the technology has been adapted to produce a still smaller and shallower design. It's known to work in the Midlands and the South, but until further tests have been carried out people to the north of this region are advised to use the 60cm aerial."

There's been a certain amount of speculation in the press as to whether BSB's Squarial will be available in time for the launch of the service this autumn. What is not in doubt is that the development programme is behind schedule. It shouldn't matter unduly since a conventional dish can as well be used, but BSB has made an advertising/promotional feature out of the Squarial and there is also the fact that planning regulations allow only one dish of under 90cm to be installed within sight of neighbours. That dish could be for Astra! With this in mind BSB has been seeking a ruling from the Department of the Environment that the Squarial is not a dish.

The Squarial was devised by John Collins who set up a small company called Fortel to develop it. The story goes that John Collins had seen a similar type of aerial in military use – on fighter aircraft – and decided to adapt the principle for domestic satellite TV reception. If, as we suspect, the technology uses phased arrays of elements in PCB form, it's not one that is easy to apply to mass production. BSB has now bought out the rights to the

The Sony Video Walkman Model GV-8E combines a full-feature 8mm VCR, a colour LC display, a v.h.f./u.h.f. tuner and a timer for one programme in a 24-hour period.

Squarial patents, for which Fortel had applied, and has also acquired the marketing rights to the aerial in the EBU region, Australia and New Zealand. It's understood that Marconi Defence Systems and Dow Chemicals will be producing aerials for BSB – Marconi's will probably be of the conventional dish variety.

Some concern has been expressed about the safety of wall-mounted satellite TV dishes. The problem lies not so much with the method of securing the dish but with the strength of the material, e.g. masonry or brickwork, into which wall plugs are inserted. To overcome this problem Hydrajaws Ltd. (Unit 3, Tile Cross Trading Estate, Birmingham B33 0NW) has introduced a fixings tester. The self-contained tester consists of a hand-wheel tensioner which transmits applied loadings through a hydraulic cylinder that incorporates a maximum load indication pointer for visual monitoring. A selection of attachments enables a variety of fixing ends to be accommodated, including fired masonry nails. In operation the tester can be used either to provide assurance that the estimated loadings imposed by the dish and supporting metalwork are within the strength provided by the fixings and wall or alternatively a full pull-out test can be imposed using a sample area of wall.

Advanced Satellite Installations Ltd. (137 Beehive Lane, Ilford, Essex – 01 550 2256) is running regular dish installation courses at Hornchurch, Essex. The company has plans to start courses at other centres.

FERGUSON SERVICE DEPARTMENT MOVES

Ferguson's Service department has moved to new purpose-built premises at Enfield, completing a £2m project. The new address is: Ferguson Limited, Service Division, PO Box 1594, Crown Road, Enfield, Middlesex EN1 1DY. Telephone number is 01-804 7979, fax number 01-443 1899 and telex number 264 905.

SATELLITE TV SCRAMBLING

Sky Television and The Disney Company have announced that the design of the VideoCrypt (previously referred to as Palcrypt) system to be used for their pay-TV services has been completed and that tests via the Astra satellite have been carried out successfully. As mentioned last month a smart card system will be used to give subscribers access to scrambled programmes. The smart cards will initially be produced in France by Gemplus Card International S.A., but a joint venture between Gemplus and the News Group is being set up to produce the cards, at a rate of over a million a month, at Livingston, Scotland. Production will start during the first quarter of 1990 and the facility will create over 100 jobs. Sky Television also hopes to establish its subscriber management centre at Livingston, creating a further 250 or more jobs. The centre would contain the computer database of subscribers and smart card preparation facilities. An electronic link between Livingston and Sky's studios at Isleworth, West London would enable control of subscribers' smart cards to be exercised via the Astra satellite.

VideoCrypt decoders are already being produced by Ferguson and Philips and it's expected that further manufacturers will be licenced this summer to produce decoders and/or integrated receiver-decoders. The Ferguson decoder was on display at the recent London trade shows. In appearance it's similar to a satellite tuner unit, with a slot at one end to take the smart card. It's expected to cost around £80.

Card payment will probably be based on two principles: for a three-month period and/or for a number of "viewing units". Since the viewing units may not be used up at the end of a three-month period they will be transferable to the next card.

British Telecom's cable and satellite TV division BT Vision has completed successful trials of a MAC encryption system. The system was developed in BT's research laboratories for pay-TV use.

TUNER DEVELOPMENTS

Philips Components has announced the availability of a divide-by-two prescaler chip, type SAB8726, for use in satellite TV tuners. The chip has a frequency range of 1-2·6GHz and contains an amplifier, a divide-by-two section and an output stage. It accepts a sinusoidal input from the local oscillator and provides an output that drives a frequency synthesis loop. The package is an 8-pin plastic DIL (SOT97) and the power requirement is typically 35mA at 5V.

Hitachi has introduced a gallium arsenide MESFET chip, type HA21001MS, for TV/VCR tuner use. It contains two local oscillators, a mixer and an i.f. amplifier. Frequency coverage is 50-470MHz and 470-900MHz, with separate oscillators and output pins for the v.h.f. and u.h.f. bands. A logic-control input determines which input signal is routed to the mixer section, which employs a double balanced circuit.

ASTRA-2

Astra's owner SES has agreed to buy a second satellite which will be placed in the same orbital position as the first one some time next year, doubling the number of Astra channels to 32. The General Electric Astro type satellite was originally built as a joint venture by GE and Time, which owns the US Home Box Office pay-TV channel.

HINARI'S UK CTV PRODUCTION

Hinari is setting up two production lines at the company's Cumbernauld plant near Glasgow to produce 14in. colour TV sets, the aim being to make it less dependent on imports. Initially most components will be imported and the production capacity will be 120,000 sets a year. Efforts will be made to obtain components from local sources. Hinari claims to have 10 per cent of the 14in. CTV market in the UK at present. The Cumbernauld plant was originally intended for VCR production. This plan was abandoned when it was discovered that the company's VCR imports would not be subject to anti-dumping duties.

ONE-FOR-ALL RC UNIT

More TV remote control handsets are lost or damaged through the antics of household pets or toddlers than for any other reason. Replacement units can be difficult to obtain and expensive. As few retailers hold stocks they have to be ordered, which results in delays. Celtel's One-for-All unit provides the solution. It's capable of controlling virtually every wireless remote control product – cable and off-air TV sets, CD players and a pair of VCRs – and is easily programmed to perform entire sequences of functions. There's a facility for upgrading to control future products and the unit can be used with such infra-red activated items as driveway gates, garage doors, security systems, curtains, hi-fi equipment and so on. It comes with an easy to use instruction book, a practical users' guide, a function code appendix and a directory of manufacturers' blink codes, ensuring universal brand applicability. The retail price is £79·95. A review of this interesting device will appear in a future issue. It's available from Celtel at 18 Central Trading Estate, Staines, Middlesex TW18 4XE.

VIDEO SCENE

The European Commission has accepted price undertakings from four Far Eastern VCR manufacturers charged with dumping and has imposed duties on a fifth. Samsung, GoldStar, Daewood and Funai have agreed to raise their EC prices while Orion has elected to pay a 13 per cent duty instead. Either way EC consumers will be faced with higher VCR prices. Last September the Commission set provisional levies on the companies of between 11·5-29·2 per cent.

The British Videogram Association expects the UK video business to be worth over £1·3bn this year. Prerecorded tape rentals are expected to generate income of £540m, sales of prerecorded tapes should exceed £200m while sales of 45m blank cassettes should produce £135m. The VCR market is put at £240m – 800,000 machines at an average price of £300 each. The Association expects camcorder sales to increase to over 200,000.

A couple of interesting items of hardware have been released recently. Panasonic's Model NV-L28 VCR is unusual in having the capability to play back NTSC VHS tapes via a PAL TV receiver with perfect colour and, in most cases, correct height. The suggested price of the machine, which incorporates digital features such as picture-in-picture, is £450. Philips has announced the first CD/CD-V player, Model CDV185, designed to play the CD-V "clip" discs. The machine handles 3in. and 5in. discs but not the larger 8in. and 12in. discs. The suggested price is around £350.

TDK has released what is claimed to be the first national study of the blank audio and video tape market in the UK. We'll summarise briefly the video aspects. In 1987 over 88 per cent of households possessed a colour TV set while 52 per cent of homes had a VCR. This suggests that there is still considerable potential for growth – VCR ownership is expected to rise to around 57 per cent of households in 1990. In 1984 VHS had 73 per cent of the market, Betamax 25 per cent and the V2000 system 2 per cent. The figures for 1987 were 91 per cent for VHS, 7 per cent for Betamax and one per cent each for 8mm and VHS-C. Some 52·4m blank video cassettes were sold in 1987, with a value of £223m. This compares with £206m spent on photographic film. Estimated blank cassette sales in 1988 were put at 55m, with stiff competition reducing the value to £194m. This makes an interesting comparison with the BVA forecast for 1989 given above.

According to TDK's consumer profile the market is biased towards males in the 25-54 age group. Overall this group owned 61 per cent of VCRs and bought 64 per cent of blank tapes. The average household apparently owns around 14 video tapes, spends about 3·5 hours per week making recordings and about 4 hours a week watching them.

There appears to be a move towards the use of higher-grade tape and four hour (E240) cassettes. Three and four hour tapes accounted for 73 per cent and 6 per cent of the market respectively in 1984, rising to 80 per cent and 16 per cent in 1987. High-grade tapes account for 5 per cent of the market at present. A breakdown of brand shares shows that four brands account for 43 per cent of the market and 46 per cent of market value. The "big four", with volume and value figures given in brackets, are Scotch (18/19 per cent), Sony (9/10 per cent), BASF (9/9 per cent) and TDK (7/8 per cent).

HD-TV

American Telephone and Telegraph and Zenith Electronics have announced plans to develop a compatible high-definition TV system for use in NTSC countries. The companies are to spend some $24m on the project, one aim being to re-establish the US TV industry – Zenith is the last US owned TV receiver manufacturer.

The start of regular experimental HD-TV transmissions in Japan has been delayed by a couple of months due, according to NHK, to a shortage of programme material. Regular Hi-vision transmissions via satellite are due to start next month to around eighty public sites. The full service is expected to come into operation some time next year. NHK proposes to add approximately £4 a month to the TV licence fee to cover the cost of the service.

A WELCOME SPARES SERVICE

In last month's leader we commented on the difficulty individuals face in obtaining TV/VCR spares. We have since heard from AGS Electronics of 49 Farringdon Road, Plymouth, Devon PL4 9ER (0752 225 946) whose aim is to provide a personal service for individual customers whether in the trade or not. The company was started fifteen years ago and is staffed by technically minded engineers who are willing to offer advice and spares for anything connected with audio/video equipment. The firm also has a trade repair service. Components can usually be supplied within 24 hours.

PAL ENCODERS FOR COMPUTER USE

Interactive Media Resources (8 North Street, Wolverhampton, West Midlands WV1 1RD – 0902 25 444) has introduced a range of PAL encoders for use with various popular computers. The Datavid series accepts an RGB input (TTL level or linear depending on the computer) and gives a near broadcast quality PAL composite video output suitable for recording purposes or for feeding into video mixers or monitors. The encoders incorporate their own power supply and the recommended price is £179·99 including VAT. There are models for use with Atari ST, Commodore Amiga, Acorn Master and Archimedes computers.

IN BRIEF

Dates for the 1990 brown goods trade shows at London hotels are April 22-25th . . . The Newport Amateur Radio Society will be holding its second "grand surplus equipment and junk sale" at Brynglas House, Newport on Sunday July 2nd, from 11 a.m. to 4 p.m. . . Maplin Electronics (PO Box 3, Rayleigh, Essex SS6 8LR – 0702 554 161) has introduced two crimping tools, one for coaxial cables and the other for heavy duty work, at £24·95 each including VAT. Dies for RG58 and RG59 cables are provided with the coaxial tool. You simply place the connector to be crimped in the appropriate die in the jaws and squeeze the handles together until the tool reopens. A ratchet with override latch prevents the tool opening until the crimp is complete.

Camcorder Servicing

Part 4: Solid-state Image Sensors

Steve Beeching, T.Eng.

Last month we described the techniques used to produce a composite colour signal in a camera employing a single tube of the Saticon type. Most video cameras and camcorders use solid-state image sensing instead. The rate of progress is such that there have already been various types of solid-state image sensor. Most of them use CCD (charge-coupled device) technology. The basis of all solid-state image sensors however is an array of photosensors each of which generates, during the 50Hz field period, a charge proportional to the light that falls on it. The advantages of the solid-state image sensor are compactness, low power consumption, resistance to burn-in effects, and long life without ageing. There is no heater element of course, and no adjustments are required for installation, temperature variation, ageing or use.

CCD Image Sensors

Solid-state image sensors vary in the way in which the charges built up during each field are read out of the device as a sequential video signal. With CCD technology, CCD shift registers are used to extract the signal. The idea is depicted in Fig. 1. During the field flyback period the charges built up on the photosensitive section of the device – the array of photosensors – are rapidly transferred to the CCD shift-register section. This consists of a series of vertical shift registers that feed a horizontal shift register, shown at the bottom. Clock pulses applied to the vertical shift register elements move the charges down into the horizontal shift register, which is clocked at a faster rate to provide the sequential output consisting of the charge packets originally generated by the photosensitive elements. Clocking consists of applying higher voltage pulses to adjacent elements to move the charges along the shift register. Once per video line the horizontal shift register receives a fresh set of charges which are then clocked out to provide the next line of the picture. The vertical shift registers are clocked at line rate so that the charges move down line by line. Thus at the end of the field the vertical shift registers are empty, ready to receive the next set of charges from the photosensors.

There are two main types of CCD solid-state image sensor, referred to as the frame- and line-transfer types. With the frame-transfer type the vertical CCD shift registers are situated beneath the photosensors. In the line-transfer type the shift registers are arranged alongside the photosensors. Although frame transfer is fine for monochrome displays it is not suitable for colour. The advantage of the line-transfer arrangement lies in the more efficient charge transfer from the photosensors to the shift registers. The method of clocking out the signal is the same for both types of CCD image sensor.

The line-transfer CCD image sensor is the type generally used for colour portable cameras and camcorders and has itself undergone considerable development during its comparatively short production life. One of the first image sensors of this type consisted of a large-scale integrated circuit with over 250,000 picture elements (pixels), more than 450 shift registers and the pulse control circuitry required all on a 7mm square substrate. Basic details are shown in Fig. 2. The photocell array has 454 horizontal by 582 vertical elements, that is 582 rows which form the TV lines and 454 pixels per line. Only part of the array is used, consisting of 575 lines by 418 pixels. The part not used is held at lack level for clamping purposes. A later version offers higher definition with 725 pixels per line, 668 of which are active, giving a total active array of 384,100 pixels. It also has an extra memory section at the bottom for high-speed shutter use.

The scene being recorded is inverted by the camera's lens. Thus when it reaches the surface of the CCD it's a

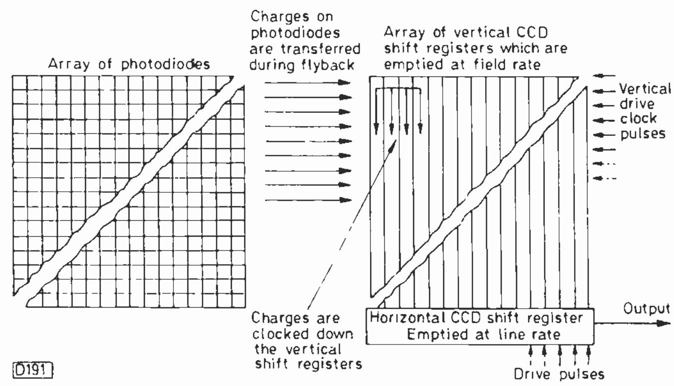


Fig. 1: Principle of the CCD solid-state image sensor.

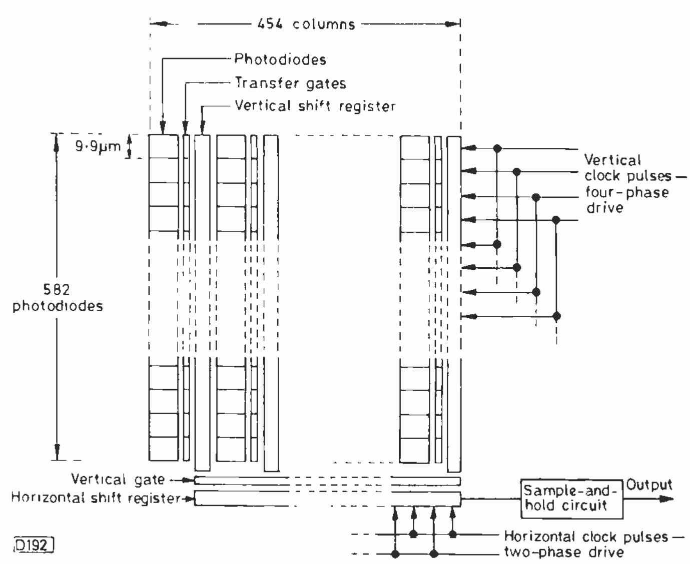


Fig. 2: Basic details of an early type of line-transfer CCD image sensor. The active imaging section, with 418 columns and 575 rows (lines), has a diagonal dimension of half an inch.

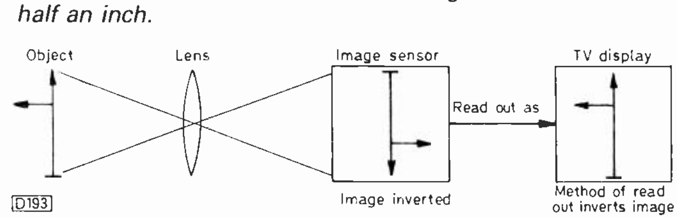


Fig. 3: The lens produces an upside-down mirror image at the surface of the image sensor. As the image sensor reads the information from the bottom right to the top left it provides correction for the effect of the lens.

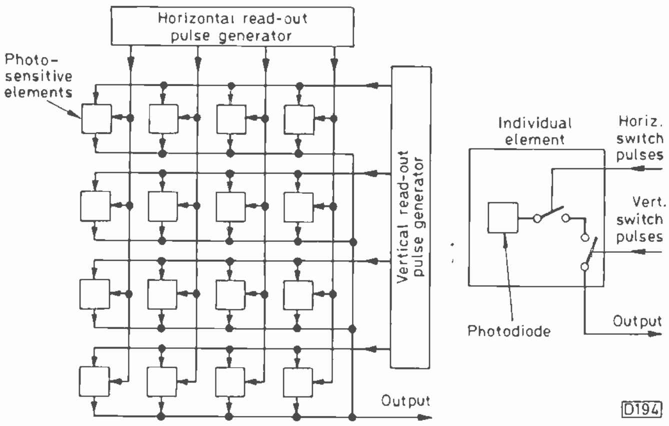


Fig. 4: Principle of the MOS type image sensor, which uses a switching matrix to produce the sequential signal.

mirror image which is upside down – see Fig. 3. It's necessary to bear this in mind in order to understand how the imager reads out the signal.

With a TV screen the scanning of the raster starts at the top left-hand corner and ends at the bottom right hand corner, the beam scanning from left to right. With a CCD image sensor the start of the picture is at the lower right hand corner, finishing at the top left-hand corner (the last pixel to be read out). This is because the horizontal shift register is at the bottom, beneath the vertical shift registers, so that the first pixel to be read out is the one at the bottom right-hand corner.

As shown in Fig. 2 the photosensitive elements (photodiodes) are mounted in columns adjacent to the vertical shift registers. Transfer of the charges from the photodiodes to the vertical shift registers is via MOS transistors. There's a MOS switching transistor for each photodiode, transfer gating (TG) pulses being used to switch the MOS transistors on briefly during the field flyback period. Driving alternate MOS transistors in each column with a different TG pulse in each field enables the control programme to allocate alternate rows to odd and even fields and to determine the colour signals for matrixing.

With the high-definition image sensor mentioned some 668 charges are read out per line. As the active line period is 52μsec the stepping frequency is around 13MHz. The charges read out of the horizontal shift register are converted to an analogue video signal voltage by means of a sample-and-hold circuit.

MOS Image Sensors

In the alternative MOS type of image sensor shift registers are not used. Instead each pixel is individually addressed once per field by using a matrix switching system. Fig. 4 shows the basic idea. The vertical read-out pulse generator selects lines sequentially, the horizontal read-out pulse generator then connecting each pixel in turn to the common output line. The advantage of individual pixel access will become obvious when we consider colour and also high-speed shutter use.

Colour System

A complex colour system is used with solid-state image sensors. The colour filter associated with the photodiode array has magenta, cyan, green and yellow sections as shown in Fig. 5. Note the way in which the pattern occurs on successive rows – from the top M, G M, G etc.

followed by C, Y, C, Y etc. then G, M, G, M etc. and next back to C, Y, C, Y etc. The first part of the signal processing takes place within the image sensor. Each row of pixels is used twice, once in each field, as shown at the bottom of Fig. 5. Successive rows are added within the sensor. Thus in field 1 rows A and B are added to give line 1n and rows C and D are added to give line 1n + 1. In field 2 rows B and C are added to give line 2n and so on. This is done by using the alternate row TG pulse switching previously mentioned. Say that transfer pulse TG1 has moved row B into the vertical shift registers (also row D etc.). The next vertical shift register clock pulse moves row B down the registers so that it is adjacent to the row A photodiodes. Transfer pulse TG2 then transfers row A into the registers so that rows A and B are superimposed. The output on line 1n will thus be

G + C, M + Y, G + C, M + Y etc.

The following line 1n + 1 will consist of

M + C, G + Y, M + C, G + Y etc.

Note that the M and G pixel sequence differs in rows A and C. Thus the pattern shown in Fig. 6 is set up.

In another type of image sensor a slightly different technique is used. Say row A has just been transferred to the vertical shift registers (also row C etc.). The shift register is then "backspaced" so that row A is alongside row B. The second transfer pulse then moves row B into the shift registers to provide the addition. The net effect is exactly the same as before.

With the MOS image sensor where the pixels can be addressed individually or together it's simple enough to program the vertical read-out pulse generator to address pairs of rows to get the same effect.

What we have said so far overlooks the fact that the filters act by blocking light, i.e. the magenta filter section blocks green light, allowing red and blue to pass, cyan blocks red allowing blue and green to pass, yellow blocks blue allowing red and green to pass while green blocks red and blue allowing just green to pass. Thus M = R + B, C = B + G, Y = R + G and G = G. In consequence our lines ln and ln + 1 give

G + (B + G), (R + B) + (R + G) etc.

and (R + B) + (B + G), G + (R + G) etc. respectively.

Simplifying, in line ln we have

2G + B, 2R + B + G etc.

while in line ln + 1 we have

2B + G + R, 2G + R etc.

There is no need to spell out in fine detail the rest of the process, which is carried out in the camera's signal processing department. The principle is similar to that outlined for the Saticon tube camera last month. Use of filtering, addition networks and a one-line delay line sorts out the signals to produce the components of a conventional composite colour signal, i.e. full-bandwidth luminance (Y = G + B + R) plus the narrow-bandwidth R − Y and B − Y colour-difference signals. The processes are shown in block diagram form in Figs. 7-9.

Circuit Arrangements

As with the Saticon tube, the output obtained from the image sensor consists of a luminance signal plus a high-frequency carrier containing the chroma information. The filtering shown in Fig. 7 provides separate full-bandwidth luminance (YH), narrow-bandwidth luminance (YL) and, from the bandpass filter, the chroma carrier. In the chroma signal path detection is followed by a low-pass filter whose output consists of 2R − G and 2B − G. By

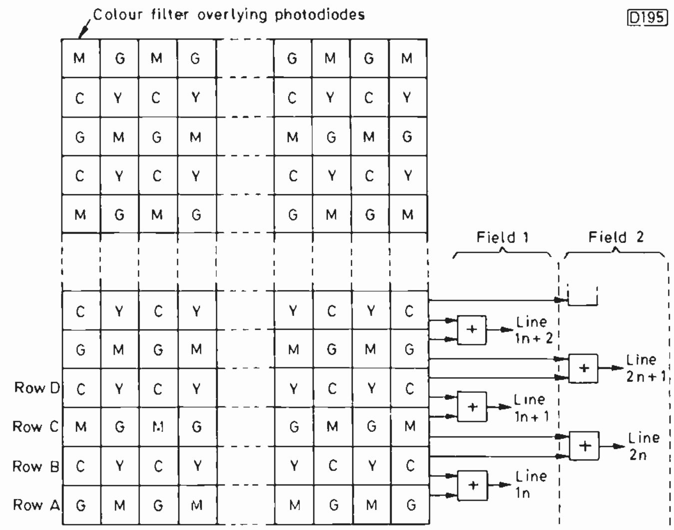


Fig. 5: Arrangement of the colour filter.

Line 1n	G+C	M+Y	G+C	M+Y
Line 1n+1	M+C	G+Y	M+C	G+Y
Line 1n+2	G+C	M+Y	G+C	M+Y
Line 1n+3	M+C	G+Y	M+C	G+Y

D196

Fig. 6 (left): Colour pattern set up by the processing in the image sensor.

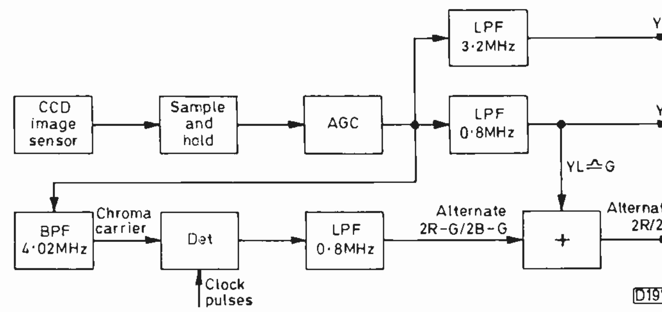


Fig. 7: Filtering system used to separate the luminance and colour components of the complex output signal produced by the image sensor.

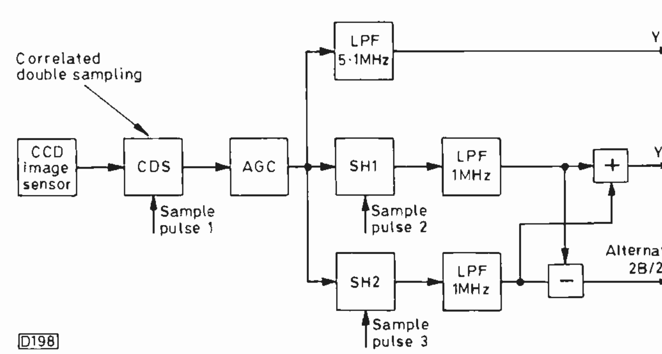


Fig. 8: Sampling system used instead of simple filters in the later high-resolution system.

adding YL (≏G) we get 2R/2B outputs, i.e. 2R on one line and 2B on the next.

Instead of the low-pass and bandwidth filters the later high-resolution system employs sampling to separate the low-frequency luminance and the chroma signals – see Fig. 8. The sampling frequency is around 16MHz. In a given line n sample-and-hold circuit SH1 will sample only the M + Y pixel output while sample-and-hold circuit SH2 samples only G + C. This gives rise to the following outputs: 2R + G + B and 2G + B. On the following line we get 2B + G + R and 2G + R. These outputs are

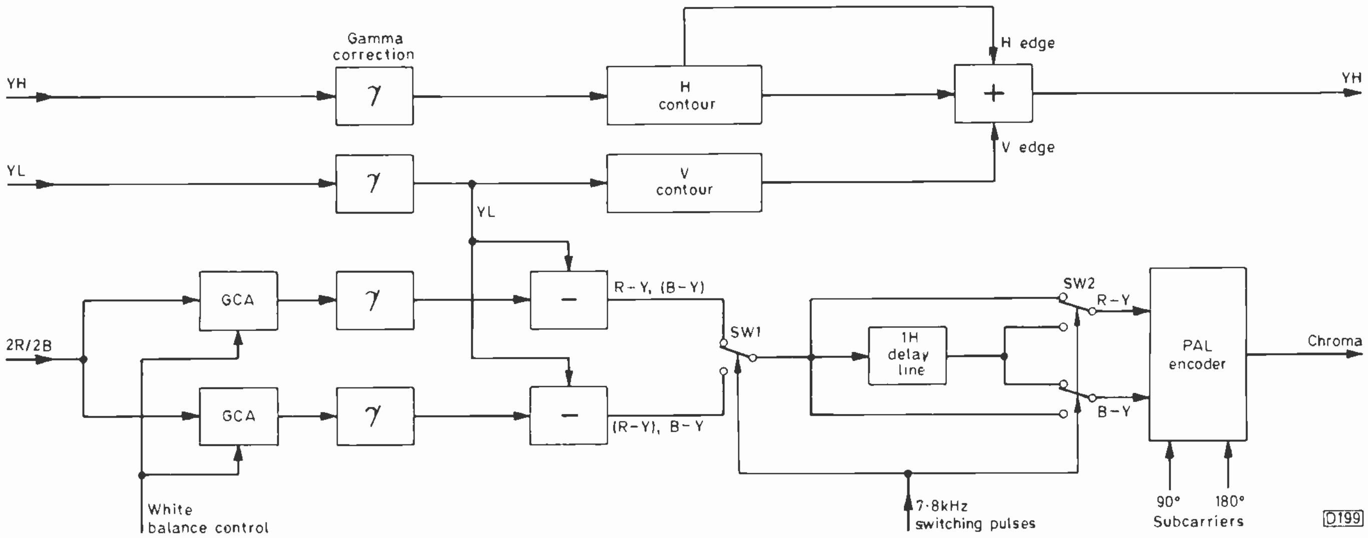


Fig. 9: Block diagram of the circuitry used to produce Y plus simultaneous colour-difference signals.

applied to add and subtract circuits which produce YL and, on alternate lines, 2R/2B as in the previous example.

The line-sequential R and B signals must next be converted to simultaneous R − Y and B − Y colour-difference signals. This is where the one-line delay line comes in. Fig. 9 shows the arrangement used. The two luminance signals are passed through individual gamma correctors to ensure linear light input/output voltage characteristics. Horizontal and vertical edge correction is then applied to the full-bandwidth luminance signal to crispen the picture. The 2R/2B information is fed to two separate paths each incorporating gain-controlled amplifiers for white balance and gamma correction. Subtract circuits then introduce the low-frequency Y signal, resulting in line-sequential colour-difference outputs (R − Y/B − Y). Use of a delay line and half line-frequency switches SW1 and SW2 finally provides simultaneous R − Y and B − Y inputs for the colour encoder. A point to note when servicing is that the two 2R/2B channels are designated the red and blue channels respectively, which could be confusing.

Our account of the colour signal processing in this article has been somewhat simplified to make it more readily understandable on first acquaintance. Those who would like to follow through a more detailed account may refer to pages 178-183 of the present (third) edition of my book "Videocassette Recorders – a servicing guide", published by Heinemann Professional Publishing at £20. Another point to note is that a four-phase clock pulse drive system is used for the vertical shift registers in CCD-type solid-state image sensors. Again you will find more on this in the book.

The Party's Over – Well Almost

Les Lawry-Johns

It's time to call it a day. Not only the song goes like that. We don't get any younger and the health problems are very persistent. As far as the business is concerned the party is over and we have to pick up the pieces and pay our debts, if we can. Us careful ones haven't got much to worry about but I know that there are a lot who have. Some years back I wrote about my Grandad. He was the skipper of a ferry boat and it was only when he bumped into Tilbury landing stage that it came out he couldn't see. After that my mum had to go across the road to get his pint of beer. The last act was on for him then, and it seems like only yesterday. Some sixty years ago I think. If anyone wants to look up the issue where I wrote up the story it was in October 1979. Yes the party is finally over as far as this shop is concerned. We're moving out soon, into a small bungalow not too far away. So we'll get a bit of a rest, but I'll still do my bit of writing to keep in touch with you.

More Sets

In the meantime the sets keep coming in.

Take the Philips CTX-E for example. The note said "no go". So I immediately dived for the switch-mode power supply. The BUX84 chopper transistor was open-circuit. I replaced it and plugged the set into the mains again, having left it switched on. Nothing happened. I checked around the BUX84 and found that it wasn't being driven. So I checked through the circuit but couldn't find anything wrong. When the owner came for it I had to tell her that I hadn't been able to find the fault. She left with the set and it was only later that I realized it had been a remote control model without the remote control unit. I hadn't done anything other than plug it into the mains. What kind of fool am I?

To show you what kind of fool, I've been looking through past issues of the magazine to try to refresh my failing memory. What about this? In the March 1982 issue I was rabbiting on about the weather and mentioned about my friend Ridley coming in. "If we keep burning fossil fuels at this rate Leslie, the greenhouse effect will become so serious we'll all be dying of heat."

Ridley was a solicitor, and that was back in 1982. How did he know then?

Well, that's all I can think of at the moment. People keep calling in to look around the shop and the accommodation upstairs. If we didn't own the joint the party would probably have been over some time back.

Grundig's Satellite TV System

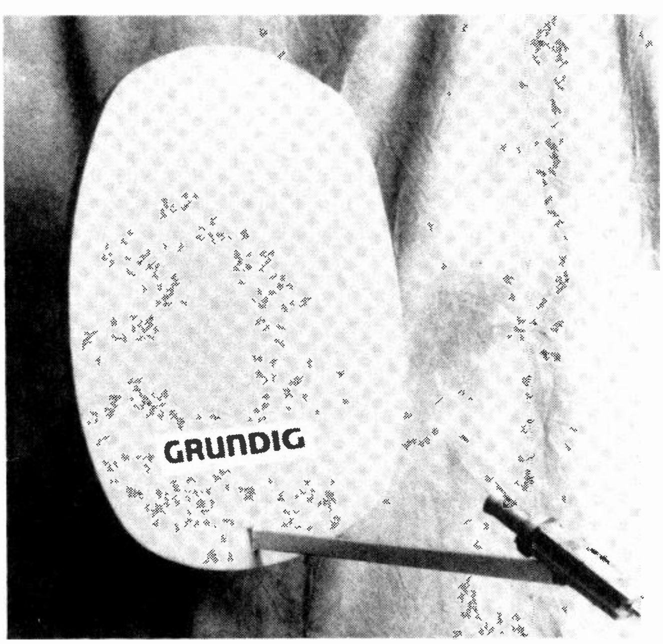
Steve Beeching, T.Eng.

When I unpacked it my first impression of the Grundig STR20 satellite TV receiver was of its smallness and neatness. It's of midi system size, being 320mm wide and 70mm high on its little feet. The depth is about 290mm including the connectors that stick out.

On the front panel there are channel change up and down pushbuttons, an on/off switch, the channel display and remote control receiver. The tuning and setting controls are behind a panel that's almost hidden. Within this panel there are the usual Grundig P and C type buttons. P is for programme: there are 49 of these buttons, each one of which can be programmed for the appropriate channel parameters. C is the channel number, from 00 (954MHz) to 99 (1,746MHz). This means that with a 10GHz LNB the satellite frequency coverage is 10·954-11·746GHz, which is adequate for Astra's intention to provide up to 48 channels in the future.

The channel parameters just mentioned are f.m. deviation, i.f. bandwidth, fine tuning, audio carrier frequency and de-emphasis. Deviation can be set for 25MHz or 16MHz – for Astra it's 25MHz. I.F. bandwidth is specified as wide (24MHz) or narrow (16MHz): if the signal is good you use the wide bandwidth; if the signal is not so good and spots are evident narrowing the bandwidth can sometimes reduce the sparklies. Audio detection is by means of a phase-locked loop, the coverage being 6·5-6·65MHz with 62μsec de-emphasis, 6·5-6·65MHz with the J17 de-emphasis characteristic or 5·8MHz with J17 de-emphasis. Although the de-emphasis with Astra is 50μsec the sound is quite acceptable with 62μsec de-emphasis. All the above characteristics, including polarisation, can be stored in the non-volatile memory. Full remote control is available for channel selection, and there's a special AV selector switch.

There are two inputs at the rear to provide for twin-dish working without the need for motorised dish drive. A four-way logic system enables the input from either LNB to be selected, with horizontal or vertical polarisation in each case.



Grundig's distinctive offset dish. With an offset dish the feedhorn has a flare instead of scalar rings at the input.

Outputs

U.H.F. and baseband outputs are provided. The output from the r.f. modulator can be tuned over the range of channels 24-40. This gives a wide scope for avoidance of any patterning that could arise due to beats with the r.f. modulator in an adjacent VCR. Video plus an audio output that can be preset are available from either a scart connector or a 6-pin DIN socket. Both carry an AV switching voltage, the scart connector at pin 8 and the DIN socket at pin 1. If the TV set has provision for these inputs, AV switching occurs when the satellite receiver is powered. With some sets the presence of the switching voltage will enforce the AV mode. The situation could thus occur that the satellite TV programme is being taped and the set won't switch to u.h.f. reception. To avoid this a button on the remote control handset can be used to inhibit the AV switching voltage. A baseband output is also provided for connection to a de-scrambler or MAC decoder.

Installation

DIY installation is not advisable as it must be done to the manufacturer's specifications regarding accuracy and safety along with lightning or electrostatic protection.

The dish arrives as a flat pack and can be assembled on site. It's very light, consisting of a metal screen sandwiched between PVC to give a corrosion free life. Once assembled correctly the elevation is preset then apart from azimuth adjustment and setting it close to a wall very little fine adjustment remains to be done. This fine adjustment is made easy by using the polariser rotator feed wire to send an a.g.c. output up to the dish. A cheap meter with a 2V range to cover the a.g.c. voltage is all that's required for final alignment – no expensive test gear is called for.

The receiver comes pretuned to six satellite channels. These settings can be over-written at a later date. Programme number one is set to Astra Vertical (Sky Channel), which means that you just switch on and line up. Once the dish is aligned in the vertical plane the polariser rotator wire can be reconnected to the 0/12V output at the receiver and the rotator input at the dish. In practice you might find it easier to use a separate cheap twin cable to the test meter, as the rotator input connector and r.f. cable are internal to the LNB support for weather protection.

The Head End

The LNB is a high-specification type with a magnetic polariser that doesn't introduce any significant attenuation. The high signal-to-noise ratio gives a high rain margin for clear pictures in the grotty English weather. The polarotor and feed horn are a single assembly which is secured to the LNB by means of four screws and an O

The Grundig STR20 satellite TV tuner unit.

ring. The whole assembly is secured to the support strut by means of a plastic clamp and earthing strip. Sensitivity is aided by the 0·62m offset dish with its 3° capture range – this is the equivalent of an 0·75m round dish with prime-focus LNB. Use of an offset dish has other advantages: the snow slides off it more easily and it can have a flat profile when wall mounted.

On Test

Before the start of the Astra transmissions I had a certain amount of fun receiving the transmissions from other satellites such as ECS1-F4. Although there was some noise the programmes were watchable, which is quite a feat with such a small dish. When Astra kicked off I compared the results with those obtained from three other receivers – one the earlier Grundig STR200 – and a much larger dish. Comparison between the small offset dish with about 10m of cable and a large 1·5m dish with 30m of cable showed that there was no degradation with any of the receivers. The small Grundig offset dish performed a treat despite being lashed to a wooden bench and subjected to very high winds, also chickens through which satellite signals do not pass when they are roosting on the LNB support . . .

The only criticism I have relates to the video outputs. I would have preferred the scart and 6-pin DIN sockets to have had separate drives instead of being just coupled together. This would have allowed for direct connection to the VCR and TV set together, but it doesn't prohibit other combinations and the cost would have been greater. Well, you can't have everything.

A receiver with an in-built stereo decoder, Model STR22, is to be introduced shortly.

The family has been very happy with the results obtained – BBC and ITV never got a look in. Even on our Cinema 9050 with 45in. screen visitors all remarked on the super picture quality with live transmissions. This was so even in foul weather conditions – and boy did we get some, high winds and heavy rainfall. Such conditions degraded reception only slightly, with the odd few sparklies and crackles during the worst periods of rain. Maybe Mr. Sugar was right when he said who needs MAC? I don't, and when scrambling starts in the autumn we'll see how secure it is or whether "digital video equalisers" start to appear in *Exchange and Mart* . . .

The Public

I'm not convinced however that the great British public will be prepared to pay £12 a month – that's £144 a year – for the two scrambled Sky channels, then perhaps more for other scrambled services. Also once a household has one type of descrambler there will probably be reluctance to get a second one, with the result that each subsequent broadcaster using scrambling will have successfully fewer viewers. We shall have to see.

TV Fault Finding

Reports from Philip Blundell, Eng. Tech., Eugene Trundle, Ian Bowden, Roger Burchett, Nick Beer, George Lithgow, Paul Hardy and Brian Renforth

Philips CP110 Chassis

This set was dead apart from the fact that the fuse hadn't blown and there was 300V at the collector of the BUT11 chopper transistor. A scope check at the base of this transistor showed that the control chip was providing drive for a split second, but of too large amplitude. The BUT11 was found to be open-circuit base to emitter. **P.B.**

Sony KV2062/2066

High-value resistors have always been a problem in TV sets, especially after several years' service. For no power, failure to come out of standby or intermittent operation of the on-off switch in sets using the XE-3 chassis check R632 (2·2MΩ) in the power supply section of panel A. **E.T.**

Rediffusion 365138 (SP2 Chassis)

No colour with "twitchy" line lock over the top quarter of the raster is caused by a high-resistance connection at pin 3 of the line output transformer. **R.B.**

Rediffusion Mk 1 Chassis

Many of these excellent sets are still in use. Unfortunately the thermal trips fitted are becoming very "touchy", tripping off at the slightest hint of trouble. Some have simply given up. Linking out the trip is all very well but can have unfortunate consequences – molten plastic from the tripler dropping on to the carpet. The correct course of action – the modification used by Rediffusion – is to link out the trip and insert a fusible 18Ω resistor in the h.t. line. Details are shown in Fig. 1. Mount the fusible resistor on a tagstrip bolted to the screw that holds the strap for the l.t. smoothing capacitors. In this position it can be easily seen and resoldered and is away from combustible material. Note that with the rare 20in. version of the chassis, which is physically quite different though electrically identical in most respects, block electrolytic C603/4/5 is mounted on the main frame. In these sets the fusible resistor should be mounted on choke L601, the red/grey lead being moved to the other end of the fusible resistor. Drill a hole in the plastic mounting for the choke's end tags and bolt on an extra tag for the new connections. The circuit is then as shown in Fig. 1(d). **R.B.**

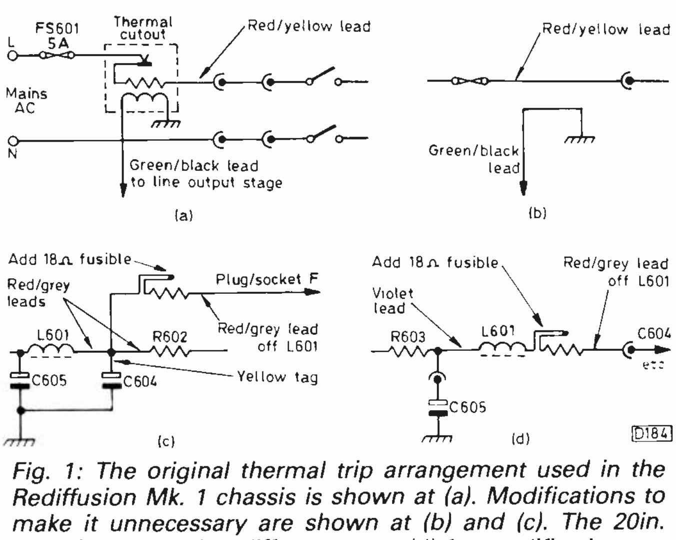


Fig. 1: The original thermal trip arrangement used in the Rediffusion Mk. 1 chassis is shown at (a). Modifications to make it unnecessary are shown at (b) and (c). The 20in. model is somewhat different – see (d) for modifications.

Decca 80 Series Chassis

A small-screen set fitted with this excellent chassis came in recently with the fault loss of line sync. The obvious thing to do was to change the TDA920 sync/line generator chip but this didn't improve matters. After much checking on the timebase panel we eventually moved to the i.f. panel and replaced the TCA270 demodulator chip. This gave us a steady picture – the faulty chip had produced a messed up video signal and passed this on to the TBA920. The picture was spoilt by flyback lines however. There appeared to be text information on the top six of these lines. They were eventually cleared by replacing C333 (1μF, 63V) on the timebase panel. This capacitor couples the field blanking pulses to the decoder. **G.L.**

Ferguson TX9 Chassis (1044 Series)

This set would lose the sound and raster very intermittently, due to loss of the 18V and 12V supplies. Another engineer had replaced the sound and 12V regulator chips and put the set on soak test, but after several days the fault returned, this time permanently. Checks in the power supply circuitry led us to a dry-joint/poor connection at one end of L103 which is in the feed to the 18V supply rectifier D70. The joint didn't look dry, but there was no continuity between the winding on the chopper transformer and the rectifier. We removed the coil, cleaned off both connections and refitted it. **I.B.**

Ferguson TX9 Chassis (1040 Series)

There were two problems with this set. First at switch on there was a burst of sound then the 1·6AT mains fuse blew. This was due to the "efficiency diode" D77 (1N4007) in the power supply being short-circuit. When this had been replaced we found the second fault, lack of contrast. The contrast control had an effect over only the first eighth of its movement from minimum, any higher setting making no difference. This suggested a fault in the beam limiter circuit, which operates via the contrast and brightness controls. When we checked the beam sensing network we discovered that R262 (18kΩ) was open-circuit. **I.B.**

Sony KV27XRTU

This six-month old set didn't look very well. The tale started when a field engineer called with a job card that read "excessive red". He had been confident of being able to cure that, but when he examined the set there were in fact severe convergence errors. He adjusted the HSTAT control to improve the convergence in the central area of the screen and then found that the dynamic convergence controls had little or no effect. So the set came back to the workshop.

With the set on the bench I found that the errors were equal at either side of the screen and that perfect convergence could be obtained at the centre using the HSAT control. A scope check then showed that the drive to the dynamic convergence coils was severely distorted, with tremendous harmonics (see Fig. 2). The collector voltage of the HAMP driver transistor Q1504 was finally found to be high at 32·7V as it had a 13·5Ω leak from base to emitter. Faults in the convergence section of these Sony sets are rare, so this was an interesting one of us. **N.B.**

Sanyo CTP5103

The fault with this set was EW bowing out. In these sets the fault is usually caused by C451 (330μF) but another engineer had already tried replacing this and most of the obvious things. After a lot of checking I found that C455 (330nF) and C456 (180nF) were open-circuit. **N.B.**

Grundig 6415

Intermittent loss of sync was traced to the TMS3755 chip in the "abstimm baustein" control module. **N.B.**

Sony KV2090/2092/2096

A weakness with these sets seems to be dry-joints on the high-wattage resistors on stand-off pillars. Sony recommend resoldering with RS high-melt solder and checking for this whenever you see one of these sets. **N.B.**

Panasonic TC800G

There was no field scan and during a check around I noticed that the centre of the field hold control was missing. As it was accessible through the cabinet I assumed that someone had used too large a screwdriver to adjust it. A replacement made no difference however. I eventually found that C407 (3·3μF, 16V tantalum) read 82Ω. Replacing this restored the field scan. On examination the capacitor was seen to have a pinprick black burn mark on its top. **N.B.**

Hitachi CPT1474

There was very, very intermittent loss of sound, the fault being sensitive to movement of the board around the audio output area. Everything here was soldered but this was no good. Use of a scope then showed loss of signal from the output transformer, the input being o.k. The problem wasn't dry-joints on the leadout wires but an open-circuit secondary winding inside the housing. A new transformer puts an end to the trouble. **J.R.A.**

Thorn 1400 Chassis

The modifications to alleviate vision buzz with these sets are well known. They don't always rectify the problem however. What next? Simply adjust the i.f. output coil in the u.h.f. tuner with a buzzy signal (pages from Ceefax are ideal!). One or two turns will remove the buzz without affecting the picture quality. Doing this with an unmodified set completely cleared the trouble. **B.R.**

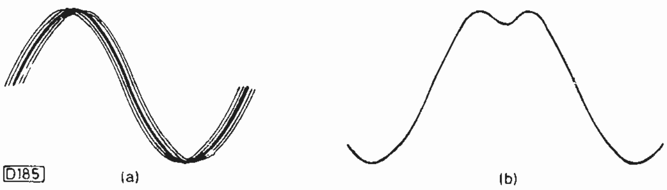


Fig. 2: Faulty (a) and correct (b) convergence coil drive waveforms, Sony Model KV27XRTU.

Sony KV1810 (Mk I and II)

A fault that's becoming quite common in these elderly sets is failure of C520 (10μF, 16V reversible electrolytic) in the field output stage. The symptoms are slight field non-linearity which can be corrected by means of the linearity control. The give-away is that with the vertical bias control set correctly there's only about 0·1V across the base and emitter of Q504 and slight crossover distortion which is not noticeable without a signal. Two 22μF capacitors connected back-to-back will provide a cure. **P.H.**

Fidelity ZX3000 Chassis

The line output transformer in one of these sets was arcing from near the e.h.t. outlet to the adjacent support bracket. Judicious use of silicone rubber sealant put an end to the arcing. **P.H.**

Sony KV1820 and KV2000

Intermittent failure of the line output GCS in these sets can be caused by the diode in this device's gate circuit. This diode is either D805 or D808 depending on chassis and goes open-circuit when hot. Sometimes the power supply will protect the GCS but more often than not the GCS fails.

When working on these sets it's worth referring to David Botto's excellent articles in the August and September 1984 issues. Note also that three different chassis (SCC-99A-A, SCC-132A-A and SCC-132A-B) were used in Model KV2000 and two different chassis (SCC-115A-A and SCC-132B-B) in Model KV1820. **P.H.**

Fidelity F14 (ZX4000 Chassis)

If it's not possible to store channels or there's a problem with the tuning, check the following: R514 should be 2·7kΩ (old value 1·8kΩ); R315-9 inclusive should all be 1·8kΩ (R319 was 1·5kΩ); ZD1 (TAA550) may be faulty; an 0·1μF capacitor (C303 in later versions) should be connected in parallel with ZD1 on the print side of the panel; finally add a 100Ω resistor and a 10μF, 50V electrolytic in parallel with ZD1 (negative terminal of the electrolytic to chassis). Check for a 25V squarewave at pin 2 of IC201; if this is absent IC201, TR304 or TR305 could be faulty. **P.H.**

Panasonic TC2203 (U1 Chassis)

The problem with this set was intermittent colour. Much time was wasted on the decoder before we finally proved that the customer colour control was intermittent internally. Now the rub! Panasonic no longer supply this part. Eventually a Ferguson slider was pressed into service after slight modification.

I find that this problem of parts is getting worse and worse. Sets are becoming more reliable but at the same time the provision of spares is in some cases getting more difficult. Unfortunately it's not the manufacturers but us in the servicing profession who have to tell Joe Public that spares for their 8-9 year old tellys (younger in some cases) are no longer available. What do other readers think? **P.H.**

Op Amp Signal Tracer Unit

David Botto

The sound sections of TV sets and VCRs can present some awkward problems, especially when the fault is intermittent. You suspect various components and replace them only to find that the fault persists. The best solution is to use a signal tracer to check through the circuitry involved. It's an invaluable aid in speeding up the fault-finding process. As a result your profits will be boosted and you'll be saved from a great deal of tension and frustration.

The signal tracer described in this article has been designed for fast fault location in the sound sections of modern solid-state TV sets and VCRs. It's also handy for making quick checks in other sections of the circuitry. There are two test probes, one for r.f. and the other for a.f. signals. They are used to follow the signal path through the circuitry stage by stage, starting if necessary at the tuner. Provided the signal path has not been interrupted the signal will be heard at each successive test point. This signal tracing procedure gives you the feeling of being able to "ride around the circuitry", enabling you to establish quickly the exact point where the sound ceases or becomes distorted.

Design Evolution

Fig. 1 shows a typical valve signal tracer of the type that was extensively used in the fifties and sixties for servicing radio receivers and 405-line TV sets. Some of these tracers are still to be found in workshops – they can be readily used for trouble-shooting in transistor radios and audio amplifiers. The circuit is basically a high-gain, two-stage audio amplifier. For audio signal tracing a screened lead with a probe and earth clip plugged into the a.f. input jack. For signal tracing in the r.f. and i.f. stages an r.f. probe with a flexible screened connecting lead plugged into a four-pin socket on the tracer's front panel. This was a fairly hefty probe containing a triode valve – typically a 6C5 – which operated as a leaky-grid detector. The complete instrument occupied considerable bench space and, with its mains transformer, was fairly heavy. Modern solid-state equipment calls for an improved design.

Since bench space is generally limited the tracer featured in this article has been designed for compactness. It measures only 7·54 × 2·9 × 6·89in. Being battery operated it can be carried around easily for field servicing or moved around the workshop. Mains operation would increase the size, weight and cost considerably. It would also cause problems when testing certain types of circuitry. Front panel LEDs have been included to give an indication so that the tracer will not be left switched on when not in use.

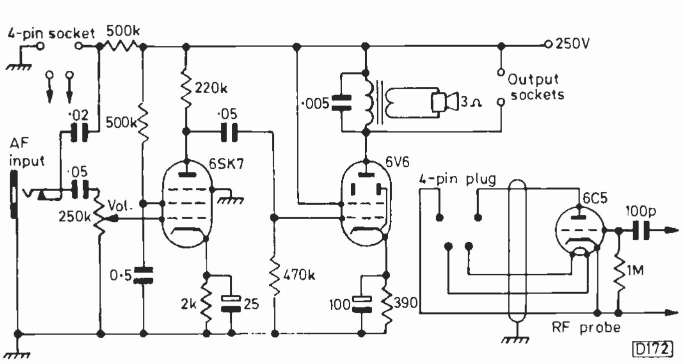


Fig. 1: Typical valve type signal tracer circuit – mains power supply omitted.

The new tracer is far more sensitive than the old valve type was. It has also been designed so that the probes cause the minimum circuit disturbance.

Circuit Description

Fig. 2 shows the new signal tracer circuit – the circuit of the r.f. probe is shown separately. Because of their high gain and excellent linearity, operational amplifiers are used for the two amplifying stages IC1 and IC2. The use of two operational amplifiers provides very high gain, enabling the tracer to respond to extremely low-level signals.

The LM386 operational amplifier IC2 functions as a high-gain audio amplifier with an output of almost 0·4W. Its output, at pin 5, drives the speaker via C6 and the switched contacts of jack socket J3. An external speaker, oscilloscope or meter can be plugged into J3, switching off the tracer's internal speaker. The jack plug of the audio signal tracer probe is connected to J2 which feeds the signal via C4 and gain control VC2 to the non-inverting input of IC2. Being intended for audio amplifier use, the LM386 has d.c. feedback within the chip; external feedback can be applied via pins 1 and 8.

The LM386 provides high sensitivity on its own. With very low signal voltages however the 741 operational amplifier IC1 can be used to provide additional gain. The

Components list

IC1	741	VC1	100kΩ lin.
IC2	LM386	VC2	10kΩ log.
D1, 2	OA90	VR1, 2	10kΩ flat-mounting presets
R1	1kΩ	C1	3·3μF 250V electrolytic
R2	4·7kΩ	C2	100pF mica
R3	1kΩ	C3	10μF 50V electrolytic
R4	1kΩ	C4	10μF 63V electrolytic
R5	100kΩ	C5	10μF 25V electrolytic
R6	1MΩ	C6	100μF 50V electrolytic
R7	47kΩ	C7	22μF 50V electrolytic
All ¼W		C8, 9	220pF ceramic tubular

J1 Stereo jack socket, 3·5mm open-circuit type, e.g. Tandy 274-249A
J2, 3 Miniature closed-circuit phone jacks, e.g. Tandy 274-296
Plastic case for tracer, Tandy 270-9503 or similar
Two subminiature d.p.d.t. toggle switches, e.g. Tandy 275-614
Experimenters' i.c. PERF board, Tandy 276-162
Two subminiature red LEDs, e.g. Tandy 276-068
Two moulded knobs, e.g. Tandy 274-416
8Ω loudspeaker, 2¼-2½in. diameter
PP9 and PP3S batteries plus snap-on connectors
Two pen cases for probes (see text)
Two lengths (about 1·3m) twin screened audio cable
Two 3·5mm stereo jack plugs
Veroboard/PCB for r.f. probe

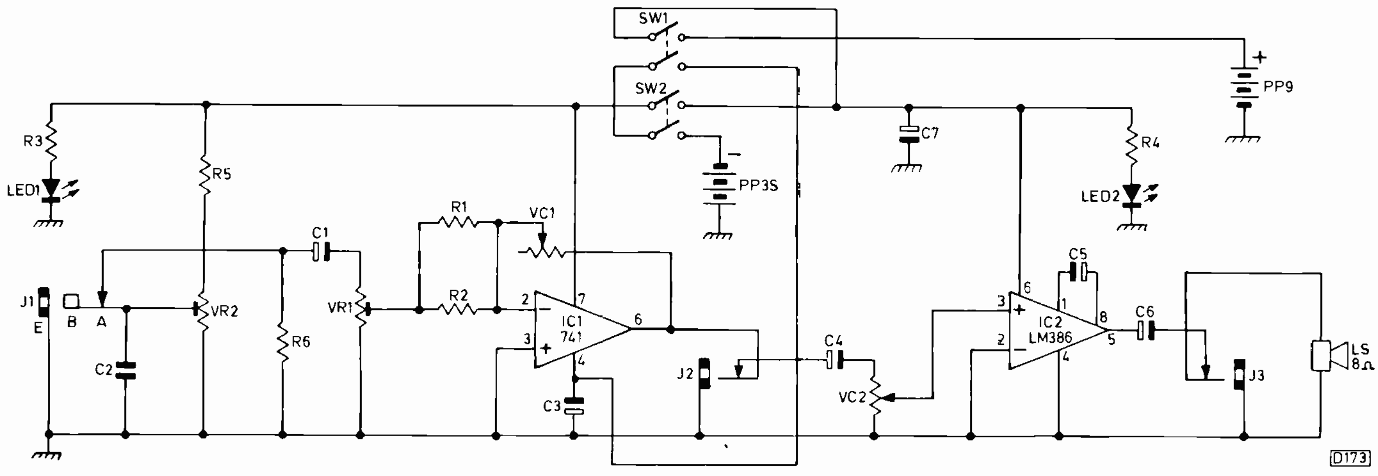


Fig. 2: Circuit of the operational amplifier signal tracer.

audio signal tracer probe is this time inserted in jack socket J1, the signal passing via C1, the preset gain control VR1 and resistors R1/2 to the inverting input of IC1. The output from this chip is fed to IC2 via the contacts of J2 and VC2. VC1 acts as a gain control for IC1, varying the amount of d.c. feedback between pins 6 and 2. The network R5/VR2 provides bias for the r.f. probe – we'll come to this shortly.

Two batteries are used, a PP9 (9V) to power the LM386 and provide the positive supply for the 741 and a PP3S (9V) Extra-Life battery to provide the negative supply required by the 741. To ensure long battery life two on/off switches are provided along with two front-panel LED indicators. When SW1 is closed power is supplied to the LM386 and LED2 lights. If SW1 is then closed the 741 is also powered and LED1 lights. With SW1 in the off position there is no power to the two chips.

The RF Probe

To obtain the maximum output from the r.f. probe a voltage-doubling detector circuit is used. How this works is illustrated in Fig. 3. Half the circuit is shown at (a). The input is applied between points X and E, charging C8 during the positive-going signal excursions. On negative-going signal excursions D2 conducts. Thus only the positive-going part of the input signal appears across the load resistor R6. The values of C8 and R6 are such that the signal across D2 is directly related to the strength of the input signal. In the section of the circuit shown at (b), D1 conducts during the positive-going input signal excursions, charging C9. Once again the positive-going parts of the input appear across the load resistor R6. By combining

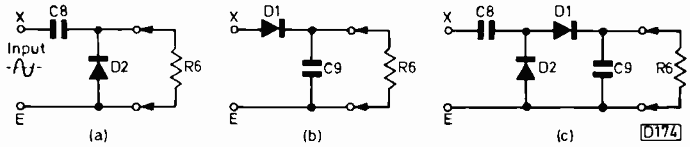


Fig. 3: The r.f. probe's detector circuit. See text.

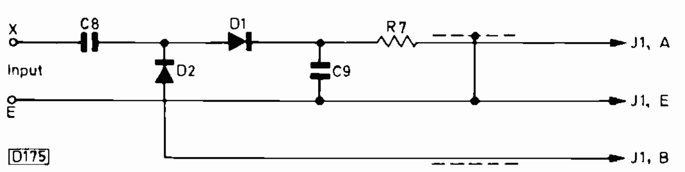


Fig. 4: R.F. probe – practical circuit.

these two circuits to give the arrangement shown at (c) twice the audio output is obtained across R6.

Because of the junction barrier voltage of a semiconductor diode – about 0·7V with a silicon device and some 0·3V with a germanium type – the input signal must reach a minimum level before the diodes will conduct. To compensate for this, bias from R5/VR2 is fed to the anode of D2. VR2 is adjusted so that D1 and D2 are biased at just below their junction barrier voltages. As a result the incoming r.f. signal "floats" on top of this fixed bias voltage. The idea dates back to the days of the crystal set! Fig. 4 shows the complete r.f. probe circuit.

Construction

There's nothing critical or difficult about the construction of the tracer and its probes and the parts required are all readily available. The accompanying photograph shows the internal layout of the finished unit. A Tandy electronic instrument box (catalogue no. 270-9503) was used for the prototype. Any similar case will do – but use a plastic one. It's advisable to fit four small self-sticking cushion feet to the bottom of the case (the Tandy case comes complete with these). The cushion feet grip the bench and thus stop the unit sliding around.

Fig. 5 shows the recommended front panel layout. Hole sizes depend on the components used. The 8Ω loudspeaker, of 2¼ or 2½in. diameter, is mounted on the front panel. You may find that with the Tandy case you need to file away a section of the ribs on the top and bottom plastic covers to accommodate the speaker.

Use of a Tandy 276-162 predrilled board makes it unnecessary to make a PCB. One end of this board fits into slots at the side of the case. The other end is secured to the bottom of the case by means of double-sided sticky pads. Don't fit these pads until you've tested the in-

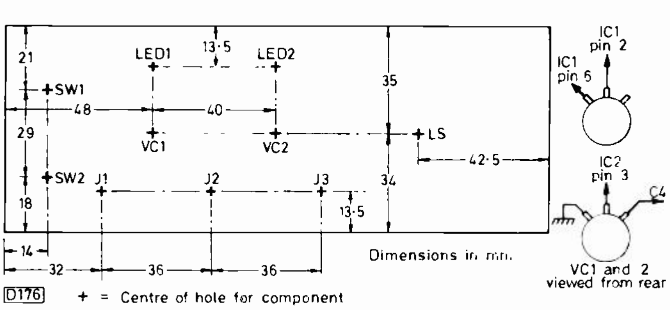
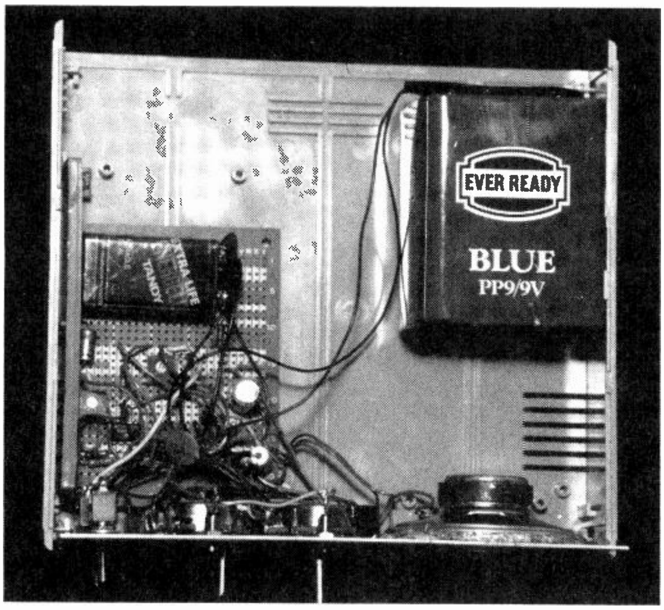


Fig. 5: Suggested front panel drilling details, sizes in mm. Loudspeaker hole size depends on type of speaker used.



Internal layout of the signal tracer.

strument. I mounted the PP3S battery on the board using a little Blu-Tack: the PP9 battery can be fixed to the bottom of the case by means of heavy-duty, double-sided sticky pads – or you could fit a battery holder clip.

Mount the two on/off switches on the front panel so that they are switched off in the upwards position. There's no need for on and off labels as the two LEDs give indication of the on positions. When you solder the two leads to the linear gain control VC1 remember that maximum gain is obtained from IC1 when the control is set to its high-resistance position.

The cases of two Berol roller pens were used for the test probes – they make neat, professional-looking probes. Small sections of suitable insulated plastic tubing could however be used. Fig. 6 shows the construction of the audio probe. Use good-quality flexible screened audio leads for both probes – a handy length is about 1·1m (about three foot six inches). The tips were taken from old test probes and fit well into the ends of the pens. Stereo jack plugs are used for both probes. The components inside the r.f. probe are mounted on a thin strip of Veroboard or PCB – see Fig. 7. It's useful to fit test prods to the flexible "ground" leads: push-on miniature alligator clips can be slipped over the tips when you want to connect the ground leads to a chassis point.

Setting Up

It's worth making a careful check after all the wiring and soldering of the probes and tracer have been completed to make sure that no mistakes have been made. Setting up, which is quite straightforward, can then be carried out. Start by turning both front panel gain controls to their minimum positions and VR1 almost fully clockwise. Plug the audio test lead into jack J2. Fit the batteries and switch SW1 on. LED2 should light. Turn up VC2 and touch your finger to the end of the probe. If all is well you'll hear a buzz.

Turn VC2 to its mid-position, transfer the audio test probe to socket J1 and switch SW2 on. Both LEDs should now be alight. Turn up VC1 and touch your finger to the probe tip. A buzz should again be heard. When SW1 is switched off both LEDs should go out.

Remove both test probes, connect a digital voltmeter across C2 and adjust VR2 for a reading of 0·5V. Any final adjustment of VR2 that may be needed must be carried out while monitoring a very weak modulated r.f. signal. Preset VR1 will not normally require any further adjustment.

Plug the r.f. probe into socket J1. To check that it's working, touch the probe tip to the inner conductor of the coaxial cable from a TV aerial (the aerial must not be connected to a TV set or VCR). You should hear signals – the tracer is operating as an untuned radio receiver.

Before finally assembling the signal tracer give the underside of the panel and the panel connections a coat of

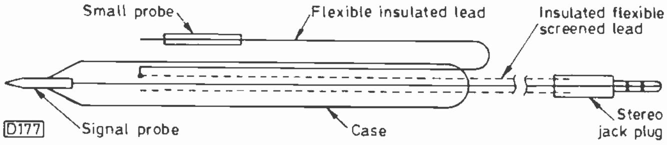


Fig. 6: Constructional details of the audio probe.

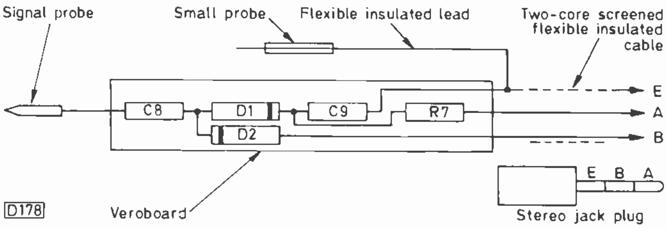


Fig. 7: Layout of components on Veroboard inside the r.f. probe. Internal cable wire A connects to the jack tip, wire B connects to the centre section and the screen E connects to the section that goes to "ground".

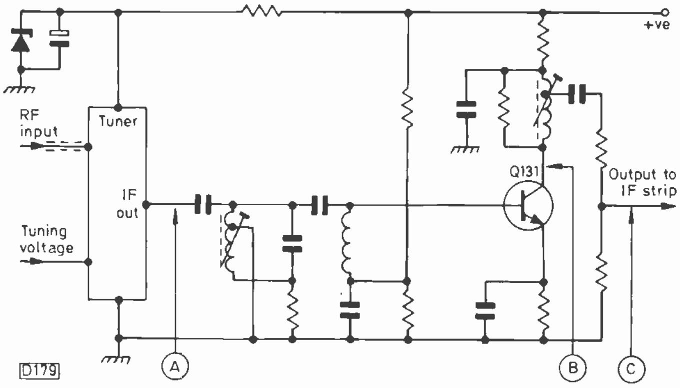


Fig. 8: Tuner and i.f. preamplifier circuit used in the Sony Model KV1810UB, showing test points.

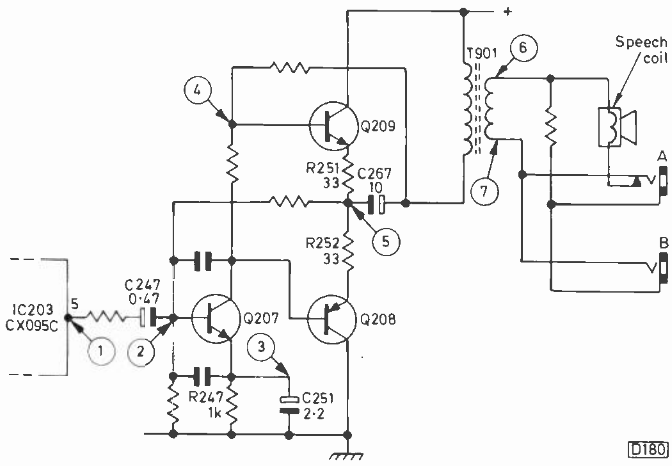


Fig. 9: Audio circuit used in the Sony Model KV1600, showing test points.

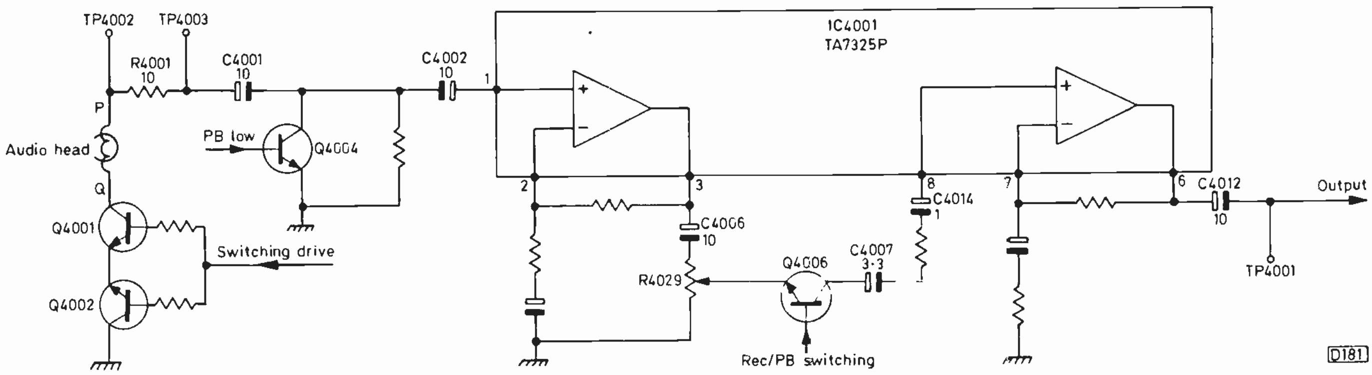


Fig. 10: Simplified circuit of the audio section of the Panasonic Model NV333 VCR, in the playback mode.

circuit varnish – use a very small brush. This will help to ensure trouble-free use.

Test Procedures

The instrument is extremely versatile and can be used to trace signals through quite a variety of different types of circuits. We'll consider just a few examples.

Fig. 8 shows the tuner panel circuit in the Sony KV1810UB Mark II colour receiver. The tracer can be used to provide a handy check on the tuner. An oscilloscope could be used for this test but it would need to have a Y response of at least 35MHz – and you might be in a customer's house without a scope at all. First check that the tuner is receiving the correct voltages, then connect the r.f. probe to the i.f. output connection – point A – with the earthing prod to chassis. The composite TV signal that should be present at the tuner's i.f. output pin should give an audible indication that changes as different channels are selected. Set the tuner slightly off station and you'll hear the programme sound.

This test can be made on any TV or VCR tuner. You'll soon get to know what signals to expect from a good tuner and a defective one. In the absence of a scope the tracer can be used to make quick checks at points B and C. It's best to use a scope and colour-bar generator to trace the composite signal through the i.f. stages but if these items aren't to hand the tracer will provide a handy means of following the signal through the circuitry, using the TV signal itself.

Fig. 9 shows the audio circuit used in the Sony Model KV1600. If the sound is absent or distorted, apply the audio probe tip – plugged into jack socket J1 or J2 – to point 1, i.e. output pin 5 of the CX095C intercarrier sound chip. Connect the earthing prod to chassis. If all is in order music or speech will be heard through the tracer's loudspeaker. Next check at the base of driver transistor Q207. If the electrolytic coupling capacitor C247 (0·47μF) has dried out you might hear only a very weak signal or even no signal at all at this point. A check at the emitter of Q207 – point 3 – should produce some sound: if the volume is loud, suspect that the decoupling capacitor C251 (2·2μF) has gone open-circuit. Good sound should be heard at the collector of Q207 and the base of Q209.

Turn down the gain control(s) and check at the junction of R251/2 where a strong signal should be heard. Connect the two test probes to each side of the audio output transformer's secondary winding – points 6/7 – to ensure that the signal is present here. Finally connect the probes across the loudspeaker's speech coil. If no sound is heard here, suspect jack A. If sound signals are present at the speech coil connections but not from the set's loudspeaker the latter is obviously faulty.

In the event of distorted sound these tests tell you at which point in the circuit the distortion appears.

The signal tracer really proves its worth when checking the audio circuitry in VCRs. Fig. 10 shows a simplified circuit of the audio section of the Panasonic NV333 VCR, in the playback mode. For tests here the audio probe must be connected to jack socket J1, with both switches closed. Switch the VCR to playback and connect the test probes across the audio head – points Q and P. With the cassette tape running you should hear the recorded sound track. Transfer the earthing test probe to chassis, leaving the signal probe at point P. If point Q is being earthed by Q4001/2 you should still hear the sound. Transfer the signal probe's tip to test point TP4003 and then to pin 1 of IC4001. The signal should be louder at pin 3 of IC4001 and can then be traced through C4006 etc. to pin 8 of IC4001. It should emerge from pin 6 and be present at TP4001. As you trace through the circuitry the volume should, after each stage of amplification, become progressively louder.

In the record mode the signal being applied to the tape's audio track should be heard with the probes connected to points Q and P. The control pulses being played back or recorded should be heard when the probes are connected across the control head winding.

Intermittent sound faults are simpler to locate using the signal tracer either with an off-air input signal, a steady signal from an audio generator or a VCR test tape signal. A multimeter set to a suitable a.c. range can be connected to jack socket J3 when a steady signal is used: with the test probe connected to specific points in the circuit the meter will indicate variations in signal strength. A scope can also be connected to J3.

Decoupling electrolytics are easy to check for the open-circuit condition. An electrolytic of 25μF or more with one side connected to chassis should not have any appreciable audio signal across it. If it does, the electrolytic is faulty. Defective coupling capacitors will stop or attenuate the signal.

The signal tracer is also handy when working on the audio sections of TV cameras/camcorders. It can save you quite a lot of component unsoldering when tracing a fault.

Quick checks across smoothing capacitors for hum can be made when a scope is not to hand. If the d.c. voltage present exceeds 250V, connect an extra capacitor of suitable working voltage in series with the audio test probe.

Breaks in signal carrying printed circuit tracks can be speedily located using the tracer and its probes. If you also carry out repairs to audio and hi-fi equipment you'll find the tracer invaluable.

LocoScript 2 Update

Vivian Capel

The version of LocoScript I used as a basis for my article in the March issue was an early one which, as I said, I wanted to try out thoroughly before preparing a review. Since then a large number of new versions have been released, reaching 2:12, i.e. the twelfth version of LocoScript 2, by September 1987. While the intervening versions incorporated various minor changes this one was a milestone in that several of the built-in features of LocoScript, such as the keyboard layout, were made user changeable by adding files from separately available discs. Thus the keyboard can now be redefined to the French AZERTY or a number of other layouts, in addition to individual keys being redefinable.

After LocoScript 2:12 the pace slowed down, but another ten months saw a further four versions and LocoScript 2:16 was reached in July 1988. Not all these versions were successful. A few contained bugs which meant that the new version was one step forward and several backwards. These were mercifully not released.

Things have pressed on since then and, in particular, support has been built in for the ever increasing number of different printers that have flooded the market. LocoScript 2 now has support for some 250 different printers. These are not entirely problem-free however, as will be seen from an account of my attempts to upgrade, to be described in a later article.

The versions have continued until reaching 2:22 at the time this article was written. This version includes a choice of two type styles which can be selected by a menu during document set up. There is also a facility for designing one's own characters.

Compatibility and Updating

There are two ways of looking at this veritable avalanche of versions. The owner of an early version might consider that it has become obsolete after too short a time and feel somewhat disgruntled about this. He might think that if he updates the new version will soon suffer the same fate. The other view is that unlike many producers the LocoScript team is not resting on its laurels and is working continually to make the system even better. Apparently most of the improvements come as a result of users' reported problems or suggestions. One can hardly grumble at that – would that certain other manufacturers did the same!

In fact there's no question of an earlier version becoming obsolete: all LocoScript 2 versions are compatible and documents originated with one can be edited or printed using another, provided the supplied printer is used. The only incompatibility is beween LocoScript 1 and 2, as described in the previous article. Anyone wishing to update to the latest version can return his disc and have it updated for a handling charge of £5, so an occasional return can keep one up-to-date with the latest improvements at no great cost.

Support Discs

In addition to the extra facilities contained in the latest versions there are now a number of support discs that considerably enlarge the scope of LocoScript 2. There is LocoMail, which permits names and addresses from a list to be automatically inserted into standard letters and can discriminate between various entries if this is required. It will also process invoices and perform basic arithmetic, cross reference entries and maintain records.

The LocoSpell disc offers a spelling check similar to those provided by other word-processing programs. It contains three dictionaries. The main 77,000 word dictionary needs a PCW8512 or an upgraded PCW8256. The smallest 17,000 word dictionary can be accommodated in the smaller PCW8256 memory. There's a facility for adding words, such as technical terms. It also incorporates a word count, but as I suggested in the previous article this should be included in the word-processor program and not be classed as an extra. This is the one glaring omission that has yet to be corrected in the LocoScript 2 series.

LocoFont is an interesting pair of discs. The first has ten different fonts that can be used to print any document on the built-in printer. The fonts are standard, roman, script, copper plate, definite, sans serif, capitals, deco, finesse and modern. Considering the £19·95 cost of the disc this is very good value. The second disc, which costs £14·95, has four fonts – penman, mini 15/17, mini PS and old English. The sans serif style which eliminates the serifs (the small horizontal projections from letters) is claimed to have the same character widths as the standard font so that document layout is the same for both. This is not actually so: many of the sans serif letters are narrower, so the words occupy less space and the line layout is different. Fonts cannot be mixed in the same document, but the same document can be printed in a different font at different times.

The latest disc is LocoFile, which is a datebase. Entries can be transferred to and from LocoScript 2 documents and the system can be indexed in eight different ways at the same time. It will also work with LocoMail.

Upgrading the PCW8256

For some time kits have been available for upgrading the PCW8256 to the PCW8512 specification, and the prices have fallen considerably. There are two stages that can be carried out. The first is to increase the internal M drive memory from 256 to 512 kbytes. All that's necessary is to plug in eight additional memory chips into the empty sockets on the main processing board and either reverse two internal switches or, in earlier models, resolder a wire link from one point to another. This conversion is well worthwhile as it permits very large documents to be handled in the M drive without danger of it becoming full. Also the large LocoSpell dictionary can be loaded. The only effect on the screen is the listing of the larger memory capacity, the indicated length of all M drive documents being rounded up to the nearest 2k instead of 1k. When these are copied to the A drive their length is given to the nearest 1k as before.

Second Disc Drive

The other stage of conversion is to fit a second, B disc drive. This too is a simple job, necessitating removal of the metal nameplate below the first disc drive and connection of leads already wired inside the PCW8256 to the points indicated in the instruction leaflet on the drive unit. B drive discs can be formatted to give a total of 720k (1Mbyte unformatted) compared with the 180k A drive. The B drive is double sided, so you do not need to remove the disc and turn it over to use both sides as you do with drive A. This means however that the rated 720k is what you get on both sides, whereas the A drive's 180k is available on both sides. B drive discs thus store twice not four times the amount of A drive.

A B drive written disc cannot be read in A drive and vice versa, although access to each is readily available when loaded in the correct drive. When considered solely for economy, the B drive is of questionable value, especially when the comparative costs are considered. Conversion to M drive costs around £20, but the extra disc drive costs around £135. With discs now costing about £2 you could buy 60 or more for the cost of the extra drive. The advantage comes when running large programs or using a number of lengthy support files such as LocoSpell and several fonts. These may not all fit on to a single-sided A drive start-up side. In this case they can be put on a B-drive disc thus making good use of its double capacity. Even this is not absolutely necessary now as the latest LocoScript 2:22 version allows more than one start-up disc to be used consecutively in drive A. This is done by creating an empty file named ET.AL and putting it on the first start-up disc. The computer is then instructed to wait for a second disc before finishing the loading operation.

Alternative B Drive

There's an alternative to fitting an internal, second B drive. At one time it was hoped that the 3in. Amstrad discs would become a recognised standard, taking over from the rather clumsy 5¼in. ones. This didn't happen, and instead the 3½in. format seems to be taking the place of the 5¼in. discs. As a result few programs outside the LocoScript series are distributed on 3in. discs. So there are a large number of useful and interesing programs, such as desk-top publishing and many others, that cannot be run on the PCW8256 because they are available only on 3½ or 5¼in. discs.

This suggests a practical alternative to fitting an internal 3in. B drive – fitting an external 3½in. drive. One of these can be connected to the PCW8256 using the same wiring and will behave in the same way except that it will give a choice of 3 or 3½in. operation. Several makers supply such units. Most are housed in neat horizontal cases that can be used as a base for the PCW8256 and thus take up no more desk room.

Hard Discs

Another possible upgrade is the hard disc which provides prodigious amounts of memory – from 10-60Mbytes. There are two forms. One is called hard card. It contains a 3½in. Winchester hard disc, drive and the control electronics, all in a slim assembly that slots into an expansion port at the back of the PCW8256. It's a permanent fixture, and when fitted is recognised by the machine as drive C. So it's in addition to rather than in place of drive B. The other is described as "hard disk". It's really another disc drive that must be wired in and used in place of drive B.

The hard card usually goes up to 32Mbytes while hard discs go higher. The hard card has more than enough capacity for most users however. It can conveniently store all operating and start-up software, files, addresses, references and much more, all available at switch on without having to search through a pile of floppy discs to find the one you want. It's really like a massive internal memory that doesn't disappear when you switch off. With such attractive features there's bound to be a catch – the price. The cheapest hard cards are around £200 and they go up to £500. For the professional user with large start-up files and masses of information required to be instantly available a hard card or disc will no doubt prove to be a boon. At these prices however the rest of us will have to make do with what we have.

Disc and Videotext Developments

Peter Marlow, B.Sc. (Hons.), C.Eng.

Some interesting issues relevant to the future of domestic television were raised at two recent events at the Institution of Electrical Egineers. The first was a colloquium on CD-ROM while the second dealt with the future of videotext.

Videotext

The future of videotext in the UK should be considered in the light of French experience. In 1984 the French Telephone Company gave away four million Minitel terminals to save the cost of printing telephone directories. By 1990 the number of terminals should reach eight million. The availability of these domestic terminals has brought about an explosion in videotext services, mainly games orientated and dominated by large groups. There are at present some 2,200 service providers, offering over 7,000 services. During last September a total of 5·6 million hours of connection time was recorded. Sixty per cent of this time was accounted for by only twelve per cent of terminal owners however.

In comparison Prestel, launched in 1979 as a residential service designed to make fuller use of the telephone network in the evenings and at weekends, never took off. By 1983 there were only 30,000 subscribers, 87 per cent of which were business users. After a rethink several professional services were launched, covering subjects such as travel, insurance, finance etc. Micronet, providing electronic mail, did attract some 20,000 domestic users. But the scale of the business has not inspired manufacturers to make low-cost equipment for home use. British Telecom is not even able to give away terminals because of provision 18 of its charter — it would be unfair to competitors.

One proposal that has been put forward is a plan to start a home shopping service called Keyline, with a hoped for quarter of a million terminals installed in homes by the end of next year. The service would be free apart from a small registration fee. Unlike the Minitel ones, the terminals would be intelligent, battery operated, would use a 4 × 40 character LCD, and would be of rugged A4 size construction with a built-in 1,200 baud modem. Encrypted data would be used so that credit card information could be transmitted. Users could enter information without having to connect up: when ready the terminal could be plugged into the phone socket, calling shops automatically to place orders. The cost of the service would be covered by making a small charge on each transaction. One wonders how far this proposal will get.

The CD-ROM

A CD-ROM is an audio compact disc used for storing computer data. 550Mbytes can be put on one disc, equivalent to 200,000 full A4 pages. The technology can also be used to store picture, graphical and audio information in digital form with the computer data. For moving pictures however the LaserVision analogue coding technique is used to get a reasonable running time. As previously reported here Philips has launched CD-V discs that give five minutes of moving pictures and twenty minutes of CD quality audio. The audio can be played back through a conventional CD player but a special unit is required to handle the video sequences. There's pressure to produce CDs with much longer playing times. This could lead to a considerable increase in the amount of recorded video available. For example the BBC has plans to publish documentaries in disc form including unused material.

Interactive TV

Also previously mentioned (March) is interactive TV using CD-I discs. Playing equipment will once more have to be upgraded for CD-I use. Forms of interactive television are in experimental use in America. In Canada for example a company called ACT is sending four cable feeds to its subscribers, giving the customer four choices during programmes. This is particularly useful during sports events where the viewer can choose different camera angles. People in New York can program their personal computers with a "user profile": TV programmes supplied to their homes via cable are then automatically selected according to the profile.

A Day in the Life of . . .

Nick Beer

Following Mick Dutton's very entertaining article in the December issue I thought I'd write a similar piece, but from a slightly different perspective. The difference is that I'm a purely workshop based engineer whereas Mick and I suspect many of you do a mixture of field and workshop servicing. It's my opinion that if at all practical it is far more successful and efficient to have engineers allocated to particular types of work. This is the system we employ and I'd better start by describing our organisation. We have three workshop based engineers, three field engineers and a number of field engineers/installers. One of these installers is workshop based, the others doubling as salesmen.

Installation and field service work obviously overlap, for example where an engineer is heading towards Exmoor and a VCR has to be delivered in that area. It also works the other way round, when a repair falls amongst a number of demonstrations.

Workshop paperwork, bills, spares ordering, labour claims and spares supervision are handled by a two-man workshop administration team. This arrangement allows us workshop engineers to get on with the job we want to do – repairs. Having a clearly established staffing arrangement of this type would obviously be of little point if we didn't also have well thought out workshop conditions.

The day's work starts at 9 a.m. Well, around then anyway. The nine mile journey to work can take me up to three quarters of an hour – we have severe traffic problems even here in north Devon, but they should improve when a new bypass is opened.

Visit to the Bill

On this particular morning I'd left late to call in at the police station. They'd found a Salora SV6600 VCR that had been stolen from one of our rental customers twelve months earlier. They wanted me to identify it and didn't think it funny when I commented that I knew it didn't have a beard . . . The desk sergeant took me to a ramshackle old building at the side of the station, inserted a security pass into a slot at the door and then used two keys to let us in. By the look of the door it would have fallen open had there been a gust of wind. Once the identification was over and statements were signed he asked me about hi-fi and was B and O worth the extra money. I explained the differences but this only raised further questions which seemed to be rephrased versions of the ones he'd just asked. In short he kept me talking for ages.

On arrival at the workshop I was greeted by the customary "good evening", suggesting that I was maybe a minute or two late, and a field engineer wondering whether his vehicle would ever turn up.

A Morning of Video

First job of the day was to reassemble a Sony CCD-V200 pro camcorder that had been on soak test following head replacement. This completed it was dumped on the next salesman to enter the workshop so that he could put it back on display. A Panasonic NV-G21 was the next job on the clip, a rental machine brought in by a field engineer as the video heads were faulty. But there were a number of other faults. This is common with earlier versions of these machines that have been out for a while. The video heads were soon replaced (VEH0343) along with the barrelled pinch roller (old brass type VXL1743) and the capstan motor (VXP0777) which was causing a loud knocking noise while lacing. The machine was tested, the new heads were set up and the sound level was then found to be low and varying. Another stock fault. The VBR0116 head was replaced with a VBR0125, then the capstan brake. whose pad had virtually disintegrated and was causing as cyclic scraping sound, was renewed. With the new head aligned and the new improved parts fitted I didn't expect to see the machine for a long time. These machines are very reliable electrically: it's only the weak design of the early mechanical parts that lets them down. The old parts were taken to the appropriate box in the storeman's office to be sent back if required.

The next job was one I'd been putting off for a while, a Sony CCD-F330 camcorder. I'd found the cause of no auto focus to be a break in the FPC from the auto focus sensor below the lens to the AF32 auto focus processing PCB. After confirmation with Sony I obtained a lens from the stores as the only way of replacing the offending item. Now those of you who know Sony camera head design will sympathise with the job of lens replacement. Suffice to say that it took until lunch time to reassemble the camcorder to a state in which it could be soak tested. The alignment was checked in the camera workshop and the camcorder was left soak testing until I felt like putting the case back on! By now it was lunch time and we adjourned to the tranquility of the audio room for some nourishment and to watch the news and Neighbours . . .

One of the field engineer/installers had been asked to call in on a B and O VHS82·2 VCR that wouldn't accept a cassette. He'd been advised to "collect and loan" but, being an intrepid soul, he came in to ask about the viability of trying anything while at the house. Now this machine has the plastic Philips mechanism, so I didn't want it brought in. I got a cassette carrier from the stores, showed him how to do the job (wiggling the insert switch etc.), handed him a manual in case he got stuck and opened the door for him as he and the other field engineers left to make their afternoon calls.

Afternoon's Mixed Bag

Television servicing in the workshop is limited to over the counter jobs and the real nasties, most of it being done in the field. This makes for more interesting work for us. My colleague Ian Bowden and I share the TV sets and we're lucky in that we prefer dealing with different types of fault. I'm more than happy with a dead Sony or B and O, something that many people would run a mile to avoid, while he prefers signal faults – decoders etc., the nastier the better. Salora Ipsalo faults are another of his favourites. He's also got more patience than the rest of us. He'll stick at an intermittent fault forever whereas we tend to put such problems aside a few times. Our third workshop engineer tends to stay in his audio room most of the time, away from the TVs, listening to his weird music.

Anyway I next turned attention to a brand new Salora 24K67, the last one in stock and booked to go out next day. It had multiple purity errors, discovered by one of our administrators while he was fitting teletext. He'd degaussed the c.r.t. but on switching off and on again the errors returned. I checked the degaussing circuit, found that it was working and after much deliberation accused the tube. The salesman involved was summoned and told the good news. He suggested sending the identical Luxor model of which we apparently had plenty in stock. But it has a wood coloured cabinet and the customer particularly wanted the grey Salora colour. It was then suggested that we take a tube from a new Luxor set and fit it in the Salora one. My next few words don't bear repeating, but 'twas duly done and the set worked fine. The Luxor set was put in the parts on order area.

A colleague asked for my advice on a dead Sony KV1400 and was given some. Next came a Panasonic NV333 whose card said it was repaired a month ago for the same fault. I checked the old card and found that it had been repaired just over three months ago. The work done had been to clean clogged heads and replace the belts and idlers etc. following the customer's acceptance of our two estimates (one for head cleaning and one for attending to the very worn belts etc.). Another note had been made on the card that a lot of oxide seemed to have been shed into the mechanism, and administration had advised the customer about the use of poor quality tapes. The heads were again clogged. They were cleaned, then the machine was soak tested for a few days after which the customer was phoned and asked to collect it.

A few days later (I must follow this one through!) the machine appeared again, along with four of the owner's tapes as instructed by administration after he'd rung to say "it's gone again". Indeed the heads were clogged and cleaning restored normal operation. A look at the tapes revealed the source of the problem. They were four-hour Scotch tapes with which we've had more than a little trouble, usually resulting in this type of fault though sometimes the cassettes themselves have broken. In one I remember the front flap had snapped off in a brand new rental Panasonic NV-G40, ruining both heads. Customers buy them because of the life guarantee. A phone call to the customer finally sorted the job out. If Scotch are reading this, it happens on all makes of machine we sell and not only with your tapes. This particular machine was one of three that came in with identical troubles during the week. What we do is to advise customers of the problem and give them a Panasonic tape to use exclusively for a trial period. When this proves to be trouble free they promise to do as they are told and not buy on price.

The field engineer/installer returned with the cassette carrier still wrapped up. He said the machine was outside and seemed to have a nasty fault. When I asked about this he laughed and admitted he'd done the job and had carefully rewrapped the carrier. As if I haven't enough troubles.

The Last Job

The next job turned out to be the last of the day, another Sony CCD-V200. It appeared to have intermittently clogged heads, but this wasn't so. When it was in the fault condition the drum phasing appeared to be incorrect. This was confirmed by lightly touching the drum with a finger then releasing it – a momentarily perfect picture was then seen. The speed was correct and a check on the circuit revealed that the ATF LOCK wasn't operating. So the signal was traced from the preamplifier. After a lot of checking through all the various paths and Ian having a nose around – it being a nasty – we jointly resigned ourselves to the fact that we would have to get to a certain test point on a small PCB in the middle of the PCB sandwich across the bottom of the mechanism.

So I gently removed the right-hand side case and while gradually lifting everything out I found the cause of the trouble – the earthing strap to the case of the narration microphone was not connected, instead being lodged across the print side of the connector, to the head amplifier area. After putting this to rights the machine performed flawlessly – we've had a number of faults that could be classed as production errors on stock Sony camcorders. I have to confess that this job was not completed until the following morning. Six p.m. came just before confirmation of the fault, and I decided to leave the excitement for another day!

A Look at Operational Amplifiers

Part 2

Keith Cummins

In Part 1 last month we dealt with the basic inverting, summing and non-inverting operational amplifier circuits. There are several other ways in which the operational amplifier can be put to use and we'll now take a look at these.

Circuit Applications

Fig. 1 shows the linear integrator circuit which enables a virtually perfect triangular waveform to be produced. The junction of R and C is the amplifier's virtual earth point. Application of a fixed voltage produces a constant current flow through R and also charges C. Integration fails when the input is held at a positive or negative potential for too long – the output from the operational amplifier then "hits the rail" and no further linear charging of C is possible. A sawtooth instead of a triangular waveform can be produced by placing a diode across R and applying drive from a low-impedance source.

Fig. 2 shows the linear voltage-to-current converter. A meter connected in series with the transistor's collector will give a current reading directly proportional to the input voltage. Since the operational amplifier has a high-impedance input, we have here the bare bones of an electronic voltmeter. The value of resistor R determines the voltage-to-current transfer ratio: a $1k\Omega$ resistor in this position will give rise to a constant 1mA for a 1V input.

Use a Darlington transistor with an output transformer connected to its collector, bias the d.c. input level for an appropriate standing current and what have you got? A class A audio power amplifier!

Fig. 3 shows a simple field output stage using a power operational amplifier such as the TDA2030. We need a linear voltage-to-current conversion and the easy way to achieve this is to connect a "tail" resistor in series with the field scan coils and feed the voltage developed across this resistor back to the operational amplifier's inverting input. The operational amplifier then takes the necessary action to drive a linear current through the tail resistor and, of course, the scan coils. The linearity is as good as the driving sawtooth. I've used this idea successfully to drive small monochrome picture tubes without the need for a linearity control.

The Schmitt trigger circuit shown in Fig. 4 looks like an inverting amplifier, but the inverting and non-inverting inputs have been transposed. Thus the feedback is positive, giving the circuit two thresholds that depend on whether the output is high or low. The difference between these thresholds is known as the hysteresis, and is a function of R1 and R2. If you want to design this sort of electronic toggle the sums are once again easy. It's a very useful circuit for light/dark daylight sensing to control lights etc. The ratio of R2 to R1 is generally not less than 10:1.

Fig. 5 shows a balanced input amplifier. This circuit arrangement, where R1a = R1b and R2a = R2b, employs the operational amplifier's common-mode rejection characteristic – the amplifier ignores common-mode noise or hum on the input lines while responding to a differential input. The circuit is particularly useful where microphones, sensors etc. have to be connected via long input leads, and can often allow the use of unscreened leads.

The gain obtained by applying the input to terminal A is −R2/R1. Via terminal B we first have an attenuation of R2/(R1 + R2) followed by a gain of (R1 + R2)/R1. The actual gain obtained by applying an input to terminal B is thus [R2/(R1 + R2)] × [(R1 + R2)/R1], i.e. R2/R1, the same as with input A but non-inverted. The total gain achieved by using both inputs is thus −2R2/R1, assuming that input A is going positive and B negative from a *low-impedance balanced source*.

There's a snag however. The input impedances don't match, which is why a low-impedance source is specified. Seen from input A the impedance is R1, while input B sees an impedance of R1 + R2. This can be bad news. An easy solution is to use two separate inverting-input amplifiers for inputs A and B (the input impedance is then R1 in both cases) and to follow these by the common-mode rejection stage. The gain required can be distributed between the three operational amplifiers. Since up to four operational amplifiers can be obtained in a single i.c. package it's easy to organise an arrangement of this type. Alternatively, the two input stages can be non-inverting, enabling a high input impedance to be achieved. With some elaboration this sort of arrangement is the basis of medical equipment such as the electrocardiograph, where common-mode rejection of hum and noise is important to enable the differential heartbeat signal to be recovered and amplified.

What about the use of operational amplifiers at video frequencies? The first point to note here is that the gain-bandwidth product and the slew rate must be very high if signals of any appreciable amplitude at up to 5MHz are to be handled. There are operational amplifiers with spectacular characteristics of this type, but their prices also tend to be spectacular! Very often a traditional transistor amplifier circuit will work well for video applications and be much more economical.

Like most manufacturers of anything, the makers of consumer electronics products are expert at selecting "horses for courses". This is why you tend to find operational amplifiers in the servo, power and audio circuits rather than in video drive circuits. If you look hard enough you'll find some operational amplifiers in video

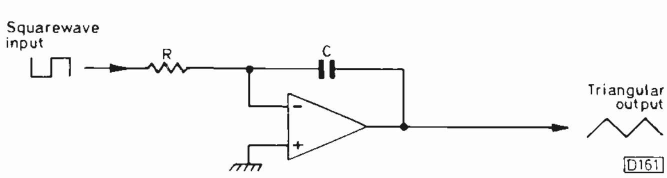


Fig. 1: The linear integrator circuit.

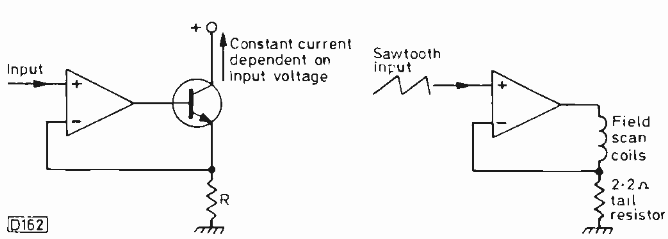
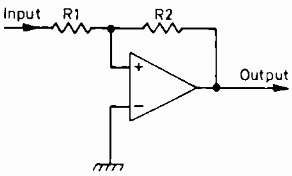


Fig. 2 (left): The linear voltage-to-current converter.
Fig. 3 (right): Operational amplifier field output stage.



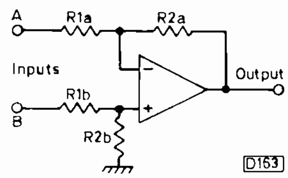


Fig. 4 (left): Operational amplifier Schmitt trigger.
Fig. 5 (right): Balanced input amplifier circuit.

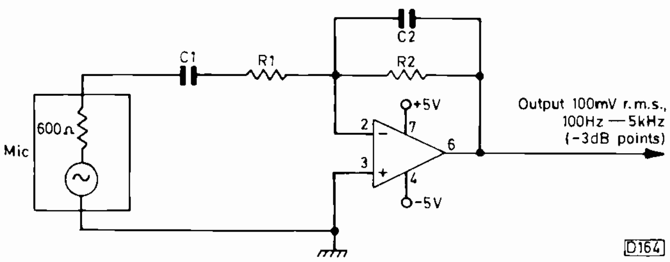


Fig. 6: Design exercise – microphone interface circuit.

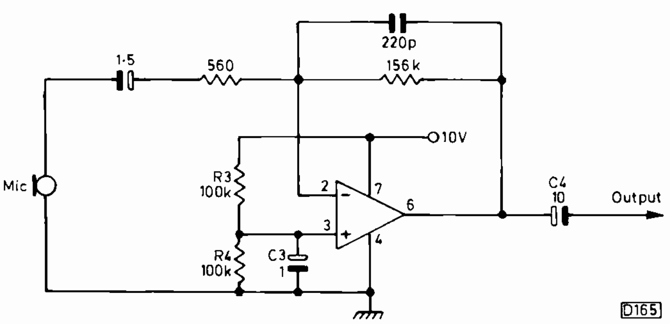


Fig. 7: Practical circuit with half-rail biasing – network R3/R4/C3 sets the output at half the rail voltage when a single supply is used.

circuitry, but they tend to be hidden away in chips designed for decoding etc.

Summing Up

Operational amplifiers are today widely used in active filters, instrumentation and medical electronics and digital-to-analogue converters, to mention just a few applications. The aim of these two articles has been to present the basics of operational amplifier use without submerging readers under a heap of information some of which would be of specialist interest only to those involved in the design side of the business. We've tried to present the operational amplifier as a functional device, so that if you come across one in a circuit you'll know what to expect of it.

If you clip your scope probe on to a virtual earth point you won't see much signal! I've often wondered how many innocent operational amplifier chips have been replaced by people who have not appreciated the subtlety of the virtual earth ("the signal's o.k. at the input resistor, but when it gets to the chip it has all gone!").

Also, if an operational amplifier overloads and its output hits the rails there'll be no feedback once the signal has squared off. Under these conditions a signal *will* appear at the virtual earth point, which has become "unstuck". This is another pitfall for the unwary, who might think the presence of this signal indicates that all is o.k. at the input to the chip.

To finish off we'll go through a little design exercise, just to prove how easy it is to use an operational amplifier. In the case in question the use of transistors would be a lot more difficult. The problem could well arise where microphones are used in connection with video recording and/or public address systems.

Here's the problem then. We have a 600Ω dynamic microphone which produces a peak-to-peak output of about 2mV, measured unloaded across the input terminals of a scope, when used for normal speech at a distance of some 1 ft. Speech reproduction only is required, so the bandwidth can be 100Hz to 5kHz, giving good speech reproduction without "opening the window" wide enough to allow out-of-band sounds to receive unwanted amplification. The equipment to be used with the microphone requires an input of 100mV r.m.s. Design an amplifier to provide an interface between the microphone and the 100mV input.

Fig. 6 shows the basic circuit. To match the microphone R1, which is connected to the virtual earth point, has to be of the same value as the microphone, i.e. 600Ω - 560Ω will do! Since the microphone has a source impedance of 600Ω, its output when loaded will be 1mV peak-to-peak instead of the 2mV peak-to-peak measured on the scope. To obtain an output of 100mV r.m.s. we must calculate the value of R2 after converting the 100mV r.m.s. to peak-to-peak (same as the input), i.e. $2\sqrt{2} \times 100\text{mV} = 280\text{mV}$. From this we can say that $R2 = 560 \times 280\text{mV}/1\text{mV} = 156{\cdot}8\text{k}\Omega$ to give us the required gain of 280. So we could use 100kΩ plus 56kΩ in series or go for 180kΩ and get a bit more gain.

What chip are we going to use? We know what the gain-bandwidth product in this particular example is – the gain is 280 and the bandwidth 5kHz, so the gain-bandwidth product is 1·4MHz. The TL071, a reasonably low-noise, general-purpose BIFET input device, has a gain-bandwidth product of 3MHz and will thus do fine in this application (note that it would be of marginal use if the upper frequency limit was 10kHz).

All we need to do now is to set the −3dB points. C1 sets the lower 100Hz point when its reactance 100Hz is equal to the *total* input impedance, i.e. the source plus termination. This is 1,200Ω, or should we be strict and say 1,160Ω – no, 1,200Ω is fine! So $1{,}200 = 10^6/2\pi \times 100C$ where C is in microfarads, i.e. $C = 10^6/2\pi \times 100 \times 1{,}200 = 10^6/24\pi = 1{\cdot}32\mu\text{F}$. What a rotten value! We have three choices, use 1μF, 1·5μF or make the value up from capacitors connected in parallel. I'd use 1·5μF – after all 1·5μF minus 10 per cent is 1·35μF, which is not far adrift. You can use a tantalum capacitor: the fact that it won't be polarised doesn't matter.

C2 sets the upper, 5kHz −3dB point when its reactance is equal to 156kΩ. That is, $C = 10^6/2\pi \times 5{,}000 \times 156{,}000 = 1/1{,}560\pi\ \mu\text{F} = 204\text{pF}$. 220pF is o.k. If 180kΩ had been used for R2, 180pF would be a better value.

So there we have our little amplifier. It can be supplied with say + and −5V, or if you prefer the circuit can be biased for single-rail working as shown in Fig. 7. This calls for four more components, as shown.

Finally, I hope you've found this discourse on operational amplifiers useful. It has at least scratched the surface. For anyone who wants to look at the subject (or electronic circuits in general) in greater depth I would recommend "The Art of Electronics" by Horowitz and Hill, published by the Cambridge University Press. It's a bit pricy, even in the soft-back edition, so get someone to give it to you for your birthday! Several books on the specific subject of operational amplifiers are listed in the Technical Library section of the RS catalogue.

VCR Clinic

Reports from Philip Blundell, Eng. Tech., Eugene Trundle, David Botto, Alfred Damp, Ian Bowden, E.M. Beddow and Alan Shaw

Philips VR6561

This machine wouldn't play as the head didn't rotate. It would begin to turn but couldn't manage a full rotation. This pointed to one of the motor's coils not being driven. D.C. checks in the drive circuit revealed that transistor T7113 (BD135) was open-circuit.

Another of these machines had the same fault but in this case it was intermittent. There was a broken wire in the loom from the PCB to the drum motor. **P.B.**

Grundig VS200

Tape path problems, such as the sound going off after a few seconds, are often caused by a faulty pinch roller.

No sound or no control track recording/playback can be caused by an open-circuit head winding.

Intermittent failure to initialise, especially from cold, is often caused by poor connections on the ribbon edge connectors to the sequence control module. **P.B.**

Philips VR6362

The symptom with this machine looked like faulty video heads – until I tried the tape in another machine and found that it had been erased! The +11·8d record supply was present all the time as transistor T7701 (BC328) was short-circuit. **P.B.**

Philips VR6561

If the idler wheel doesn't flip across to contact the reel discs, check that the block (item 257 4822 466 81643 that fits under the top plate) hasn't fallen off. **P.B.**

Sharp VC7300

An increasingly common problem with these machines is tape slack at the end of a rewind. The loop of tape then gets crunched by the cassette flap when the tape is ejected. Much time can be spent on the reel brakes if you don't realise that the cause of the trouble lies elsewhere. At eject the loading motor, under the deck, kicks to take up the slack, via a belt coupling to the spool turntable. If the latter doesn't move, check the loading (short) belt for slippage and the clutch on the loading block assembly for excessive friction. **E.T.**

Hitachi VT220

This machine uses a multi-legged slab type chip (STK5471) to produce the regulated power supplies. We've had several of these fail, giving the following symptoms: operate light comes on, no deck functions and a noisy "r.f.-through" picture to the TV set, this picture disappearing altogether when the VCR is switched on. It's the 12V line that fails. Use plenty of heatsink compound when replacing this device. **E.T.**

Panasonic NV333

This fault gave us a few headaches. The machine, an older version, had no clock display. Probably IC7501 on the front panel we thought. However as soon as we removed the screws that hold the front and main PCBs and swung these out the clock display lit up, went out, lit up and went out again. A dry-joint we concluded, wrongly. We finally got to work with our trusty component tester and found that diode D1015 (MA165), marked D15 on the print, was leaky though not short-circuit. This diode is connected to the emitter of transistor Q1002 in the power supply section, feeding a regulated 17V supply to the clock PCB. A 1N4148 is a suitable replacement. **D.B.**

Hitachi VT130

The problem with this machine was very bad audio flutter. When an alignment tape was played a scope hooked to the audio output socket produced a display with marked wobble at the right-hand side. We found that the capstan motor drew about 140mA off load and that the waveform generated across its input connections was rough. A new motor drew 85mA and produced a much smoother waveform. When it was fitted in the machine the sound returned to normal. **E.T.**

JVC GR-C1

The reported symptom with this early camcorder was no sound. In fact the playback audio was fine but during record no sound reached the tape and there was no output via the E-E monitor channel. We found that the audio E-E mute line was in operation. For the machine to be brought out of mute the line needs to drop below 1V. In this case it fell to only 2·3V. The cause of the problem was on the mechacon board: the cure was to remove a big blob of yellow glue in the area of Q30. **E.T.**

Sanyo VHR3300

We've had a couple of these machines that intermittently failed to come out of standby: the clocks worked fine but there was sometimes no response from the on button. If you get this problem check the fitting of the front PCB and the clearance between it and the plastic front cover. If one of the control switches is held in the others don't work. **E.T.**

Hitachi VT11

The fault with this machine looked very like dirty video heads but after several attempts at cleaning them it was obvious that we had to look elsewhere for the answer. A check at the playback f.m. test point produced the waveform shown in Fig. 1(a). Assuming that the heads were o.k., we decided to check the drum flip-flop waveform which was as shown in Fig. 1(b). This signal is produced by the drum pick-up pulses which were then found to have the correct mark-space ratio. So the servo chip which contains the multivibrators that generate the drum flip-flop signal was accused of being faulty. Unfortunately replacing it made no difference. Time to look closer at the drum pick-up pulses. The waveform was as shown in Fig. 1(c) – Fig. 1(d) shows the correct waveform. The small positive-going overshoot pulse circled in Fig. 1(c) was of sufficient amplitude to make the positive monostable trigger, thus creating the incorrect drum FF signal. Replacing the Hall i.c. on the drum motor cured the fault. **A.D.**

Hitachi VT64

The drum motor had stopped and voltage checks around the drive chip IC601 revealed that the supply voltage at pin 10 was low. This i.c. is supplied via D642 and a cold check suggested that the diode was o.k. Replacing it restored drum motor operation however. **A.D.**

Hitachi VT17

The drum ran at full speed because there was no FG signal at the servo board. We found that there were dry-joints on the FG board within the drum motor. **A.D.**

Panasonic NV-G21

The customer's complaint was that the cassette wouldn't eject. In fact the machine was very sluggish in lacing the tape. If the capstan motor was given a helping hand everything worked. A new capstan motor put matters right. **A.D.**

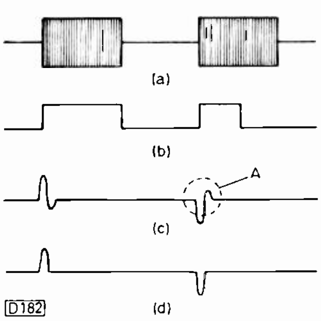
Panasonic NV430

We at first thought that this machine had dirty video heads, but cleaning made no improvement. When the scope was connected to the head preamplifier module to check for head wear the fault cleared itself. A check on the inside of the module revealed dry-jointed connectors and earthing connections. Resoldering the faulty joints cured the fault. It's worth checking that the module fixing screws are tight and thus providing good earthing. **A.D.**

Panasonic NV788

The fault reported by the customer was a poor picture which was worse in pause and slow motion. A field engineer had visited the house and cleaned the heads. This had improved the playback picture but didn't help very much in the still/slow-motion modes, so the machine was brought into the workshop for further investigation.

We found that the top third of the picture was noisy in the still mode, the rest of the picture looking all right. The back tension was checked and adjusted without producing any improvement and new heads made no difference. A slight improvement was obtained by adjusting the inlet guide. We then looked at the f.m. output waveform at TP3512 – see Fig. 2. In the playback mode the normal L and R heads are used and the output was correct. In the still/slow modes however a fifth head L' is switched into circuit, replacing head R. As shown in Fig. 2 it was the output from this head that was causing the problem. Since heads R and L' share the same playback amplifier the only cause of the difference could be in the switching, which is done by relay RY3501. We didn't have a replacement in stock so the relay was removed, its cover was opened and the contacts were squirted. When the relay was refitted the fault had gone and the machine gave perfect stills and noise-free slow motion – despite the fact that the heads were the original ones. **I.B.**



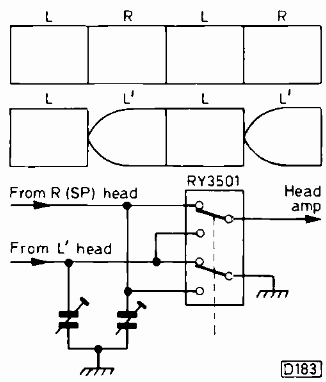


Fig. 1 (left): Waveforms associated with the Hitachi VT11 fault described above.

Fig. 2 (right): F.M. output waveforms and head switching relay, see the Panasonic NV788 fault.

Salora SV8300/Mitsubishi HS304

This machine would ignore any tape operation function after a couple of hours' use, e.g. if the machine was in the playback mode you couldn't stop a tape without switching the machine off. If rewind was selected and the tape was allowed to rewind fully you would then find that the machine wouldn't eject. The cause of the problem was a poor leaf switch contact, FL-SW-2, which is the inner of the two leaf switches on the right-hand side of the cassette loading housing. It's the one that makes when a cassette is pushed in and is held closed by the loading cam, going open again only when the tape is fully ejected. **I.B.**

Grundig VS200

We see a lot of these machines. They seem to be very reliable electronically but the mechanics are not so hot. Failure to initialise is often due to a faulty brake switch which is located between the reel motors. If it has a plastic cover this must be discarded and the switch changed, not just cleaned.

The reel motors are suspect if the machine chews tapes or shuts off. A light tap on the top of the reels will sometimes free a tight motor. The feed motor causes the worst problems – when it becomes tight it will jam the mechanics. Changing the motors over will often cure the problem.

We've also had a few sound heads go open-circuit recently. You need to take note of the pink slip that comes with the new head as the wiring is different. If you get this wrong you'll still have no sound. **E.M.B.**

Grundig VS310

Faulty or worn heads can be responsible for poor reverse search. For sound wow check whether the capstan belt has split. To get to this you have to hinge out the electronics chassis – don't remove the deck or you'll never dress the wires in the right place again. If you have a different fault when it's back together check all the plugs – they are of very poor quality. **E.M.B.**

Amstrad VCR6000/VCR6100

This fault has fooled several of our field technicians: the remote control handset can be programmed on its liquid crystal display but the VCR won't accept its commands.

When the first machine with this complaint was brought into the workshop our trusty remote control handset checker proved that the unit was transmitting something. A further check revealed that the batteries produced only 5·6V. New 6V batteries cured the problem. **A.S.**

Servicing Compact Disc Players

Part 3

Joe Cieszynski

Last month we considered in some depth the various different types of laser assembly used in domestic CD players. Having done so we can deal with the servicing aspects. The laser optical unit is a throw-away item, so the only thing you can do is to replace it. Since the trade price of such units is in the region of £35-£120 however it's essential that your diagnosis of a faulty laser unit is correct! Training officers I've spoken to tell me that a sizeable proportion of the units returned under guarantee prove to be in working order when tested. There are probably several reasons for this. Some units may have been replaced simply to rule out the laser as the cause of player failure; in other cases a quick diagnosis under pressure of work may have led to the unit being returned. As more players come out of the guarantee period however it's going to be essential that such mistakes are avoided.

There's another problem that could arise in practice. With older players the cost of a replacement laser unit is generally at the higher end of the range. The customer might well decide that he doesn't want to pay out such a large sum of money to have his player repaired. If you have spent several hours before finally deciding that the laser unit is defective you could well find yourself out of pocket. This is not a new problem with domestic equipment servicing of course, but it's one that must be avoided wherever possible. So this month we'll look at methods of checking the laser in a CD player.

Safety

The safety aspects must first be made clear. All service manuals contain a warning about damage to the retina of the eye if the laser is looked at directly. There's a temptation to do this when attempting to establish whether the laser is lit – although the output is infra red, some visible light in the red spectrum can be seen in the lens. We must be adamant however that the warnings are taken seriously. Thus another method must be found to ascertain whether the laser is lit.

Many players contain safety switches that allow the laser to light only when a disc has been inserted. It's usually necessary to override such switches while carrying out service checks. When you have done so, take great care not to look at the laser accidentally or allow the beam to touch your skin. Warning labels should be present on all CD decks, but it's possible that with time some of them will go missing.

There is also the possibility of damage to the laser, which is prone to damage by static charges. Although the problem is not as great as with unprotected CMOS devices, certain precautions should be taken when replacing a laser unit. These are as follows:

(1) The new laser unit will come packed in an anti-static bag. Don't remove it until necessary.

(2) Ensure that the laser unit, yourself and the deck are at the same static potential by touching the deck whilst handling the laser unit (the use of earthed bracelets and the like is not necessary).

(3) Put the suspect laser unit in the bag as soon as possible – after all it may not be faulty.

(4) Don't touch the laser unit lens as this would not only put grease on the surface but could damage the rubber suspension of the two-axis mounting.

(5) Don't place the laser unit close to large magnets that could affect the strength of the permanent magnets in the two-axis mounting.

(6) The new unit may have a shorting link or clip across the terminals to keep the laser's anode and cathode shorted during transit. Make sure that you remove this. It's not always obvious unless you take the trouble to read the fitting instructions enclosed with the new unit, something engineers don't always do . . .

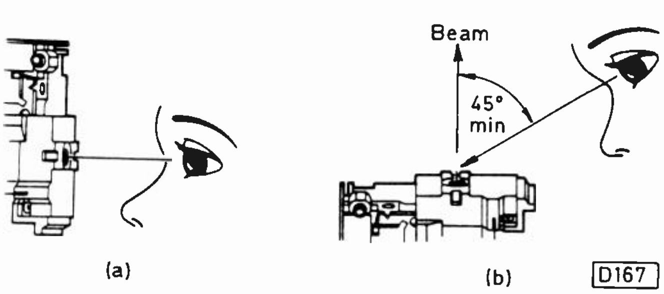


Fig. 1: (a) Never look at the laser beam directly. To do so will damage the eye. (b) It's permissible to view the beam at an angle of at least 45° and a distance of at least twelve inches.

Laser Checks

One of the first things you must do when servicing a CD player is to establish whether the laser is lit. A quick way of doing this it to see if the front display shows the usual information, such as the number of tracks, playing time etc., once a disc has been inserted. If this data is picked up the laser must be emitting light. This doesn't however mean that its output is high enough to ensure correct reproduction from all discs, and you may have to check this. If the player doesn't show even the front display data there are several possible causes, only one of which is the laser unit. So how can you check whether the laser is lit and that its output power is correct?

By far the simplest method is to use a laser power meter. This will tell you not only whether the laser is emitting light but also whether the output is within specification – around $300\mu W$. There's one drawback: the cheapest meter I've come across costs over £200. If your workshop is a large one that services numerous CD players the purchase of a meter may well be a worthwhile investment. If the number of players that come in is small however you will probably be reluctant to buy a meter. The good news is that there are other simple ways of determining whether the laser is emitting light. Unfortunately it's not so easy to determine whether the output is adequate.

A simple method that some engineers have adopted is to view the laser at an angle of about 45° and a minimum distance of twelve inches (see Fig. 1). You can usually see the red glow in the lens from this angle. This technique is suggested in some service manuals, the theory being that the laser light is dangerous only when viewed directly from above: when viewed from the side you are seeing diffused light at a low power level. Although I've used this technique, with no adverse affects, I personally favour the use of an infra-red detector circuit instead. Fig. 2 shows a circuit suggested by Hitachi. It can be assembled easily and is also useful for checking the output from infra-red remote control handsets and the stop sensors in VCRs. If you already possess one of the IR remote control unit testers available from various trade suppliers it would be worth trying it, but remember that the laser unit's output is far more intense, so don't hold the tester too close. With a 9V PP3 battery the circuit shown in Fig. 2 should sense the beam when held at a distance of about twelve inches. I use the RS Components IR sensor in my own unit but there's no reason why you shouldn't try an IR end sensor from a scrap VCR.

Another alternative is to use the technique suggested by Jim Littler on page 420 of the letters section in the April 1988 issue of *Television*. He connects a phototransistor across an ohmmeter and measures the resistance. A word of warning however. He uses this method to test IR remote control handsets: when used with a CD laser unit you may encounter some difficulty in locating the 1·7μm beam.

Fault Finding

As mentioned earlier, with many players the laser is enabled only when a disc has been inserted. Don't be caught out by thinking that the laser is dead when in fact it has not been turned on by the control microcomputer chip. With many of the more expensive players this chip has a service or test mode which, when selected, will permit the laser to light. If the player doesn't have this facility you will have to locate the disc-inserted sensor and fool the microcomputer into thinking that a disc has been inserted.

Some players keep the laser lit permanently, using the disc clamp arm as protection against accidental eye damage. Obviously this arm will have to be removed before carrying out the tests suggested. Having done so, be careful that you don't view the laser accidentally.

A laser that gives no output at all is perhaps one of the simplest faults to diagnose in a CD player. On insertion of a disc the first thing a player does is to perform the focus search routine: the object lens is pulled fully backwards and is then moved progressively forwards until correct focus is achieved. When this has been done the control microcomputer proceeds with the tracking search and disc rotation run-up routines. Clearly if the laser is not lit the focus search will be unsuccessful. Thus the disc will not even start to rotate and the front display will show some form of error message. A number of other faults could also produce these symptoms, but as a first step when you

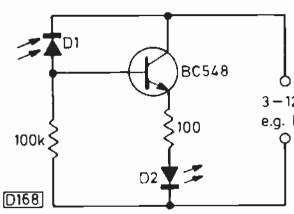


Fig. 2: Simple laser radiation sensor circuit suggested by Hitachi. The circuit can also be used to check IR sources. D1 is an RS Components IR sensor, order no. 306-083. D2 is a standard 0·2in. LED, e.g. RS 586-475..

encounter them a check on whether the laser is lit is a logical starting point.

Low Output

The more difficult problems arise when the laser's output is low and you don't have a power meter with which to check it. In this case it's a good idea simply to clean the lens – in most cases this will cure the problem. When the laser points upwards dust tends to settle on the lens, causing diffusion of the light. The problem is particularly likely to occur when the user smokes.

Cleaning the lens is a simple task but you must observe similar precautions to those followed when cleaning video heads. The best method is to wipe the lens gently with a cotton swab damped in isopropyl alcohol: don't press too hard or you may damage the two-axis mounting device. Other types of cleaning fluid are not recommended as the lens is coated with a plastic-based material that could dissolve during the cleaning process, leaving the lens with a "foggy" surface.

If the problem is simply dust the lens can be cleaned with an air brush.

Various symptoms will be encountered when the light output is low, either because the lens is dirty or because the laser diode is failing. In most cases the player will fail to achieve initial focus and will thus not operate. There are occasions however when the complaint is of intermittent operation, or that the player will play only certain discs. In these cases lens cleaning is the first step to take. If this fails to cure the problem it's really necessary to check that the laser's output power is correct.

The procedure given in the service manual for setting the laser's output power usually involves the use of a power meter. It's unwise to attempt adjustment without a meter, bearing in mind the point made last month about laser damage due to excessive current. There are those who may be particularly familiar with a certain model and know of a safe though unofficial way of carrying out this adjustment without damaging the laser, but such techniques can be learnt only through experience. What else can be done?

In many players the r.f. waveform (the name given to the modulated off-disc signal after amplification) will be of reduced amplitude when the laser's output is low. This can be used as an indication of the laser's output power. In fact one of the unofficial techniques I've used for setting the output power is to adjust it until the amplitude of the r.f. waveform is correct. But beware – I've noticed that once the correct amplitude has been reached you can turn up the output power still further without the r.f. amplitude being increased. This is possibly due to some form of a.g.c. in the r.f. amplifier i.c., but the action of the a.g.c. in adjusting the signal amplitude doesn't alter the fact that the laser is operating at an excessive power level.

When the laser's output power is low the player will in many cases manage to achieve correct focus and will proceed with the disc run-up and tracking search routines. The player will then attempt to read the table of contents at the start of the disc. If successful, it will indicate the number of tracks, the playing times, etc. For the disc to attain its correct speed however the servo must receive data from the disc. If for any reason whatsoever it doesn't the disc will usually take off at high speed before the control microcomputer finally steps in and initiates the stop mode. During this brief period it's possible to scope the r.f. waveform as a check on whether the laser's output power is adequate – but you have to be quick, and I mean quick!

More Symptoms

Another fault symptom is when the player gets as far as reading the table of contents, the disc doesn't take off, but the player fails to read the table and stops after about ten seconds. This is very rarely caused by a low output laser, but again you can use this ten second period of rotation to scope the r.f. and ascertain the laser's output.

Other difficulties arise when the player refuses to play at all and you are thus unable to obtain an r.f. waveform display. In this case the best approach to adopt is to establish first that the laser is at least lit, then check that the focus o.k. (FOK) logic level changes during the focus search routine. The FOK logic will be discussed in more detail when we look at the focus servo. Suffice it to say here that if the FOK logic is correct the player must have attained correct focus and the reason for failure of the disc to rotate must lie elsewhere.

Service Mode

The above suggestions for briefly scoping the r.f. output apply to players that don't have a service mode facility. One of the reasons for including a service mode is to enable the control microcomputer to operate the machine under fault conditions, thus giving access to many of the waveforms including the r.f. You generally require the service manual to discover how to enter the service mode. Some of you may wonder why all players don't include this facility. The answer is simple. Because this is an aid to the serviceman and not the customer it doesn't help to sell players. There is also the need for extra programming in the microcomputer's ROM. Thus the makers of some cheaper players don't bother with it.

Laser Adjustments

No adjustments after replacement are required with most of the latest laser units. This is not the case with many earlier players, where adjustments are required before an r.f. output can be obtained. The adjustments most commonly found are the laser position switch, the grating adjustment and the tangential screw. The latest production technology seems to have made them largely unnecessary.

The laser position switch is a deck adjustment that sets the point at which a leaf switch or microswitch closes when the laser carriage returns to the disc centre. If misadjusted the player will not be able to find the table of contents when a disc has been inserted. We'll look at this in more detail when we cover player mechanisms.

The grating adjustment rotates the diffraction grating in the laser assembly. Last month we explained that this grating splits the beam into three, the two side beams being used to produce a signal for the tracking servo. The object of this adjustment is to rotate the position of the side beams so that they fall evenly on either side of the data track – see Fig. 3.

If this adjustment is not set correctly the signal sent to the tracking servo will move the laser forwards or backwards at quite a high speed. Until this adjustment has been carried out correctly the player will not be able to perform any functions and attempts to carry out other

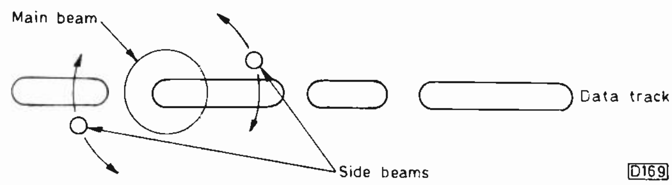


Fig. 3: The principle of diffraction grating adjustment. The side spots should be equidistant from the data track.

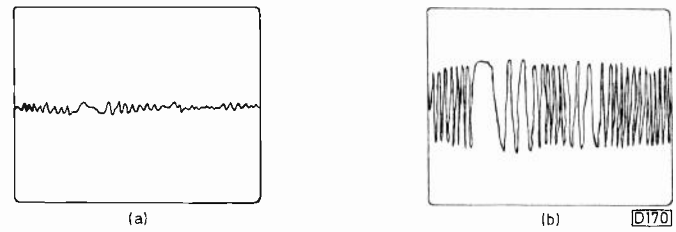


Fig. 4: Diffraction grating adjustment. (a) TE signal at null, (b) TE signal at peak.

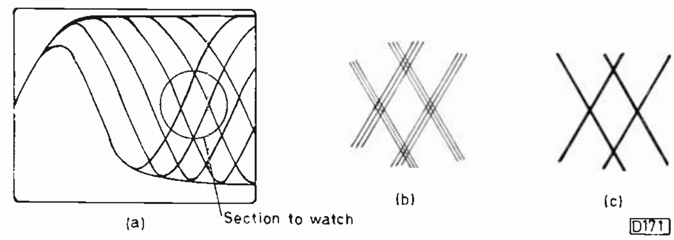


Fig. 5: Tangential adjustment. (a) A good waveform with minimal jitter. (b) An r.f. waveform with jitter. (c) An r.f. waveform without jitter.

adjustments will result in all sorts of problems. The only correct way of carrying out this adjustment is to do it by the book, but even so you may encounter difficulties at first.

One manufacturer who still incorporates this adjustment is Pioneer. Anyone who has dealt with these machines will know that grating adjustment is one thing you shy away from where possible. For the benefit of those who work on these players however I can offer some useful advice.

The method of grating adjustment laid out in the manual is to scope the tracking error (TE) signal and turn the screw (a special eccentric screwdriver is required) that rotates the grating until the signal reaches a peak — see Fig. 4. The problem arises when you've managed this quite successfully but the player still doesn't operate. Quite naturally you go on to attempt other adjustments to clear the fault. What the manual doesn't tell you is that there is more than one peak – in fact there are on average ten peaks, and only one of them is the correct one! The key to success is to turn the grating screw to one extreme and then rotate it slowly to the other extreme, counting the peaks as you go. The correct peak is the centre one. So if for example you count eleven peaks, turn the grating screw back until you are at the sixth peak. In the case of ten peaks being counted take a guess at five or six – it will be one of the two. Credit for this time-saving method must go to Ken Clements, Pioneer UK's technical training officer, who spent some time working on the problem before he came up with this simple solution. I've not had the opportunity to see if it will work with other makes of player, but I would certainly attempt it if I found myself in difficulties with the grating adjustment.

When is it necessary to carry out grating adjustment? There are basically three occasions when the adjustment may be required: when fitting a new laser unit, when the unit has been subjected to a severe shock – or when someone has decided to have a go.

The tangential adjustment sets the optical assembly so that the beam is at right angles to the disc. If this adjustment is not correct the beam will be eccentric instead of circular at the disc's reflective surface, causing problems in both the focus and the tracking servos. In most players this adjustment is done by scoping the r.f. signal and setting the screw so that the signal has minimum jitter – see Fig. 5. Next month we will be looking at the r.f. signal in detail. It will then be clearer just what you have to look for.

In Conclusion

In this instalment we've concentrated on ways of establishing that the laser's output power is correct, with or without the use of a power meter. It's far simpler with a meter, but cost and circumstances have to be taken into account. The other methods of checking a laser really amount to dodges that can be adopted in the absence of a meter. Suppose you've tried these dodges and still find yourself chasing your tail? The cause of the problem could of course lie elsewhere, and we'll be looking at other possibilities in later parts of the series. This month we've outlined the CD player's initial start-up routines and emphasised the importance of establishing that the laser is lit, that its output is adequate and that any mechanical adjustments have been made correctly.

One final point. If the laser isn't lit, don't assume that the cause has to be the laser itself. In all probability the fault will lie in the power supply to the laser assembly.

Cable and Satellite 89

Harold Peters and Alan Sidall

This year's Cable and Satellite event was held at Olympia on March 16-19th. Last year, reporting from the event at its Wembley venue, the conflict between the various impending satellite TV systems was so obvious that we expanded the article to give readers an update on the situation. A year later TV from space has indeed got itself into a mess, as predicted, but not quite in the way the writer expected. The "Murdoch factor" had not then entered the equation, but now that it has it was bound to dominate the show.

From an engineer's point of view there was little to be gained from looking at the set-up converters for Sky as most are on allocation. The dishes and their substitutes were interesting however. The ones for Astra, with an average 55cm diameter and mostly with offset LNBs, were of note particularly for the flimsiness of their fixing bracketry. We who live near the coast and have experience of dishes of over 1·5m diameter drew in our breath sharply at the prospect of them being able to stand up to equinoctal gales.

The Squarial for BSB was in evidence, the mock-ups being mostly under 12in. square. Now that BSB's power could be divided between five transponders instead of three as initially planned, surely something bigger than a foot square will be needed? Nobody was prepared to say.

Sir Clive Sinclair with the Cambridge 45cm square satellite TV aerial announced at the Cable and Satellite Exhibition.

A further type of aerial was introduced by Sir Clive Sinclair's Cambridge Computers, for reception of the Astra transmissions in the Midlands and the South. It's a 17in. (45cm) square device which is only five inches deep and has a circular concave section in the centre. Deliveries are expected to start in the autumn and the price should match the Amstrad offerings.

BSB used MAC transmissions from the French TDF-1 satellite to demonstrate the quality of MAC pictures. Pity they had to use D2-MAC. A pity too that Aerospatiale is having to advertise the satellite in the trade magazines in an effort to find users for the three vacant transponders. Overheard conversation leads us to believe that TDF-1's signals are so strong that an LNB pointed at 19°W will produce a picture without a dish.

The signals from Astra are quite powerful too. On the Alston Barry stand an 0·9m dish locked an Astra picture direct, despite the screening provided by all the steel that supports Olympia's roof. The last time the writer spotted anyone breaking through the Olympia screening was in 1939, when Radiolympia was struggling against the approach of World War Two and we were all listening to the news from outside on battery portables, so as to find out where our families had been evacuated. But back to this year.

"Bird finders" were to be seen in profusion, mostly based on the humble compass. A device from the USA used three spirit levels to set the elevation, azimuth and declination of polar mounts without having to refer initially to true south.

Most of the big boys amongst the TV receiver manufacturers were conspicious by their absence. Perhaps they are waiting until they can offer the user a TV set that will receive everything without the need for black boxes on top. Philips was there however, mostly because of the SMATV activities of its associated Portseigne company and the fibre-optic cabling of the Pope wire and cable subsidiary. I often wonder what the outcome would have been if earlier this century Mr. Pope, who supplied Mr. Philips with the wire for his lamps, had won the takeover battle instead. I wonder too what this show will be like in a few years' time, when there will be two Astras, two BSB satellites, two TDF satellites, some high-power Eutelsat 2 birds and lots more. Could we end up with more broadcasters than viewers?

Service Bureau

Requests for advice in dealing with servicing problems must be accompanied by a £2 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.

BACK TENSION

Is it possible to convert the tentelometer back-tension figures specified in certain service manuals to the figures of a back-tension cassette gauge, e.g. the JVC PUJ48076-2?

Yes. The cassette gauge is calibrated in gm whereas the tentelometer readings are "tension units". Torque is tension times the radius of the reel pack. Thus 40g is equivalent to 120 grams-force per cm in a 3cm radius reel – $120 = 40 \times 3$.

TATUNG 160 SERIES CHASSIS

There seems to be a compatibility problem between this set and a Panasonic NV7200 VCR. Are there any modifications that can be tried?

Tatung suggest the following modifications for improved operation of 160 series chassis sets with VCRs: increase the value of C004 to 22μF, change R114 to 2·7kΩ, R106 to 150kΩ or 180kΩ, R117 to 1·2kΩ, R116 to 1·2kΩ and C111 to 0·2μF.

PANASONIC NV7200

This machine won't operate though the voltages from the power supply panel are o.k. and the front panel indicators light.

In our experience the most common cause of this problem is failure of the cassette-down microswitch. With the cassette down there should be 12V at connector D6010. If this voltage is present, suspect an open-circuit tape sensor LED.

VIDEO LINK

We have a Hitachi Model CPT2188 with a 6-pin DIN input/output socket, the connections being as follows: 1 VTR switch; 2 video input/output 1V/75Ω; 3 ground; 4 audio input/output L 0·7V/10kΩ; 5 12V; 6 audio input/output R 0·7V/10kΩ. This is to be used with a Sanyo VHR-D500E VCR that has a scart input/output socket. How does one go about this?

Link pins 1 and 5 of a 6-pin DIN plug. Connect the other pins as follows: 2 to pin 19 of the scart connector; 3 to pins 17 and 4 of the scart connector; 4 to pin 3 of the scart connector; 6 to pin 1 of the scart connector. The link-lead will need to contain three screened cores.

FERGUSON TX90 CHASSIS

A very faint patch has developed on the left-hand side of the screen, about half way down. On a blue raster this shows up as a slightly darker shade of blue. Vertical lines on the left-hand side bend around this patch and veer towards the bottom left-hand corner of the screen. A slow ripple effect runs up the lines adjacent to the patch. Vertical lines on the right-hand side of the screen remain straight and steady.

We have known this effect to be caused by an over-strong magnetic field around the mains transformer as a result of half-wave operation. Check diodes D120 and D123 and their connections to the transformer. Then if necessary check the dual-posistor Z102, C183 and the setting of the set-h.t. potentiometer RV224.

HITACHI VT33

There is no playback though fast forward and rewind are all right. On completion of loading the machine stops within a few seconds then the tape is returned to the cassette.

Check whether the head drum and take-up reel are rotating at loading completion in play. If they are the reel sensor is suspect – check whether the pulses from this are present at pin 50 of IC901. If necessary check for flip-flop pulses at pin 49. If the take-up reel is not rotating the fault could be due to the idler slipping or the reel motor.

FIDELITY F14 (ZX4000 CHASSIS)

The problem with this set is no line sync. The TDA4503 signals/timebase generator chip has been replaced and the voltages around it seem to be about right. During service work the BU508D line output transistor went short-circuit. This has been replaced but there is still no line sync – also no sound.

With this set the sound is muted until the picture is correctly synchronised. Feedback from the line output stage for sync purposes is via R109 (ten separate 5·6kΩ resistors) and C25 (0·1μF). These items should be checked, also if necessary R30 (5·6kΩ), C24 (22nF) and the horizontal shift control PR18 (100Ω).

HITACHI VT9500

When returning to play after reverse picture search the capstan continues to run in the reverse direction before gradually slowing down and resuming the correct direction and speed. This has the effect that tape is spewed out of the cassette for three-four seconds before it's eventually reeled back on to the take-up spool. The problem is also present with forward search, but is not so noticeable. The picture quality is very good.

To prevent this effect the microcomputer chip IC905 was changed from type HD38800A50 to type HD38800A74. At the same time R955 was changed to 27kΩ, R420 to 5·6kΩ and a 47μF, 10V capacitor (C461) was added from pin 11 of IC402 to chassis. If the tape is not actually being damaged you might decide that the trouble and expense of carrying out this modification are not worthwhile.

SONY KV2706

This five year old set shows horizontal flyback lines on the picture. Any ideas on clearing the fault?

First check the level of the 12V line at the emitter of Q291. If it's wrong check D291, Q291 and C855. If the level is correct check the setting of the screen control on the c.r.t. base panel. Sometimes the fixed resistors associated with this control can drift in value, altering the screen (A1) voltage.

TEST CASE

317

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.

It's some years since TV chassis with thyristor regulated power supplies were last designed but many sets of this type continue to come into the workshop. Amongst the last thyristor-based power supply systems were those used in early versions of the Ferguson TX9 chassis and in the Philips G11 and Bang and Olufsen 20AX chassis. It's the latter chassis that concerns us here. Models using this chasis include the 3502, 3602, 3702, 3802, 4002, 4402 and 6002. The basic elements of the circuit are shown in Fig. 1. It has the virtue of drawing current on both halves of the mains supply cycle since the two thyristors 5SCR1/2 are used in a full-wave bridge configuration (with 5D3/4).

Certainly the fault symptom suggested that the power supply section of the set was faulty: a hum-bar effect travelled slowly up or down the screen, affecting both the signal and the deflection. Sometimes the whole picture would flutter in size, as though the power supply was unstable. On the assumption that excessive mains-rate ripple was present on the main h.t. rail, two items came under suspicion: the large reservoir capacitor 5C3 and the active filter circuit consisting of transistor 0TR1 and the associated components. 5C3 and 0TR1 were both checked by substitution, but this produced very little change in the on-screen symptom. So — should this perhaps have been done before? — an oscilloscope was brought into action to check the level of ripple on the h.t.line.

The manual indicates that the mains-rate ripple at the emitter of 0TR1 should be around 30mV peak-to-peak, riding on about 300mV of line-rate hash. In this set the amplitude of the 50Hz ripple could be measured in volts. Further attention was therefore paid to the active filter circuit — to the two transistors 5RT1 and 5TR2, capacitors 5C4 and 5C5, and the associated resistors. No faults could be found in this area, but a further scope check showed that a huge 30V sawtooth waveform was present at the common cathode connection of the two thyristors. The reservoir capacitor had already been checked, and the scope showed that drive pulses were present at the gates of the two thyristors. We next fitted a new pair of thyristors, which didn't alter the situation one bit. That something was wrong in this area seemed certain. What it could be was less clear.

What had been overlooked — in both the fault symptom and the oscilloscope's display? Which component had failed? Answer next month.

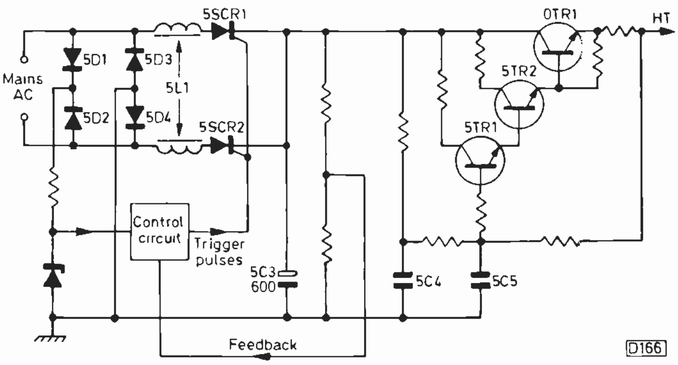


Fig. 1: Basic elements of the full-wave thyristor regulated power supply used in the B and O 20AX chassis.

ANSWER TO TEST CASE 316 — page 441 last month —

John's efforts with the Ferguson TX9 chassis last month provided him with an instructive insight into TV fault-finding techniques. The set concerned wouldn't start up, though the power supply was working and h.t. was present in the line driver and output stages. It didn't take him long to find that there was no line drive and that the sync/line oscillator chip was inactive as its 12V supply was absent. He came unstuck however in trying to establish the cause of its absence.

The supply for the line oscillator is derived from the line output transformer, so at switch-on something has to be done to kick-start the line timebase. Once it comes into operation pulses from the line output transformer are rectified and fed to the 12V regulator which provides the supply for the low-voltage sections of the set, including the TDA9503 sync/line oscillator chip. For start-up purposes the line driver transistor VT67 is biased on and the voltage at its emitter is used to power the TDA9503. Once the latter gets going it produces a squarewave output to switch VT67 off and on. The forward bias for VT67 is obtained from the h.t. line, two zener diodes and a resistor being used for the purpose.

In this case the 68V zener diode W86 had gone open-circuit, leaving VT67 without base bias. Failure of VT67 or the resistor involved (R222) due to an open-circuit, or a short-circuit in the other zener diode W87 (15V) or C176 (100μF), could as easily have caused the problem. The key to diagnosis however is knowledge of how the circuit is supposed to work rather than the availability of elaborate test equipment or a degree in electronics!

QUERY COUPON

Available until 17th May 1989. One coupon, plus a £2 (inc. VAT) cheque or postal order, must accompany EACH PROBLEM sent in accordance with the notice on page 524.

TELEVISION MAY 1989

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 £18, overseas (surface mail) £21 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.

A V S THE A.V.S. GROUP

AUDIO VISUAL SERVICES

AVS SUMMER SALE ● AVS SUMMER SALE ●

THE BOSS HAS HAD A FIT OF MID-SUMMER MADNESS — OVER 4000 PIECES OF NEW & EX-RENTAL STOCK MUST BE CLEARED!

YOU NAME YOUR REQUIREMENTS AND WE PROBABLY HAVE IT, AND WE WILL TRY TO MATCH ANY DEAL YOU ARE GETTING ELSEWHERE!

EX-RENTAL TV's, EX-RENTAL VCR's, NEW VCR's, MIDI SYSTEMS, MICROWAVE OVENS — WE DO THE LOT.

LOOK OVER LOOK OVER LOOK OVER

SO TRY US — WE'RE NOT AFRAID OF DOING A DEAL

HEAD OFFICE ☎ 08444 3226 08444 2995

36 WYCOMBE ROAD, PRINCES RISBOROUGH, BUCKS.

HUMBERSIDE OFFICE ☎ 0652 660242 0652 660243

UNIT 8, ST. MARY'S WORKS, MARSH LANE, BARTON-ON-HUMBER, SOUTH HUMBERSIDE

N.B. SWINDON CUSTOMERS PLEASE CONTACT →

AVS SUMMER SALE ● AVS SUMMER SALE ● AVS SUMMER SALE

★ SALE ★ SALE ★ SALE ★ SALE ★ SALE ★ SALE ★ SALE ★ SALE ★ SALE ★ SALE ★ SALE ★

S A L E

VASCORT LTD – LEEDS

S A L E

★ SALE ★ SALE ★ SALE ★ SALE ★ SALE ★ SALE ★ SALE ★ SALE ★ SALE ★ SALE ★ SALE ★

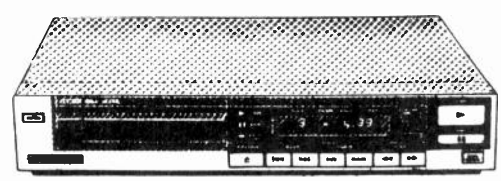
ANNOUNCING

THE SALE TO BEAT *ALL* SALES

BIGGEST & BEST SELECTION OF THORN & EX-GRANADA STOCK IN THE WHOLE OF YORKSHIRE

LOOK AT OUR

FANTASTIC BARGAINS



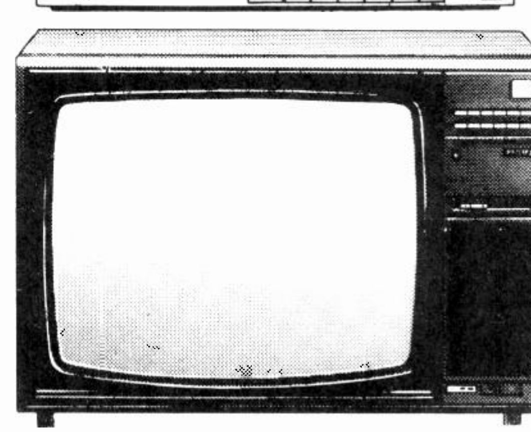
WORKING VCR — **From**

Hitachi/Nat-Pan **£55.00**

Infra-Red VCR **£70.00**

Many more varieties of V.C.R.'s in stock to choose from

Non-working VCR **£15.00**



CTV — **From**

Basic (Various) **£5.00**

Remote **£10.00**

Text **£15**

STEREO SUPERSOUND (working, excellent condition) – from **£75.00**
(Note: VAT & H/sets extra)

PLUS MANY, MANY MORE BARGAINS IN STOCK **NOW!**

ANY QUANTITY, LARGE OR SMALL

VASCORT LTD., UNIT 2,

COPLEY HILL TRADING ESTATE, WHITEHALL RD., LEEDS.

TEL: 0532 422774

AA117	9p
AA119	9p
AAY32	9p
AC107	40p
AC125	25p
AC126	25p
AC127	21p
AC128	21p
AC128K	26p
AC141K	30p
AC142K	30p
AC153K	23p
AC176	22p
AC176K	28p
AC187	21p
AC187K	28p
AC188	21p
AC188K	28p
ACY18	48p
ACY19	48p
AD142	100p
AD149	60p
AD161	35p
AD162	35p
AD164	200p
AF106	50p
AF109	45p
AF124	50p
AF125	50p
AF126	50p
AF127	50p
AF139	30p
AF239	30p
AF201	70p
AF379	45p
AL100	450p
AL112	300p
AM150	28p
AM151	30p
AM154	35p
AM156	35p
AM158	50p
ASZ15	100p
ASZ17	100p
AU113	600p
BA145	10p
BA148	10p
BA154	6p
BA157	12p
BAY78	250p
BAY82	20p
BB101	13p
BB103	16p
BB105B	18p
BB205B	24p
BC107	8p
BC108	8p
BC109	8p
BC109C	10p
BC115	10p
BC118	11p
BC140	20p
BC141	20p
BC142	20p
BC143	20p
BC147	8p
BC148	8p
BC149	8p
BC157	8p
BC158	10p
BC159	8p
BC160	30p
BC171	10p
BC172	10p
BC177	14p
BC178	14p
BC179	14p
BC182	7p
BC182L	7p
BC183	7p
BC183L	7p
BC184	7p
BC184L	7p
BC212	7p
BC212L	7p
BC213	7p
BC213L	7p
BC214	7p
BC214L	7p
BC237	7p
BC238	7p
BC239	7p
BC300	20p
BC301	20p
BC302	20p
BC303	20p
BC304	25p
BC308	10p
BC327	7p
BC328	7p
BC337	7p
BC338	7p
BC441	28p
BC446	8p
BC449	15p
BC461	28p
BC477	18p
BC478	18p
BC479	18p
BC489	20p
BC490	18p
BC516	22p
BC528	22p
BC537	25p
BC546	8p
BC547	8p
BC548	8p
BC549	8p
BC550	8p
BC556	8p
BC557	7p
BC558	8p
BC559	8p
BC560	8p
BC637	20p
BC638	20p
BC639	20p
BC640	20p
BCY32	200p
BCY33	200p
BCY34	200p
BCY42	20p
BCY56	16p
BCY70	16p
BCY71	16p
BCY72	16p
BD111	99p
BD112	95p
BD115	30p
BD124P	50p
BD124	110p
BD128	35p
BD131	25p
BD132	25p
BD133	50p
BD135	20p
BD136	20p
BD137	20p
BD138	20p
BD139	20p
BD140	20p
BD142	45p
BD144	90p
BD150	30p
BD157	38p
BD158	38p
BD166	30p
BD175	30p

BD177	30p
BD179	32p
BD181	45p
BD182	60p
BD184	60p
BD187	30p
BD201	33p
BD202	38p
BD203	42p
BD204	42p
BD222	31p
BD225	31p
BD232	31p
BD233	30p
BD234	32p
BD235	28p
BD236	28p
BD237	30p
BD238	21p
BD239	24p
BD240	30p
BD241A	30p
BD243A	40p
BD244	50p
BD245	50p
BD246A	50p
BD265	50p
BD267	45p
BD269	45p
BD278	50p
BD311	100p
BD312	100p
BD313	100p
BD314	100p
BD315	150p
BD316	150p
BD317	150p
BD318	150p
BD331	40p
BD332	40p
BD361	60p
BD362	60p
BD370	30p
BD371	30p
BD410	30p
BD433	28p
BD434	30p
BD435	31p
BD436	30p
BD437	28p
BD438	28p
BD439	40p
BD440	40p
BD441	40p
BD442	40p
BD520	60p
BD533	50p
BD534	38p
BD535	38p
BD536	38p
BD537	38p
BD538	40p
BD643	50p
BD645	50p
BD647	50p
BD649	50p
BD651	50p
BD675	40p
BD676	40p
BD677	38p
BD678	40p
BD679	40p
BD680	40p
BD681	45p
BD682	45p
BD705	50p
BD707	50p
BD709	50p
BD711	50p
BD736	50p
BD826	50p
BD828	50p
BD875	50p
BD897	50p
BD899	50p
BD901	50p
BD977	50p
BDX32	100p
BDX33	60p
BDX53	60p
BDX65	80p
BDW23	55p
BDW24	55p
BDW93	45p
BDW94	45p
BDY20	100p
BDY92	100p
BF137	35p
BF154	25p
BF167	30p
BF173	30p
BF178	30p
BF180	16p
BF181	18p
BF183	20p
BF184	20p
BF185	20p
BF194	7p
BF195	8p
BF196	8p
BF197	10p
BF198	10p
BF199	8p
BF200	20p
BF225	30p
BF240	16p
BF241	10p
BF245	25p
BF247	20p
BF254	15p
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	20p
BF362	30p
BF367	20p
BF371	17p
BF391	18p
BF392	18p
BF393	20p
BF414	18p
BF420	16p
BF421	18p
BF422	21p
BF423	25p
BF440	16p
BF450	20p
BF451	17p
BF455	14p
BF458	19p
BF459	19p
BF461	60p
BF462	62p
BF469	30p
BF470	26p
BF471	28p
BF472	28p

BF479	30p
BF493	18p
BF494	16p
BF495	16p
BF506	25p
BF595	16p
BF596	16p
BF597	10p
BF615	30p
BF617	30p
BF680	30p
BF757	40p
BF758	41p
BF759	40p
BF760	40p
BF763	40p
BF869	22p
BF870	22p
BF871	22p
BF872	23p
BF960	38p
BF961	35p
BF963	40p
BF964	38p
BF966	40p
BFR34	110p
BFR36	110p
BFR40	25p
BFR51	21p
BFR62	21p
BFR79	25p
BFR90	52p
BFR91	99p
BFR94	500p
BFS22	110p
BFT37	130p
BFT42	150p
BFT43	30p
BFW84	30p
BFW92	35p
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
BR303	85p
BRY39	55p
BRY49	38p
BRY56	33p
BSS74	33p
BSX20	15p
BSX26	18p
BSX29	19p
BT100A	70p
BT106	120p
BT109	90p
BT116	80p
BT119	100p
BT120	100p
BT138	60p
BT146	99p
BT151	58p
BTY79	140p
BU100A	110p
BU104	100p
BU105	80p
BU108	100p
BU109	100p
BU110	110p
BU111	140p
BU124	60p
BU126	70p
BU180	150p
BU184	100p
BU204	75p
BU205	70p
BU206	100p
BU208	75p
BU208A	80p
BU208D	100p
BU209	140p
BU225	190p
BU226	190p
BU312	120p
BU325	55p
BU326	85p
BU406	85p
BU406D	95p
BU407	75p
BU407D	95p
BU408	85p
BU408D	95p
BU409	95p
BU426	120p
BU500	110p
BU508A	120p
BU508D	100p
BY536	150p
BU526	80p
BU546	140p
BU608	150p
BU626	150p
BU636	150p
BU801	95p
BU806	120p
BU807	95p
BU902	130p
BU903	130p
BU920	130p
BU921	130p
BU922	130p
BU930	130p
BUX80	180p
BUX82	180p
BUX84	65p
BUX85	65p
BUY69A	200p
BUY70C	160p
C106D	28p
J174	38p
J300	50p
MCR220	120p
MEO411	38p
MEO414	125p
ME3001	12p
ME4103	12p
ME6001	12p
ME6002	15p
ME8001	15p
ME9021	12p
MJ802	350p
MJ900	200p
MJ901	200p
MJ1000	200p
MJ1001	200p
MJ10012	300p
MJ15001	325p
MJ15002	300p
MJ15003	325p
MJ15004	375p
MJ15022	400p
MJ2500	100p

MJ2501	110p
MJ2955	55p
MJ3000	115p
MJ3001	115p
MJE29A	30p
MJE30A	30p
MJE340	25p
MJE350	80p
MJE520	30p
MJE2955K	90p
MP8111	40p
MP8112	45p
MP8113	55p
MP8512	50p
MPN3404	30p
MPS6571	20p
MPS9012	20p
MPS9013	20p
MPS9014	20p
MPS9015	20p
MPSA05	15p
MPSA06	15p
MPSA13	15p
MPSA20	15p
MPSA42	15p
MPSA43	15p
MPSA65	25p
MPSA66	25p
MPSA70	15p
MPSA92	20p
MPSA93	20p
MR510	35p
MR856	36p
MRF479	350p
MV1622	80p
MV209	48p
MV2209	48p
OC28	250p
OC29	250p
OC35	250p
OC36	250p
OC45	50p
OC71	30p
OC72	50p
OC200	180p
OT121	120p
R2008B	100p
R2010B	100p
R2030	100p
R2306	55p
S2800D	52p
S2800M	72p
T2800D	52p
T2800M	72p
TAG4442	76p
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
TIP33C	60p
TIP34	50p
TIP34C	60p
TIP35C	65p
TIP36C	65p
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	50p
TIP117	50p
TIP120	43p
TIP121	46p
TIP122	47p
TIP125	47p
TIP126	56p
TIP127	56p
TIP130	30p
TIP131	30p
TIP140	90p
TIP141	90p
TIP142	90p
TIP145	95p
TIP146	90p
TIP147	100p
TIP150	90p
TIP151	90p
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
VN46AF	88p
VN66AF	100p
VN88AF	115p
VN89AF	110p
Y723	75p
Y827	75p
Y860	22p
Y969	65p
ZTX107	11p
ZTX108	11p
ZTX109	12p
ZTX212	27p
ZTX300	13p
ZTX301	16p
ZTX302	18p
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.706	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.1893	30p
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	40p
2N.3055	38p
2N.3055H	50p
2N.3440	58p
2N.3442	85p
2N.3525	150p
2N.3583	90p
2N.3585	120p
2N.3702	9p
2N.3703	9p
2N.3704	9p
2N.3705	9p
2N.3706	9p
2N.3707	9p
2N.3708	9p
2N.3710	12p
2N.3711	12p
2N.3771	85p
2N.3772	90p
2N.3773	110p
2N.3799	18p
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.4062	12p
2N.4064	100p
2N.4240	150p
2N.4248	130p
2N.4401	12p
2N.4403	12p
2N.4443	76p
2N.4444	76p
2N.4904	75p
2N.5061	20p
2N.5062	28p
2N.5088	20p
2N.5163	45p
2N.5192	50p
2N.5241	500p
2N.5245	45p
2N.5294	30p
2N.5296	30p
2N.5303	200p
2N.5320	90p
2N.5321	60p
2N.5366	25p
2N.5401	12p
2N.5448	12p
2N.5496	80p
2N.5777	40p
2N.6106	40p
2N.6107	40p
2N.6109	40p
2N.6254	110p
2N.6292	40p
2N.6384	120p
2N.6385	120p
2N.6403	160p
2N.6649	140p
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	30p
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	60p
BYX71/600	80p
OA47	6p
OA90	6p
OA91	8p
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
SKE4F2/06	50p
SKE4F2/08	70p
SKE4F2/10	90p

I.C. SOCKETS

8pin	6p
14pin	8p
16pin	9p
18pin	12p
20pin	14p
22pin	16p
24pin	18p
28pin	20p
40pin	25p

ZENER

400MV
BYZ88 RANGE
2V7 to 39V 6p
1.3W
BZX61 RANGE
2V7 to 39V 12p

VOLTAGE REGULATORS

7805	35p
7806	35p
7808	35p
7812	35p
7815	35p
7818	35p
7824	35p
7905	35p
7906	40p
7908	40p
7912	40p
7915	40p
7918	40p
7924	40p
78L05	28p
78L08	28p
78L12	28p
78L15	28p
78L18	28p
78L24	28p
79L05	40p
79L08	40p
79L12	40p
79L15	40p
7818KC	100p
7824KC	100p
LM309K	100p
LM317K	220p
LM317T	180p
LM323K	420p
LM723	40p
78HGKC	570p
78HO5KC	800p
78H12KC	700p
78GU1C	190p
79GU1C	215p
79HGKC	800p

VALVES

DAF96	60p
DF96	50p
DL92	60p
DY86	50p
DY87	60p
DY802	75p
EABC80	60p
E891	44p
EBF80	45p
EBF89	50p
ECC82	80p
ECC83	80p
ECC84	70p
ECC85	80p
ECH81	100p
ECH84	70p
ECL80	65p
ECL82	80p
ECL84	70p
ECL85	70p
ECL86	90p
EF80	65p
EF85	65p
EF89	85p
EF183	75p
EF184	85p
EL34	250p
EL36	90p
EL84	75p
EL95	85p
EL500	100p
EL504	130p
EY86	45p
EY87	45p
EY88	65p
EZ35	65p
EZ80	70p
EZ81	55p
GZ34	200p
PC97	100p
PCC85	60p
PCF80	80p
PCF200	135p
PCF801	110p
PCF802	80p
PCF806	115p
PCH200	100p
PCL81	62p
PCL82	80p
PCL84	50p
PCL85	80p
PCL86	80p
PCL805	80p
PFL200	110p
PL36	120p
PL82	60p
PL83	60p
PL84	80p
PL95	180p
PL500	110p
PL504	120p
PL508	200p
PL519	450p
PY81	90p
PY88	70p
PY500A	190p

L.E.D.'S

LED 3MM RED	5p
LED 3MM YEL	10p
LED 3MM GRN	10p
LED 5MM RED	5p
LED 5MM YEL	10p
LED 5MM GRN	10p

LINEAR IC'S

AN-124	230p
AN-127	250p
AN-136	250p
AN-203	210p
AN-210	165p
AN-214Q	170p
AN-228	280p
AN-234	450p
AN-235	450p
AN-236	235p
AN-238	400p
AN-239Q	400p
AN-240P	150p
AN-241	135p
AN-245	290p
AN-247	230p
AN-252	150p
AN-259	250p
AN-262	140p
AN-270	200p
AN-271	230p
AN-272	480p
AN-274	250p
AN-294	380p
AN-295	340p
AN-301	330p
AN-303	250p
AN-304	360p
AN-305	320p
AN-306	800p
AN-313	270p
AN-315	210p

AN-316	350p
AN-318	460p
AN-331	295p
AN-360	100p
AN-362	140p
AN-366	150p
AN-610	160p
AN-612	160p
AN-3320K	900p
AN-5151	600p
AN-5430	280p
AN-5612	400p
AN-5620	330p
AN-5712	350p
AN-5722	140p
AN-5730	160p
AN-5732	160p
AN-5753	170p
AN-6100	425p
AN-6120	400p
AN-6135	150p
AN-6300	600p
AN-6320	300p
AN-6330	380p
AN-6340	830p
AN-6341	350p
AN-6344	440p
AN-6350	610p
AN-6359	810p
AN-6360	400p
AN-6362	480p
AN-6371	510p
AN-6387	560p
AN-6430	390p
AN-6431	400p
AN-6677	550p
AN-6811	130p
AN-6876	270p
AN-6884	240p
AN-7105	210p
AN-7110	130p
AN-7114	150p
AN-7115	150p
AN-7116	130p
AN-7120	130p
AN-7130	110p
AN-7222	300p
AN-7310	90p
AN-7311	90p
AN-7410	250p
AN-7420	250p
AN-7140	450p
AN-7145	195p
AN-7146	210p
AN-7154	180p
AN-7156	240p
AN-7158	310p
AN-7168	260p
AN-7178	270p
AY3-1015	290p
AY3-1270	800p
AY3-1350	450p
AY3-8910	360p
AY3-8912	400p
AY5-3600	570p
BA-301	65p
BA-302	90p
BA-308	100p
BA-311	80p
BA-313	60p
BA-314	100p
BA-318	120p
BA-333	100p
BA-340	150p
BA-401	60p
BA-402	60p
BA-403	100p
BA-501	450p
BA-511	160p
BA-514	160p
BA-516	150p
BA-521	160p
BA-524	240p
BA-526	220p
BA-527	95p
BA-532	140p
BA-534	290p
BA-535	600p
BA-536	180p
BA-546	180p
BA-612	160p
BA-656	150p
BA-658	380p
BA-684	400p
BA-664	300p
BA-684	400p
BA-685	400p
BA-1310	160p
BA-1320	110p
BA-1330	160p
BA-1360	160p
BA-4403	220p
BA-5101	500p
BA-5102	250p
BA-5204	200p
BA-5402	250p
BA-5406	280p
BA-5408	220p
BA-6104	250p
BA 6135	250p
BA 6208	250p
BA 6209	320p
BA-6304	190p
CA-3011	110p
CA-3012	150p
CA-3014	250p
CA-3018	75p
CA-3019	75p
CA-3020	190p
CA-3023	190p
CA-3028A	95p
CA-3035	230p
CA-3036	240p
CA-3043	240p
CA-3045	360p
CA-3046	60p
CA-3048	190p
CA-3052	190p
CA-3054	95p
CA-3059	300p
CA-3060	280p
CA-3065	210p
CA-3080E	60p
CA-3085	135p
CA-3086	55p
CA-3088E	200p
CA-3089E	150p
CA-3089Q	250p
CA-3130E	80p
CA-3130S	100p
CA-3134E	280p
CA-3140E	38p
CA-3160	85p
CA-3161E	140p
CA-3162E	450p
CA-3189E	230p
CA-3193E	230p
CA-3240E	90p
CA-3260E	170p
CA-3290E	150p
CX-108	750p
CX-130	450p
CX-136	610p
CX-139A	1150p
CX-143A	580p
ER-1400	200p

HA-1125	150p
HA-1137W	135p
HA-1144	380p
HA-1156	110p
HA-1197	150p
HA-1199	145p
HA-1306W	170p
HA-1319	240p
HA-1338	300p
HA-1339A	350p
HA-1342	350p
HA-1366WR	160p
HA-1367	300p
HA-1368	160p
HA-1371	300p
HA-1372	300p
HA-1374	230p
HA-1377	200p
HA-1388	320p
HA-1389	210p
HA-1392	230p
HA-1394	280p
HA-1397	250p
HA-1398	240p
HA-1452	120p
HA-1457	120p
HA-11219	280p
HA-11221	210p
HA-11223	340p
HA-11225	170p
HA-11226	410p
HA-11235	170p
HA-11251	240p
HA-11423	210p
HA-11701	310p
HA-11703	390p
HA-11705	620p
HA-11710	340p
HA-11714	400p
HA-11715	560p
HA-11724	800p
HA-12005	450p
HA-12017	130p
HA-13001	260p
HA-13007	400p
HA-13008	800p
HA-13432	400p
ICL-7016	650p
ICL-7017	950p
ICL-7611	90p
ICL-7660	240p
ICM-7555	60p
ICM 7556	130p
LA-1111	80p
LA-1130	240p
LA-1150	150p
LA-1185	150p
LA-1201	75p
LA-1210	140p
LA 1222	60p
LA-1230	130p
LA-1231	210p
LA-1352	120p
LA-1364	200p
LA-1365	120p
LA-1368	220p
LA-1369	260p
LA-1385	170p
LA-1460	220p
LA-2000	150p
LA-2100	260p
LA-2101	270p
LA-2200	190p
LA-3100	125p
LA-3101	160p
LA-3120	125p
LA-3155	100p
LA-3160	120p
LA-3201	80p
LA-3210	65p
LA-3220	100p
LA-3300	140p
LA-3301	110p
LA-3350	110p
LA-3361	100p
LA-3375	300p
LA-4030	180p
LA-4031	140p
LA-4032	140p
LA-4050	130p
LA-4051	160p
LA-4100	85p
LA 4101	80p
LA-4102	120p
LA-4110	120p
LA-4112	120p
LA-4120	270p
LA-4125	200p
LA-4126	240p
LA-4135	250p
LA-4137	180p
LA-4140	70p
LA-4160	220p
LA 4180	300p
LA-4182	190p
LA-4190	300p
LA-4192	180p
LA-4200	130p
LA-4201	120p
LA-4210	150p
LA-4220	120p
LA-4230	175p
LA-4250	260p
LA-4260	230p
LA-4261	300p
LA-4270	300p
LA-4400	190p
LA-4420	140p
LA-4422	130p
LA-4430	130p
LA-4440	230p
LA-4445	260p
LA-4450	150p
LA-4460	170p
LA 4461	180p
LA-4500	230p
LA-4505	260p
LA-4507	360p
LA-4508	260p
LA-4510	160p
LA-4520	230p
LA-4530	250p
LA-4540	300p
LA-4550	200p
LA-4555	220p
LA-4560	300p
LA-4570	300p
LA-5112	120p
LA-5523	150p
LA-5527	150p
LA-5700	300p
LA-6324	200p
LA-6358	100p
LA-6458	100p
LA-7000	100p
LA-7003	400p
LA-7005	350p
LA-7007	400p
LA-7009	500p
LA-7011	220p
LA-7013	300p
LA-7015	300p
LA-7017	320p
LA-7018	160p
LA-7019	160p
LA-7020	400p
LA-7025	380p

LA-7027	400p
LA-7031	250p
LA-7032	700p
LA-7033	400p
LA-7040	280p
LA-7042	280p
LA-7043	300p
LA-7045	300p
LA-7046	300p
LA-7048	300p
LA-7050	250p
LA-7051	300p
LA-7060	250p
LA-7061	250p
LA-7070	500p
LA-7071	500p
LA-7072	350p
LA-7090	300p
LA-7110	400p
LA-7112	300p
LA-7205	250p
LA-7210	300p
LA-7212	300p
LA-7215	300p
LA-7220	300p
LA-7224	150p
LA-7225	180p
LA-7230	500p
LA-7505	250p
LA-7506	250p
LA-7507	250p
LA-7508	250p
LA-7520	500p
LA-7590	250p
LA-7620	500p
LA-7621	500p
LA-7751	450p
LA-7755	300p
LA-7770	300p
LA-7800	180p
LA-7801	280p
LA-7802	300p
LA-7803	400p
LA-7805	400p
LA-7806	260p
LA-7808	250p
LA-7810	300p
LA-7811	300p
LA-7820	250p
LA-7822	280p
LA-7823	280p
LA-7910	150p
LA-7920	150p
LAP-512	310p
LAG-552	200p
LAG-600	200p
LAG-634D	300p
LAM-508	200p
LC-7120	280p
LC-7130	280p
LC-7131	250p
LC-7132	400p
LC-7137	450p
LF 347	110p
LF-351	45p
LF-353	48p
LF-355	60p
LF-356	60p
LF-357	70p
LF-398	300p
LM-301	26p
LM-307	42p
LM-308CN	70p
LM-310	220p
LM-311	35p
LM-318	120p
LM-319	165p
LM-324	35p
LM-325	45p
LM-334Z	115p
LM-335Z	120p
LM-336	140p
LM-337	250p
LM-339	37p
LM-348	55p
LM-358	45p
LM-377	220p
LM-380	100p
LM-381	150p
LM-382	130p
LM-383	300p
LM-384	130p
LM-386	85p
LM-387	100p
LM-389	150p
LM-391	160p
LM-392	100p
LM-393	55p
LM-394CH	370p
LM-558	160p
LM-709DIL	30p
LM-710	45p
LM-711	85p
LM-723	40p
LM-725CN	380p
LM-733	60p
LM-741DIL	18p
LM-741MET	45p
LM-747	58p
LM-748	35p
LM-1458	33p
LM-1889	400p
LM-3900	40p
LM-3909	80p
LM-3911	160p
LM-3914	250p
LM-3915	255p
LM-3916	290p
LM-8560	300p
LM-016H	3200p
M-5155	150p
M-50120	600p
M-51102	290p
M-51316B	540p
M-51513L	160p
M-51514	160p
M-51515BL	220p
M-51516	260p
M-51517L	260p
M-51518	200p
M-54836	600p
MB-3705	150p
MB-3712	140p
MB-3722	310p
MB-3730	240p
MB-3731	300p
MB-3756	230p
MB-3759	200p
MB-8719	360p
MC-1310P	130p
MC-1327	70p
MC-1413	65p
MC-1455	45p
MC-1458	33p
MC-1469	290p
MC-1488	85p
MC-1489	65p
MC-1494	670p
MC-1495	285p
MC-1496	65p
MC-1569	210p
MC-3302	70p
MC-3401	45p
MC-3403	60p
MC-3423	75p
MF-10	295p
ML-920	480p
ML-922	380p

NE-531	115p
NE-544	170p
NE-555	20p
NE-556	40p
NE-564	380p
NE-565	110p
NE-566	130p
NE-567	115p
NE-570	360p
NE-571	290p
NE-592	85p
NE-5532P	140p
NE-5533P	150p
NE-5534P	110p
SAS-560	110p
SAS-570	110p
SAA-1006	300p
SAA-1008	450p
SAA-1009B	350p
SAA-1024	250p
SAA-1016T	400p
SAA-1220	400p
SAA-1251	380p
SAA-1272C	280p
SAA-1274	280p
SAA-3004	400p
SAA-5040A	280p
SAA-5040B	400p
SI-3242P	360p
SI-7300A	1400p
SNR-20A130K	200p
STA-301A	380p
STA-312	280p
STA-401A	380p
STK-0025	420p
STK-0029	430p
STK-0030	400p
STK-0039	410p
STK-0040	560p
STK-0049	570p
STK-0050	570p
STK 0059	620p
STK-0060	900p
STK-0070	1100p
STK-0080	690p
STK-011	370p
STK-013	700p
STK-014	700p
STK-015	490p
STK-016	800p
STK-020	540p
STK-022	700p
STK-024	700p
STK-025	700p
STK-031	820p
STK-041	700p
STK-043	980p
STK-050	1450p
STK-056	820p
STK-077	600p
STK-078	620p
STK-080	710p
STK-082	720p
STK-084	740p
STK-086	910p
STK-430	500p
STK-433	490p
STK-435	510p
STK-436	490p
STK-437	600p
STK-439	550p
STK 441	740p
STK-443	740p
STK-457	580p
STK-459	610p
STK-460	720p
STK-461	720p
STK-463	780p
STK-465	800p
STK-501	580p
STK-563	480p
STK-583	600p
STK-732	850p
STK-734B	510p
STK-772B	480p
STK-1039	550p
STK-1040	700p
STK-1049	800p
STK-1050	750p
STK-1060	760p
STK-1070	1200p
STK-1080	1000p
STK-2025	800p
STK-2028	650p
STK-2029	500p
STK-2110	680p
STK-2120	820p
STK-2125	650p
STK-2110	680p
STK-2155	1000p
STK-2139	800p
STK-2230	580p
STK-2240	920p
STK-2250	920p
STK-3041	600p
STK-3042	580p
STK-3044	575p
STK 3062	600p
STK-3082	700p
STK-3083	550p
STK-4021	425p
STK-4025	600p
STK-4026	800p
STK-4036	500p
STK-4038	680p
STK-4048	1280p
STK-4060	580p
STK-4111	650p
STK-4122	560p
STK-4121	800p
STK-4131	650p
STK-4141	700p
STK-4151	720p
STK-4161	820p
STK-4162	820p
STK-4171	1000p
STK-4181	820p
STK-4191	1100p
STK-4311	800p
STK-4332	500p
STK-4352	700p
STK-4362	625p
STK-4372	600p
STK-4392	720p
STK-4773	1000p
STK-4793	1180p
STK 4803	820p
STK-4813	950p
STK 4833	920p
STK-4843	865p
STK-4853	950p
STK-4893	1400p
STK-4913	1220p
STK-5314	625p
STK-5315	650p
STK-5322	620p
STK-5324	550p
STK-5325	650p
STK-5332	300p
STK-5372	300p
STK-5421	625p
STK-5422	600p
STK-5441	500p
STK-5471	500p
STK-5476	600p
STK-5481	520p
STK-6922	600p

STK-6962	320p
STK-6972	630p
STK-7216	610p
STK-7308	800p
STK-7309	650p
STK-7402	660p
STK-7404	680p
STK-7406	800p
STK-7408	880p
STK-7410	1200p
STK-7563	1000p
STK-8250	700p
STK-8050	880p
STK-4833	1200p
STR-370	650p
STR-380	580p
STR-440	520p
STR-441	480p
STR-451	500p
STR-453	700p
STR-2012	650p
STR-3115	580p
STR-3125	580p
STR-4090	650p
STR-6020	600p
T2800D	52p
TA-7054	190p
TA-7061	115p
TA-7063	70p
TA-7066	120p
TA-7072	300p
TA-7073	200p
TA-7089	300p
TA-7108	130p
TA-7109	220p
TA-7119	150p
TA-7120	55p
TA-7130	80p
TA-7137	83p
TA-7140	130p
TA-7142	220p
TA-7145	220p
TA-7146	400p
TA-7148	350p
TA-7157	140p
TA-7162	300p
TA-7169	420p
TA-7176	240p
TA-7193	400p
TA-7200	200p
TA-7201	200p
TA-7203	180p
TA-7204	140p
TA-7205	80p
TA-7207	150p
TA-7208	145p
TA-7210	200p
TA-7212	300p
TA-7213	200p
TA-7214	260p
TA-7215	215p
TA-7217	145p
TA-7220	220p
TA-7222	120p
TA-7223	210p
TA-7224	270p
TA-7225	300p
TA-7226	290p
TA-7227	190p
TA-7229	300p
TA-7230	170p
TA-7232	250p
TA-7233	250p
TA-7237	400p
TA-7238	400p
TA-7240	260p
TA-7241	260p
TA-7242	290p
TA-7243	350p
TA-7245	450p
TA-7247	800p
TA-7267	290p
TA-7269	850p
TA-7270	250p
TA-7271	400p
TA-7272	260p
TA-7273	350p
TA-7274	260p
TA-7280	330p
TA-7281	270p
TA-7282	260p
TA-7283	260p
TA-7288	260p
TA-7299	400p
TA-7310	100p
TA-7312	120p
TA-7313	110p
TA-7314	210p
TA-7315	200p
TA-7317P	240p
TA-7320	300p
TA-7324	200p
TA-7325	90p
TA-7328	200p
TA-7335	200p
TA-7336	250p
TA-7341	250p
TA-7343	250p
TA-7357	400p
TA-7358	200p
TA-7401	400p
TA-7607	270p
TA-7608	360p
TA-7609	270p
TA-7611	280p
TA-7612	360p
TA-7614	230p
TA-7616	400p
TA-7621	520p
TA-7622	420p
TA-7625	420p
TA-7628	240p
TA-7629	420p
TA-7630	300p
TA-7632	400p
TA-7640	150p
TA-7641	170p
TA-7658	130p
TA-7668	160p
TA-7680	480p
TA-7688	250p
TA-7698	720p
TA-7699	1200p
TA-7769	300p
TAA-550	20p
TAA-611B12	100p
TAA-661	100p
TBA-120S	50p
TBA-395	60p
TBA-396	70p
TBA-520	120p
TBA-530	120p
TBA-540	120p
TBA-560	120p
TBA-641B11	400p
TBA-750	120p
TBA-800	40p
TBA-810AS	60p
TBA-820	65p
TBA-820M	50p
TBA 920	120p
TBA-950	120p
TBA-990	120p
TBA-1440G	120p
TC-5020	285p
TC-9109	500p
TC-9106	470p

TCA-240	200p
TCA-610	100p
TCA-740	130p
TCA-830	90p
TCA-940	100p
TCEP-100	200p
TDA-1001	200p
TDA-1003	150p
TDA-1029	300p
TDA-1035	120p
TDA-1044	300p
TDA-1054	200p
TDA-1083	200p
TDA-1170	100p
TDA-1180	190p
TDA-1190	100p
TDA-1200B	80p
TDA-1270	200p
TDA-1410	210p
TDA-1412	100p
TDA-1420	200p
TDA-1470	140p
TDA-1670A	300p
TDA-1770A	300p
TDA-1870A	300p
TDA-1908A	100p
TDA-1940	280p
TDA-1950	280p
TDA-2002	80p
TDA-2003	150p
TDA-2004	170p
TDA-2005	170p
TDA-2006	150p
TDA-2008	175p
TDA-2009	200p
TDA-2010	100p
TDA-2020	140p
TDA-2030	140p
TDA-2532	120p
TDA-2540	100p
TDA-2560	120p
TDA-2575A	100p
TDA-2581	180p
TDA-2590	200p
TDA-2593	150p
TDA-2600	580p
TDA-2611A	120p
TDA-2653	380p
TDA-2670	150p
TDA-2690	100p
TDA-2760	400p
TDA-3190	100p
TDA-3300B	480p
TDA-3301B	380p
TDA-3560	350p
TDA-3561	280p
TDA-3651A	290p
TDA-3652	300p
TDA-3710	320p
TDA-3800	350p
TDA-4420	180p
TDA-4600	260p
TDA-4601	250p
TDA-4950	200p
TDA-5700	200p
TDA-7040	250p
TDA-7050	200p
TDA-7211	150p
TDA-7220	150p
TDA-7270	150p
TEA-1002	650p
TLO-61	40p
TLO 64	80p
TLO-71	38p
TLO-72	55p
TLO-74	92p
TLO-81	40p
TLO-82	48p
TLO-83	67p
TLO-84	80p
UCN-5801A	560p
ULN-2002	70p
ULN-2003	69p
ULN-2004	69p
ULN-2068	270p
ULN-2802	170p
ULN-2803	130p
ULN-2804	170p
UPC-16C	160p
UPC-20C	220p
UPC-30C	190p
UPC-358	150p
UPC-554	130p
UPC-555	60p
UPC-556H	80p
UPC-558	200p
UPC-566	60p
UPC-571	220p
UPC-572	200p
UPC-574	60p
UPC-575C2	90p
UPC-576	200p
UPC-577	64p
UPC-578	400p
UPC-580	300p
UPC-592	95p
UPC-595	190p
UPC-596	190p
UPC-1001	220p
UPC-1018	170p
UPC-1020	200p
UPC-1021	200p
UPC-1023	60p
UPC-1025	230p
UPC-1026	95p
UPC-1028	90p
UPC-1031H2	180p
UPC-1032	60p
UPC-1155	200p
UPC-1156	250p
UPC-1158H2	70p
UPC-1167C2	170p
UPC-1168	105p
UPC-1181	110p
UPC-1182	110p
UPC-1183	200p
UPC-1185H2	230p
UPC-1186	80p
UPC-1187	150p
UPC-1191	100p
UPC-1197	140p
UPC-1216	120p
UPC-1222	130p
UPC-1230	210p
UPC-1238	120p
UPC-1263	230p
UPC-1277	240p
UPC 1278	240p
UPC-1350	115p
UPC-1353	160p
UPC-1363	190p
UPC-1365	320p
UPC-1373	85p
UPC-1378	210p
UPC-1380	450p
UPC-1382	110p
UPC-1383	250p
UPC-1384	260p
UPC-1394	170p
UPC-1397	450p
UPC-1470	200p
ZN-423	100p
ZN-424	100p
ZN-425	320p
ZN-426	260p
ZN-427	560p

LINEAR IC'S — Cont.

ZN-428425	
ZN-429215	
ZN-435340	
ZN-448510	
ZN-459190	
ZN-1034170	
ZN-1040640	
ZNA-134H2150	
ZNA-234E920	
2SJ-48480	
2SJ-49425	
2SJ-50425	
2SJ-77350	
2SJ-122580	
2SK-15350	
2SK-1945	
2SK-4950	
2SK-55100	
2SK-68100	
2SK-133480	
2SK-134415	
2SK-135415	
2SK-147160	
2SK-176800	
2SK-191160	
2SK-19245	
2SK-195150	
2SK-197140	
2SK-210130	
2SK-211130	
2SK-217130	
2SK-291300	
2SK-294400	
2SK-312750	
2SK-322300	
2SK-323130	
2SK-555480	
2SK-557650	
3SK-8870	

JAPANESE TRANSISTORS

2SA-473	35p
2SA-483	400p
2SA-490	60p
2SA-562	57p
2SA-563	45p
2SA-571	500p
2SA-634	50p
2SA-636	50p
2SA-673	20p
2SA-684	60p
2SA 699	100p
2SA-715	90p
2SA-720	20p
2SA-733	30p
2SA-798	55p
2SA-844	30p
2SA-872	40p
2SA-872A	50p
2SA-886	90p
2SA-899	80p
2SA-907	650p
2SA-909	700p
2SA-933	40p
2SA-934	40p
2SA-935	40p
2SA-937	40p
2SA-940	70p
2SA-950	30p
2SA-952	50p
2SA-953	60p
2SA-965	60p
2SA-966	70p
2SA-970	50p
2SA-979	85p
2SA-984	50p
2SA-992	30p
2SA-1012	130p
2SA-1015	30p
2SA-1102	190p
2SA-1103	200p
2SA-1104	200p
2SA-1105	250p
2SA-1106	250p
2SB-022	80p
2SB-324	55p
2SB-370	45p
2SB-546	70p
2SB-557	225p
2SB-561	50p
2SB-566	130p
2SB-595	80p
2SB-596	60p
2SB-600	500p
2SB-600	500p
2SB-616	190p
2SB-621	85p
2SB-646A	90p
2SB-647	30p
2SB 649	40p
2SB-688	120p
2SB-703	125p
2SB-705	200p
2SB-707	200p
2SB-716	30p
2SB-727	200p
2SB-754	80p
2SB-755	310p
2SB-761	170p
2SB-764	60p
2SB-772	45p
2SB-775	160p
2SB-791	280p
2SB-792	70p
2SB-795	60p
2SB-825	135p
2SB-861	160p
2SB-882	180p
2SB-884	120p
2SB-886	225p
2SB-895	120p
2SB-950	180p
2SB-951	190p
2SB-1009	110p
2SB-1037	110p
2SB-1077	180p
2SB-1091	100p
2SC-97A	380p
2SC-454	45p
2SC-458	15p
2SC-461	30p
2SC-495	60p
2SC-536	30p
2SC-681	340p
2SC 710	50p
2SC-733	30p
2SC-790	125p
2SC-792	380p
2SC-828	25p
2SC 930	50p
2SC-943	160p
2SC-945	40p
2SC-1010	300p
2SC-1050	300p
2SC-1060	99p
2SC-1061	100p
2SC-1070	65p
2SC-1096	60p
2SC-1106	180p
2SC-1114	415p
2SC-1115	400p
2SC-1116	290p
2SC-1161	110p
2SC-1162	35p
2SC-1164	600p
2SC-1172	150p
2SC-1173	60p
2SC-1213	50p
2SC-1214	40p
2SC-1226	75p
2SC-1279	30p
2SC-1306	90p
2SC-1308K	350p
2SC-1317	25p
2SC-1318	25p
2SC-1327	20p
2SC-1342	120p
2SC-1383	50p
2SC-1384	50p
2SC-1398	80p
2SC-1413	265p
2SC-1419	150p
2SC-1444	360p
2SC-1454	320p
2SC-1472	40p
2SC-1505	80p
2SC-1507	140p
2SC-1509	80p
2SC-1514	65p
2SC-1515	60p
2SC-1520	120p
2SC-1573	95p
2SC-1586	540p
2SC-1624	140p
2SC-1675	100p
2SC-1678	120p
2SC-1729	900p
2SC-1730	540p
2SC-1740	40p
2SC-1741	45p
2SC-1755	90p
2SC-1756	40p
2SC-1758	30p
2SC-1775	20p
2SC-1809	40p
2SC-1815	30p
2SC-1826	60p
2SC-1845	20p
2SC-1847	120p
2SC-1865	120p
2SC-1875	260p
2SC-1881	210p
2SC-1906	75p
2SC-1907	75p
2SC-1909	250p
2SC-1921	60p
2SC-1923	25p
2SC-1941	40p
2SC-1942	260p
2SC-1944	350p
2SC-1945	350p
2SC-1946	1500p
2SC-1947	450p
2SC-1957	70p
2SC-1969	160p
2SC-1971	400p
2SC-1972	600p
2SC-1983	130p
2SC-2001	60p
2SC-2002	40p
2SC-2003	25p
2SC-2023	180p
2SC-2026	60p
2SC-2028	75p
2SC-2029	120p
2SC-2053	120p
2SC-2060	60p
2SC-2068	90p
2SC-2073	70p
2SC-2075	80p
2SC-2078	95p
2SC-2086	60p
2SC-2098	600p
2SC-2166	90p
2SC-2228A	60p
2SC-2229	25p
2SC-2233	125p
2SC-2235	60p
2SC-2236	60p
2SC-2238	70p
2SC-2240	45p
2SC-2259	80p
2SC-2271	60p
2SC-2275	50p
2SC-2290	1800p
2SC-2314	70p
2SC-2324	120p
2SC-2329	480p
2SC-2334	240p
2SC-2335	120p
2SC-2335	120p
2SC-2369	100p
2SC-2371	45p
2SC-2373	210p
2SC-2407	110p
2SC-2408	120p
2SC-2470	65p
2SC-2482	40p
2SC-2484	240p
2SC-2509	580p
2SC-2545	55p
2SC-2547	65p
2SC-2550	70p
2SC-2551	70p
2SC-2562	90p
2SC-2564	245p
2SC-2565	280p
2SC-2570	60p
2SC-2577	125p
2SC-2578	220p
2SC-2579	200p
2SC-2580	240p
2SC-2581	290p
2SC-2608	620p
2SC-2611	40p
2SC 2611	65p
2SC-2625	380p
2SC-2681	270p
2SC-2688	70p
2SC-2695	2100p
2SC-2719	80p
2SC-2749	350p
2SC-2785	60p
2SC-2810	360p
2SC-2837	360p
2SC-2922	610p
2SC-2979	320p
2SC 2988	280p
2SC-3025	500p
2SC-3039	140p
2SC-3040	260p
2SC-3042	300p
2SC-3060	900p
2SC-3148	410p
2SC-3150	200p
2SC-3151	230p
2SC-3152	250p
2SC-3153	350p
2SC-3156	400p
2SC-3158	220p
2SC-3173	180p
2SC-3178	340p
2SC-3181	240p
2SC-3210	400p
2SC-3212	510p
2SC-3264	510p
2SC-3277	280p
2SC-3293	85p
2SC-3299	120p
2SC 3318	500p
2SC-3355	90p
2SC-3358	80p
2SC-3402	50p
2SC-3416	80p
2SC-3417	90p
2SC-3422	110p
2SC-3467	70p
2SC-3468	70p
2SC-3503	90p
2SC-3568	200p
2SC-3675	160p
2SC-3685	400p
2SC-3789	75p
2SD-024	60p
2SD-313	70p
2SD-325	60p
2SD-348	460p
2SD 371	240p
2SD-401	130p
2SD-438	100p
2SD-600	120p
2SD-613	70p
2SD-718	100p
2SD-1277	190p
2SD-1398	250p
2SD-1453	180p
2SD-1609	110p

BRIDGE RECTIFIERS

1A/50V	16p
1A/100V	18p
1A/200V	19p
1A/400V	21p
1A/600V	23p
1A/800V	28p
2A/100V	33p
2A/200V	33p
2A/400V	37p
2A/600V	43p
2A/800V	43p
3A/200V	43p
3A/400V	43p
3A/600V	44p
6A/200V	80p
6A/400V	72p
25A/100V	150p
25A/200V	165p
25A/400V	185p
25A/600V	200p
25A/800V	240p
35A/100V	185p
35A/200V	200p
35A/400V	220p
35A/600V	230p
35A/800V	260p
1.5A/100V	40p
1.5A/800V	40p

PLASTIC CASED TRIACS

4A/400V	60p
6A/400V	69p
8A/400V	68p
12A/400V	85p
16A/400V	105p
20A/400V	190p
25A/400V	205p
8A/400V	52p

THYRISTORS

0.8A/60V	20p
0.8A/100V	28p
0.8A/200V	29p
4A/400V	28p
8A/300V	59p
8A/400V	70p
8A/600V	79p
12A/400V	75p
12A/600V	90p
2N4444	76p
BR103	37p
BR303	85p
BT 106	120p
BT 116	80p
BT119	100p
BT120	100p
OT121	120p
TIC44	22p
TIC45	27p
TIC47	32p
17088	200p
17089	200p
17127	200p
15/80H	230p
15/85R	230p
SG613	850p
SG264A	300p

4000B SERIES CMOS IC's

4000	13p
4001	13p
4002	13p
4006	34p
4007	13p
4008	38p
4009	20p
4010	21p
4011	13p
4012	13p
4013	19p
4014	32p
4015	32p
4016	18p
4017	29p
4018	30p
4019	28p
4020	33p
4021	36p
4022	32p
4023	13p
4024	25p
4025	13p
4026	60p
4027	18p
4028	29p
4029	34p
4030	17p
4031	90p
4032	52p
4033	60p
4034	76p
4035	42p
4036	180p
4037	75p
4038	46p
4039	180p
4040	30p
4041	36p
4042	30p
4043	36p
4044	36p
4045	72p
4046	42p
4047	45p
4048	27p
4049	18p
4050	20p
4051	38p
4052	35p
4053	35p
4054	53p
4055	52p
4056	52p
4060	40p
4063	52p
4066	20p
4067	120p
4068	13p
4069	13p
4070	13p
4071	13p
4072	13p
4073	13p
4075	13p
4076	42p
4077	13p
4078	13p
4081	13p
4082	13p
4085	36p
4086	30p
4089	75p
4093	18p
4094	44p
4095	58p
4098	50p
4099	42p
4501	27p
4502	36p
4503	30p
4504	55p
4505	180p
4506	58p
4507	30p
4508	67p
4510	32p
4511	30p
4512	38p
4513	80p
4514	65p
4515	65p
4516	36p
4517	100p
4518	36p
4519	28p
4520	36p
4521	88p
4522	43p
4526	38p
4527	41p
4528	38p
4529	65p
4532	48p
4551	75p
4553	140p
4555	29p
4556	36p
4557	140p
4583	60p
4584	30p
4585	40p
40100	120p
40101	78p
40102	150p
40103	120p
40104	90p
40105	140p
40106	35p
40107	50p
40108	260p
40109	74p
40110	170p
40114	180p
40117	180p
40147	240p
40160	55p
40161	55p
40162	55p
40163	55p
40174	48p
40175	60p
40181	170p
40182	70p
40192	48p
40193	48p
40194	58p
40208	240p
40257	120p

74 SERIES

7400	20p
7401	16p
7402	18p
7403	20p
7404	35p
7405	10p
7406	40p
7407	40p
7408	25p
7409	20p
7410	35p
7413	35p
7414	45p
7416	40p
7417	32p
7420	22p
7421	25p
7425	15p
7430	25p
7437	28p
7438	35p
7442	46p
7447	60p
7450	22p
7451	10p
7454	25p
7470	30p
7473	30p
7474	40p
7475	25p
7481	90p
7482	70p
7485	30p
7486	28p
7489	80p
7490	35p
7492	45p
7493	35p
7495	48p
7497	80p
74107	30p
74111	52p
74116	85p
74119	85p
74122	40p
74123	20p
74125	40p
74126	45p
74132	42p
74141	55p
74145	70p
74153	45p
74155	45p
74157	45p
74160	50p
74164	50p
74167	35p
74173	50p
74174	70p
74175	65p
74176	45p
74180	50p
74182	45p
74192	40p
74196	40p
74197	45p
74393	70p

74HC SERIES HIGH SPEED CMOS

74HC00	14p
74HC02	14p
74HC03	14p
74HC04	15p
74HC08	15p
74HC10	20p
74HC11	14p
74HC14	28p
74HC20	20p
74HC21	20p
74HC30	20p
74HC32	20p
74HC42	32p
74HC51	20p
74HC73	26p
74HC74	26p
74HC75	30p
74HC76	30p
74HC77	40p
74HC85	33p
74HC86	29p
74HC93	50p
74HC107	31p
74HC109	31p
74HC112	31p
74HC113	31p
74HC123	43p
74HC125	35p
74HC126	36p
74HC131	38p
74HC132	37p
74HC133	35p
74HC137	55p
74HC138	36p
74HC139	24p
74HC147	45p
74HC148	40p
74HC151	36p
74HC153	35p
74HC154	110p
74HC155	50p
74HC157	36p
74HC158	36p
74HC160	44p
74HC161	44p
74HC162	44p
74HC163	44p
74HC164	44p
74HC165	58p
74HC166	70p
74HC173	55p
74HC174	38p
74HC175	38p
74HC181	130p
74HC182	60p
74HC190	46p
74HC191	60p
74HC192	60p
74HC193	43p
74HC194	47p
74HC195	47p
74HC221	100p
74HC237	50p
74HC238	65p
74HC240	48p
74HC241	47p
74HC242	55p
74HC243	60p
74HC244	44p
74HC245	49p
74HC251	25p
74HC253	37p
74HC257	41p
74HC258	50p
74HC259	55p
74HC273	42p
74HC279	37p
74HC280	65p
74HC283	65p
74HC297	950p
74HC298	52p
74HC299	105p
74HC354	38p
74HC356	45p
74HC365	34p
74HC366	36p
74HC367	36p
74HC368	36p
74HC373	47p
74HC374	50p
74HC375	60p
74HC377	55p
74HC386	20p
74HC390	55p
74HC393	50p
74HC423	70p
74HC533	68p
74HC534	65p
74HC540	73p
74HC541	73p
74HC563	73p
74HC564	73p
74HC573	73p
74HC574	70p
74HC583	90p
74HC595	85p
74HC597	85p
74HC620	110p
74HC623	110p
74HC640	90p
74HC643	90p
74HC646	150p
74HC648	150p
74HC651	110p
74HC652	110p
74HC670	90p
74HC688	150p
74HC690	120p
74HC691	120p
74HC4002	25p
74HC4015	85p
74HC4016	75p
74HC4017	48p
74HC4020	50p
74HC4022	40p
74HC4024	34p
74HC4028	40p
74HC4040	34p
74HC4049	50p
74HC4050	50p
74HC4051	95p
74HC4052	95p
74HC4053	95p
74HC4059	85p
74HC4050	33p
74HC4066	33p
74HC4072	33p
74HC4075	26p
74HC4078	32p
74HC4094	50p
74HC4316	100p
74HC4351	160p
74HC4352	160p
74HC4310	120p
74HC4511	85p
74HC4514	140p
74HC4515	130p
74HC4516	130p
74HC4518	70p
74HC4520	80p
74HC4538	90p
74HC4543	120p
74HC7266	75p
74HC22106	580p
74HC40104	190p
74HC40105	250p

74LS SERIES LOW POWER SCHOTTKY T.T.L.

74LS00	14p
74LS01	14p
74LS02	14p
74LS03	14p
74LS04	14p
74LS05	14p
74LS08	14p
74LS09	15p
74LS10	14p
74LS11	14p
74LS12	14p
74LS13	22p
74LS15	15p
74LS20	15p
74LS21	15p
74LS22	15p
74LS24	38p
74LS26	15p
74LS27	15p
74LS28	15p
74LS30	15p
74LS32	17p
74LS33	17p
74LS31	16p
74LS38	17p
74LS40	16p
74LS42	28p
74LS47	56p
74LS48	52p
74LS51	15p
74LS54	15p
74LS55	17p
74LS73	26p
74LS74	20p
74LS75	26p
74LS76	26p
74LS78	26p
74LS83	40p
74LS85	40p
74LS86	28p
74LS90	29p
74LS91	60p
74LS92	35p
74LS93	28p
74LS95	46p
74LS96	56p
74LS107	30p
74LS109	30p
74LS112	30p
74LS113	30p
74LS114	30p
74LS122	38p
74LS123	38p
74LS124	85p
74LS125	32p
74LS126	32p
74LS132	32p
74LS133	32p
74LS136	32p
74LS138	31p
74LS139	31p
74LS145	70p
74LS147	100p
74LS148	80p
74LS151	30p
74LS153	36p
74LS154	85p
74LS155	36p
74LS156	41p
74LS157	28p
74LS158	31p
74LS160	44p
74LS161	44p
74LS162	44p
74LS163	40p
74LS164	40p
74LS165	56p
74LS166	60p
74LS168	68p
74LS169	60p
74LS170	75p
74LS174	36p
74LS175	38p
74LS190	51p
74LS191	48p
74LS192	46p
74LS193	47p
74LS194	47p
74LS195	50p
74LS196	55p
74LS197	48p
74LS221	50p
74LS240	50p
74LS241	46p
74LS242	50p
74LS243	55p
74LS244	45p
74LS245	46p
74LS247	46p
74LS248	48p
74LS249	78p
74LS251	28p
74LS253	40p
74LS256	58p
74LS257	38p
74LS258	40p
74LS259	55p
74LS260	38p
74LS266	26p
74LS273	50p
74LS279	37p
74LS280	100p
74LS283	55p
74LS290	30p
74LS293	30p
74LS365	30p
74LS366	35p
74LS367	33p
74LS368	35p
74LS373	50p
74LS374	50p
74LS375	52p
74LS390	46p
74LS393	41p
74LS399	75p
74LS629	105p
74LS641	100p
74LS642	140p
74LS644	140p
74LS645	140p
74LS670	68p
74LS674	320p
74LS687	260p

COMPUTER IC'S

2114	200p
2532	330p
2716	200p
2732	280p
2732A	300p
2764	240p
27C64	550p
27128	350p
26256-25	400p
41256-15	450p
256DRAM	450p
4116	75p
4164	150p
6116	200p
6264-15	300p
6502	300p
6502A	400p
65C02	930p
6503	570p
6520	170p
6522	330p
6530	1050p
6532	460p
6545	880p
6551	530p
6800	210p
6802	220p
6803	800p
6808	500p
6809	600p
6810	150p
6818	380p
6820	140p
6821	140p
6840	310p
6845	620p
6850	110p
8080A	400p
8085A	300p
8155	360p
8156	360p
81LS95	120p
81LS96	130p
81LS98	130p
8224	270p
8226	270p
8228	270p
8243	250p
8250	850p
8087	11000p
8251	320p
8253	320p
8255	310p
8256	1200p
8257	350p
8259	360p
8271	3400p
8272	1200p
8279	450p
8282	300p
8283	400p
8284	440p
8287	360p
8288	650p
8748	1100p
8755	1400p
AY3-1015	290p
AY5-3600	570p
SP0256AL2	500p
Z80ACPU	180p
Z80BCPU	500p
Z80ADMA	650p
Z80AP10	230p
Z80BP10	480p
Z80ACTC	250p
Z80AS10	660p
Z80AS10-1	700p
Z80BP10-2	700p
Z80ADRT	680p
74S188	175p
74S189	210p
74S201	240p
74S287	190p
74S288	160p
74S289	180p
74S387	200p
75107	80p
75108	80p
75109	110p
75110	80p
75112	140p
75113	105p
75114	130p
75115	130p
75121	125p
75122	125p
75150	110p
75154	110p
75158	140p
75159	200p
75160	400p
75161	400p
75162	700p
75172	720p
75182	100p
75183	100p
75188	60p
75189	60p
75195	185p
75322	130p
75324	340p
75325	155p
75365	145p
75450	45p
75451	42p
75452	42p
75453	65p
75454	65p
75480	135p
75491	60p
75492	60p
8T26	95p
8T28	110p
8T31	330p
8T95	90p
8T96	110p
8T97	90p
8T98	110p

UHF TUNERS

U322LO	600p
U341	500p
U342	500p

VIDEO RUBBER BELTS

AKAI	
VS-2EG/5EG 5 belts/kit	180p
VS-9300 7 belts/kit	220p
VS-9700EG 6 belts/kit	200p
VS-9500/9800 7 belts/kit	220p
JVC	
HR-3300/3600 9 belts/kit	220p
HR-3330 7 belts/kit	200p
HR-3360/3660 7 belts/kit	190p
HR-4130 7 belts/kit	195p
HR-7200 3 belts/kit	75p
HR-7600 3 belts/kit	145p
HR-7730 3 belts/kit	77p
NATIONAL	
NV-300 5 belts/kit	160p
NV-333 5 belts/kit	135p
NV-777 4 belts/kit	130p
NV-2000 5 belts/kit	155p
NV-3000 6 belts/kit	180p
NV-7000 5 belts/kit	100p
NV-7200 5 belts/kit	90p
NV-8600 7 belts/kit	200p
SONY	
SL-C72SL-J7 6 belts/kit	140p
SL-T7ME/T7MER 6 belts/kit	170p
SL-T9/P7/J9 7 belts/kit	210p
SL-8000-8080 6 belts/kit	240p
SANYO	
VTC-5300 5 belts/kit	190p
VTC-5500 3 belts/kit	95p
VTC-9300 4 belts/kit	240p
HITACHI	
VT-5000 7 belts/kit	155p
VT-8000 3 belts/kit	110p
VT-11 5 belts/kit	190p
FISHER	
VBS-7000 6 belts/kit	245p
VBS-9000 3 belts/kit	120p
TOSHIBA	
V-5250/5280 5 belts/kit	230p
V-5480 7 belts/kit	210p
V-5475 6 belts/kit	190p
V-7540 5 belts/kit	190p
V-8600 6 belts/kit	150p
SHARP	
VC-6300 5 belts/kit	195p
VC-7300 5 belts/kit	160p
VC-8300 5 belts/kit	175p
VC-9300 5 belts/kit	155p

CASSETTE MOTOR

6V	290p
9VCW	290p
12VCCW	290p
12VCW	290p
13.2VCW	290p
13.2VCCW	290p

CASSETTE TAPE HEADS

Mono Head	90p
Stereo Head	150p
Mono Mini Head	230p
Auto Reverse Head	260p

VIDEO MOTORS

Sanyo	
Reel Motor (RM11) P/N 4-529V-10800	790p
Capstan Motor 4-527V-51000	2400p
Sony	
Capstan Motor BHF-1100D	2500p
Sharp	
Reel Motor RMOTB 1007 Gezz	1750p
Reel Motor RMOTM 1008 Gezz	1750p
Loading Motor RMOTM 1017	1000p
JVC	
Capstan Motor PU-55371V	2200p
Capstan Motor PU-45979	2250p
Drum Motor PU-46414	2250p

VIDEO PINCH ROLLERS

National	
NV-300	475p
NV 7000	475p
Sanyo	
VTC-9300	475p
VTC-5500	475p
Sony	
SL-T7	475p
SL-C7	475p
JVC	
HR-3300	500p
HR-3330	500p
HR-3360/3660	500p
HR-7200	500p
HR-3300	500p
Akai	
VS-9700EG	360p
Hitachi	
VT-5000	475p
Sharp	
VC-6300/6500	

IDLERS & PULLEYS REPLACEMENTS

Sanyo	
Reel. Pulley 143-0-6E2T-01201	520p
Gear Idler 143-04904-00900	450p
Take Up Idler 143-0-4204 00100	650p
Idler 143-256T-0320C	450p
Sony	
Rew Pulley A 6706-348 B	400p
Rew Pulley A 6706-391-A/B	300p
Sharp	
Idler Assembley NIDL0005 Gezz	325p
Idler Assembley NIDL0006 Gezz	325p
Idler Sharp NIDL0005 Gezz	225p
Hitachi	
Idler Assembley 6886971	300p
Idler Assembley V-68661482	385p
JVC	
Idler Assembley PU-47752	480p
Take Up Idler PU-51402A	145p
Take Clutch PU-55373	225p
Idler Arm PU 55374-3-8	285p
Fast Forward Idl PU-45896C	210p
National	
Idler	300p

SERVICE AIDS

SERVISOL PRODUCTS

V. Head Cleaner	85p
Switch Cleaner	100p
Silicone Grease	115p
Freeze It	105p
Foam Cleaner	105p
Anti-Static	105p
Aerokleane	90p
Aero Duster	115p
Plastic Seal	105p

* * * UNIVERSAL TRIPLERS 500p * * *

* * * SONY on/off SWITCHES 250p * * *

VIDEO LAMPS

UNIVERSAL VIDEO LAMP 30p
12V. 60mA (300mm Wires)
RED OR BLUE
VIDEO LAMP FOR PANASONIC 60p

FLOPPY DISCS

5¼ inch DSDD (10 in box) Branded Name	£12.50
5¼ inch DSDD (bulk pack) 25	£10.00
3½ inch DSDD (10 in box) Branded Name	£21.00
3 inch CF2 Branded Name	£2.40
3 inch CF2D Branded Name	£3.00

ELECTROLYTIC CAPACITORS RADIAL LEAD

10 Volts	
22 MF	15p
47 MF	15p
100 MF	18p
220 MF	18p
470 MF	25p
1000 MF	35p
16 Volts	
10 MF	15p
22 MF	15p
47 MF	15p
100 MF	18p
220 MF	18p
470 MF	25p
1000 MF	50p
2200 MF	60p
4700 MF	110p
25 Volts	
10 MF	15p
22 MF	15p
47 MF	15p
100 MF	18p
220 MF	18p
470 MF	25p
1000 MF	50p
2200 MF	70p
35 Volts	
10 MF	15p
22 MF	15p
47 MF	15p
100 MF	20p
220 MF	25p
470 MF	30p
1000 MF	60p
2200 MF	100p
40 Volts	
10 MF	15p
15 MF	15p
22 MF	15p
47 MF	20p
100 MF	25p
220 MF	30p
470 MF	35p
1000 MF	50p
2200 MF	190p
50 Volts	
1 MF	15p
2.2 MF	15p
4.7 MF	15p
10 MF	20p
22 MF	25p
63 Volts	
0.47 MF	15p
1.0 MF	15p
2.2 MF	15p
4.7 MF	15p
10 MF	15p
22 MF	20p
47 MF	25p
100 MF	30p
220 MF	35p
470 MF	50p
1000 MF	100p
100 Volts	
0.47 MF	15p
1.0 MF	15p
2.2 MF	15p
4.7 MF	15p
10 MF	15p

ELECTROLYTIC CAPACITORS

AXIAL LEAD

16 VOLTS	
47 MF	25p
100 MF	30p
220 MF	35p
470 MF	45p
1000 MF	60p
2200 MF	120p
4700 MF	160p
10 VOLTS	
470 MF	40p
1000 MF	50p
2200 MF	70p
25 VOLTS	
22 MF	25p
47 MF	35p
100 MF	35p
220 MF	40p
470 MF	45p
1000 MF	70p
2200 MF	125p
35 VOLTS	
10 MF	25p
22 MF	25p
47 MF	30p
100 MF	35p
220 MF	40p
470 MF	90p
1000 MF	110p
2200 MF	160p
40 VOLTS	
10 MF	25p
22 MF	30p
47 MF	35p
100 MF	40p
220 MF	50p
470 MF	60p
1000 MF	100p
2200 MF	160p
63 VOLTS	
1.0 MF	25p
2.2 MF	25p
4.7 MF	25p
10 MF	30p
22 MF	35p
47 MF	40p
100 MF	50p
220 MF	60p
470 MF	100p
1000 MF	160p
100 VOLTS	
1.0 MF	25p
2.2 MF	25p
4.7 MF	30p
10 MF	35p
22 MF	35p
47 MF	40p

SOLDERING IRON

ANTEX XS25W 240V Soldering Iron 240Vac	540p
Spare Element for XS25W 240V	260p
ANTEX C15W 240V Soldering Iron 240Vcm	540p
Spare Element for C15W 240V	260p

DESOLDERING PUMP

Desolder Pump	290p
Spare Nozzle	60p

SOLDER MOP	65p

SOLDER

18 SWG	500g	580p
20 SWG	500g	650p

SOLDERING IRON STAND

Soldering Stand	200p
Spare Sponge	40p

VIDEO HEADS REDUCED TO UNBEATABLE PRICES

JVC/AKAI/FERGUSON 3HSS	£15.50
NATIONAL PANASONIC 4HSS	£15.50
SONY DSR-35R C20/C30/C40	£20.00
SONY DSR-43R	£20.00
HITACHI VT11/33	£20.50
SHARP VC387/9700 VC581/681	£21.00
TOSHIBA V21/V9600	£22.00
AMSTRAD VCR 4500 VCR 7000	£20.50
NATIONAL NV370	£21.00
NATIONAL NV430	£21.00

ENGINEERS SERVICE SMALL ZIPPED TOOL KIT
£28.99 + VAT
CONTAINING:
PLIAR, CUTTER,
TOP CUTTER
MULTI TESTER,
TWEEZER
FIVE DIFFERENT TYPES
OF TINE TOOLS

PLEASE PHONE US FOR TYPE NOT LISTED HERE AS WE ARE HOLDING 5000 ITEMS AND QUOTATIONS ARE GIVEN FOR LARGE QUANTITIES. Please send 70p 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. Prices quoted are subject to stock availability and may be changed without notice.

GRANDATA LTD

K.P. HOUSE, UNIT 15, POP IN COMMERCIAL CENTRE,
SOUTHWAY, WEMBLEY, MIDDLESEX, ENGLAND
Telephone: 01-900 2329 Telex No: 932 885 (Sunmit)
Fax: 01-903 6126
Access & Visa Card accepted. Open Monday to Saturday

W. TREE TRADE T.V.

UNIT 1 SUNSHINE MILLS
WORTLEY ROAD LEEDS 12
TEL: 0532 638804

THORN 'STEREO' VHS VIDEOS
ALL FRONT LOADERS
ALL STRAIGHT FROM SOURCE
6 FOR ONLY £485

BARGAINS

MIXED VHS VIDEO'S
ALL TOP LOADERS
ALL STRAIGHT FROM SOURCE
10 FOR ONLY £517

BARGAINS

THORN 3V29 TOP LOADERS

STRAIGHT FROM SOURCE
20 FOR ONLY £1115

BARGAINS

SAVE – SAVE – SAVE

BARGAINS

PHILIPS K30 – PYE K30

6 BASIC 1 REMOTE
THE LOT ONLY £95

PHILIPS G11 TEXT – PYE G11 TEXT

OFF THE PILE – MIXED LOT
10 FOR ONLY £150

BARGAINS

BARGAINS

FERGUSON RC02 RADIO CASSETTE
4 BAND – TWIN TAPE – STEREO
ALL BOXED
ONLY £25 EACH

TV/VIDEO STANDS
NEW – BOXED
ONLY £5 EACH
OR 10 FOR £40

BARGAINS

ALL PRICES PLUS VAT

TV LINE OUTPUT TRANSFORMERS

PRICES INCLUDE VAT & CARRIAGE

VIDEO HEADS, TRANSISTORS, IC's, ALSO STOCKED.

BAIRD: 8290, 8752, 8773, 8180	12.00
RANK BUSH MURPHY	
A774 with stick rectifier	9.78
A816, T16, T18, Z712, Z715	10.35
T20, T22, T26, Z179, A823	11.50
Z718 Basic unit	13.50
DECCA: 1210, 1211, 1511	11.50
1700, 2001, 2020, 2401, 2404	9.20
CS1730, 1733, 1830, 1835	9.20
30, 70, 80, 90, 100	9.20
120, 130, 140, 160	P.O.A.
FERGUSON, THORN: 1590, 1591	9.20
1690, 1691. built in rect.	9.78
1600, 1615, 1700, 1790	P.O.A.
3000, 3500, 8000, 8500, 8800	P.O.A.
9000, 9200, 9300 series	12.00
9500, 9600, 9650 series	12.00
TX9, TX10,TX90, TX100, TXP5	P.O.A.
MOVIESTAR 3781, 3787, 8180	12.00
TX10 focus unit	10.87
FIDELITY: FTV12 mono	10.35
ZX2000 ZX3000 14", 16", 20"	16.43
ZX3000 22"	27.28
G.E.C. 2047 to 3135 mono	9.20
1201H, 1501H, 2114, 3133, 3135	9.20
DUAL & SINGLE hybrid col.	10.00
SINGLE STD solid state	12.00
SINGLE STD split diode	P.O.A.
INDESIT: 24EGB, 12LGB, 12SGB	10.35
WINDINGS	
TYNE: main winding	6.80
RBM: T20, T22, T26, Z179	6.33
WALTHAM: W125 eht winding	2.37
KORTING: hybrid winding	6.90
THORN: 8000, 8500, 8800 eht	6.70

ITT: VC200 to VC402	9.20
CVC1, CVC2 (FORGESTONE)	11.50
CVC5, CVC7, CVC8, CVC9, CVC20	10.35
CVC25, CVC30, CVC32, CVC45	9.20
CVC800, 1100, 1150, CVC40	P.O.A.
CVC1200, 1204, 1210, 1215, 2600	P.O.A.
PYE: 169, 173, 569, 368	9.20
CT200, CT200/1, CT213	10.35
725-731, 735, 737, 741	9.78
PHILIPS: 170, 210, 300	9.20
320 series	9.78
TX, T8, TX2, TX3 mono	P.O.A.
G8 and G9 Series	9.20
KT2. KT3. series	9.20
CTX G11. K30. K4. K40. split diode	P.O.A.
K12, CF1, 2A, 2B, 3A, NC3	P.O.A.
REDIFUSION Mk1 to 5	P.O.A.
DORIC Mk3, Mk1	11.50
SONY KV 1400, 1612, 2000	P.O.A.
GRUNDIG: most models in stock	
NORDMENDE: 8290, Z206, Z306	P.O.A.
SANYO: 5101, 5103, 7118, 7130	P.O.A.
SHARP: C1851H, C2051H, 1405	P.O.A.
HINARI: CT4, CT5	P.O.A.
TANDBURG: 190, CTV2, CTV3	P.O.A.
TELEFUNKEN: most models in stock	
HITACHI: 1471, CPB260, 2501	P.O.A.
SAISHO MATSUI SENTRA	P.O.A.

Delivery by return of post.

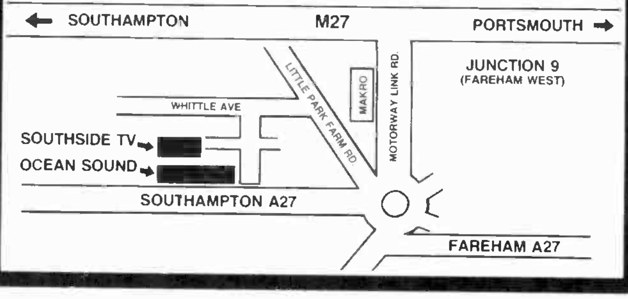
Tidman Mail Order Ltd.,
236 Sandycombe Road,
Richmond, Surrey TW9 2EQ.
Approx. 1 mile from Kew Bridge.
Phone: 01-948 3702
Mon-Fri 9 am to 12.30 pm &
1.30-4.30 pm
Sat 10 am to 12 noon.

SOUTHSIDE TV

UNIT 8, APPLE IND. EST.,
WHITTLE AVE.,
SEGENSWORTH WEST,
FAREHAM OFF JUNCTION 9, M27
LOCKSHEATH
HANTS. TEL. (04895) 77251

- ★ **TOP QUALITY** ex-rental TV's & Videos
- ★ Fresh stock deliveries **EVERY** week
- ★ All items complete with original handsets
- ★ Working stock always available in quantity
- ★ 24 hr ansaphone service

Opening times: Mon-Fri 10am-5.30pm.
Sat Mornings 10am-1pm.



AUDIO TELEVISION VIDEO

TRADE EXPORT

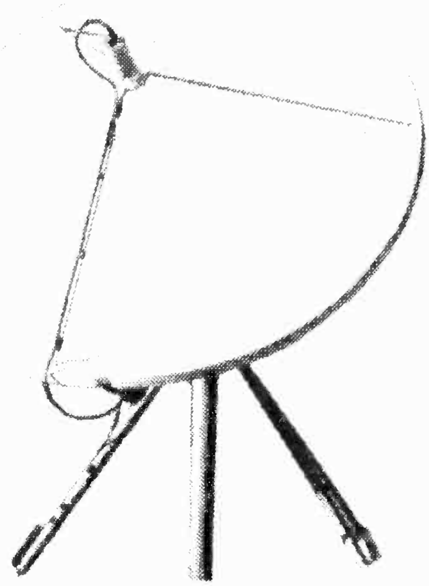
FOR GUARANTEED CTV & VIDEO'S

TRADE SERVICE AVAILABLE ON ALL MAKES

EXPORT ENQUIRIES WELCOME

COURTEOUS SERVICE

ELECTRONICS SERVICES
UNIT 18
TILE CROSS TRADING ESTATE
TILE CROSS ROAD
MARSTON GREEN
BIRMINGHAM B33 0NW
Telephone: 021 779 5734



A Link with Europe

Ring Norman - Gloria - Paul on new number

021 779 5465
021 779 5466

Fax: 021 779 4701

* *TRADE ONLY SATELLITE ENQUIRIES*

Satellite

AN103	£1.95	AN6610	£1.95	BA1320	£1.25	HA11749	£4.75	LA4440	£2.75	STK082	£7.75	STR6020	£6.75	TDA3540	£3.80
AN127Q	£2.20	AN6676	£7.50	BA1330	£1.75	HA11750	£5.00	LA4445	£2.75	STK084	£7.60	TA7063P	£1.50	TDA3541	£3.60
AN203	£2.20	AN6677	£6.30	BA1360	£1.80	HA11753	£8.50	LA4460	£1.80	STK430	£5.50	TA7066P	£1.50	TDA3560	£4.50
AN210	£1.75	AN6780	£2.30	BA5102A	£2.75	HA11758	£8.50	LA4461	£1.80	STK431	£5.95	TA7073AP	£2.75	TDA3561A	£4.95
AN211A	£2.30	AN6811	£1.60	BA5204	£2.75	HA11768	£4.50	LA4500	£2.50	STK433	£5.25	TA7074P	£1.95	TDA3562A	£6.00
AN217B	£2.20	AN6873	£4.50	BA5402A	£2.75	HA11788	£4.50	LA4505	£2.80	STK435	£5.50	TA7122AP	£0.90	TDA3651	£2.70
AN228W	£2.90	AN6875	£3.50	BA5406	£3.20	HA11816	£6.50	LA4507	£4.25	STK436	£5.25	TA7136P	£1.00	TDA3652	£3.30
AN236	£2.50	AN6884	£2.75	BA5408	£2.75	HA11828	£9.50	LA4508	£2.85	STK437	£6.50	TA7140P	£1.75	TDA4420	£3.75
AN240P	£1.50	AN7105	£2.50	BA6104	£2.80	HA12001	£6.50	LA4520	£2.50	STK439	£5.95	TA7145P	£2.50	TDA4500	£3.95
AN241P	£1.50	AN7106K	£2.95	BA6124	£2.80	HA12002	£2.95	LA4570	£3.75	STK441	£7.95	TA7193P	£4.00	TDA4600/2	£2.95
AN259	£2.75	AN7110	£1.50	BA6208	£2.95	HA12035	£9.50	LA5112	£1.85	STK443	£7.95	TA7205AP	£1.00	TDA4600/2D	£2.95
AN260P	£2.20	AN7111	£1.50	BA6209	£3.75	HA12038	£6.75	LA5527	£1.95	STK457	£6.50	TA7207P	£1.75	TDA7270	£2.20
AN262	£1.60	AN7112E	£2.95	BA6304	£2.20	HA12402	£2.95	LA6324	£2.50	STK459	£6.75	TA7208P	£1.75	UPC575C	£1.00
AN264	£3.75	AN7114E	£2.50	BX342	£5.00	HA12413	£2.75	LA6358S	£1.20	STK461	£7.50	TA7217AP	£1.60	UPC1001H	£2.20
AN271A	£2.50	AN7115E	£1.60	HA1124A	£2.75	HA13001	£2.95	LA6458D	£1.20	STK463	£8.40	TA7220P	£2.50	UPC1018C	£1.95
AN274	£2.75	AN7116	£1.50	HA1124DS	£3.50	HA13007	£4.95	LA7016	£2.75	STK465	£8.50	TA7222AP	£1.30	UPC1025H	£2.30
AN277	£2.50	AN7120	£1.50	HA1125	£1.75	HA13402	£4.95	LA7031	£2.75	STK501	£6.25	TA7223P	£2.30	UPC1031H	£1.95
AN295	£3.60	AN7130	£1.30	HA1137W	£1.75	HA13432	£4.50	LA7032	£4.50	STK0025	£4.95	TA7225P	£3.20	UPC1032H	£0.60
AN301	£3.50	AN7131	£2.75	HA1144	£4.25	LA1111	£0.95	LA7215	£2.75	STK0029	£4.75	TA7227P	£2.20	UPC1158H	£0.95
AN302	£3.30	AN7140	£2.20	HA1151	£2.50	LA1130	£2.75	LA7224	£2.95	STK0039	£4.75	TA7229P	£3.25	UPC1181H	£1.10
AN303	£2.75	AN7143	£2.95	HA1156W	£1.20	LA1140	£2.20	LA7505	£2.95	STK0040	£6.25	TA7230P	£1.95	UPC1182H	£1.10
AN305	£3.50	AN7145M	£2.50	HA1167	£3.75	LA1222	£1.00	LA7507	£2.95	STK0049	£6.50	TA7232P	£2.95	UPC1185H	£2.50
AN313U	£2.95	AN7146M	£2.80	HA1196	£1.75	LA1230	£1.50	LA7520	£3.25	STK0059	£7.00	TA7233P	£2.95	UPC1188H	£2.75
AN315	£2.30	AN7149N	£2.95	HA1197	£3.70	LA1231	£2.00	LA7521	£4.50	STK0060II	£9.50	TA7240AP	£2.95	UPC1225H	£2.75
AN316	£3.75	AN7154	£1.90	HA1199	£1.85	LA1240	£1.95	LA7751	£4.75	STK0080	£7.75	TA7241AP	£2.95	UPC1230H	£2.50
AN318	£4.95	AN7156N	£2.50	HA1319	£2.50	LA1260	£2.95	LA7755	£3.20	STK1060	£7.95	TA7269P	£5.50	UPC1263C	£2.50
AN337	£5.25	AN7158N	£3.25	HA1366W	£1.80	LA1353	£2.50	LA7800	£1.95	STK2025	£7.50	TA7270P	£2.75	UPC1277H	£2.75
AN340P	£1.50	AN7160	£3.75	HA1366WR	£1.85	LA1365	£1.50	LA7801	£2.95	STK2028	£7.50	TA7271P	£2.75	UPC1278H	£2.75
AN360	£1.30	AN7161	£3.75	HA1367	£3.25	LA1368	£2.50	LA7806	£2.75	STK2029	£5.75	TA7272P	£2.95	UPC1363C	£2.75
AN362L	£1.60	AN7166	£3.95	HA1368	£1.90	LA1385	£1.95	LA7808	£2.95	STK2038II	£9.50	TA7273P	£3.20	UPC1364C	£4.75
AN363N	£3.50	AN7168	£2.75	HA1368R	£1.95	LA1387	£3.60	LA7820	£2/75	STK2125	£6.75	TA7274P	£2.95	UPC1365C	£3.60
AN366P	£1.70	AN7178	£2.95	HA1370	£3.70	LA1460	£2.50	LA7910	£2.20	STK2129	£6.75	TA7280P	£3.50	UPC1384C	£3.50
AN374P	£2.20	AN7213	£1.95	HA1372	£3.50	LA1464	£3.20	LA7920	£1.75	STK2230	£6.50	TA7281P	£2.95	UPC1387C	£2.50
AN377	£2.00	AN7218	£1.75	HA1374	£2.50	LA2100	£2.95	LB1405	£2.20	STK2240	£9.50	TA7282AP	£2.95	UPC1391H	£1.50
AN610P	£1.80	AN7222N	£3.50	HA1377	£2.50	LA2101	£3.30	LB1409	£2.95	STK2250	£9.50	TA7283AP	£2.95	UPC1394C	£1.95
AN612	£1.80	AN7223	£3.95	HA1384	£3.95	LA3160	£1.50	LC4066B	£2.95	STK3041	£6.50	TA7288P	£2.95	UPC2002	£0.80
AN5010	£4.75	AN7224	£3.50	HA1388	£3.50	LA3201	£0.95	LC7130	£3.50	STK3042	£6.50	TA7299P	£2.95	UPC4558C	£0.90
AN5151N	£6.50	AN7256	£3.50	HA1389	£2.20	LA3210	£0.75	LC7131	£3.75	STK3044	£5.95	TA7317P	£2.75	BC639	£0.22
AN5265	£3.20	AN7273	£3.95	HA1389R	£2.75	LA3220	£2.95	LC7132	£4.00	STK3062III	£6.75	TA7323P	£2.20	BC640	£0.22
AN5410	£5.50	AN7310	£1.20	HA1392	£2.50	LA3300	£1.65	LC7136	£3.75	STK4026	£5.75	TA7343AP	£2.95	BFR90	£0.78
AN5411	£3.50	AN7311	£1.20	HA1394	£2.95	LA3301	£1.30	LC7137	£4.50	STK4060	£6.50	TA7358P	£2.80	BFR91	£1.20
AN5430	£2.95	AN7410	£3.00	HA1396	£3.75	LA3310	£2.75	LC7800	£3.95	STK4131II	£6.75	TA7607AP	£2.95	BFY90	£0.50
AN5510	£2.75	AN7415	£2.95	HA1397	£3.75	LA3350	£1.30	M5134P	£3.25	STK4141II	£7.50	TA7608CP	£3.95	BR303	£1.50
AN5512	£2.95	AN7420	£3.25	HA1398	£2.75	LA3361	£1.20	M5155P	£1.85	STK4151II	£7.50	TA7609P	£2.70	BRY56	£0.20
AN5612	£2.95	BA301	£0.80	HA1457W	£2.75	LA3370	£2.80	M51102L	£3.95	STK4332	£5.75	TA7613AP	£2.75	BT106	£1.00
AN5620X	£3.50	BA311	£0.95	HA11215W	£4.35	LA4030P	£2.00	M51104L	£3.95	STK4352	£6.50	TA7628P	£2.95	BU208A	£1.20
AN5701	£1.80	BA313	£0.80	HA11219	£3.25	LA4031P	£1.95	M51513	£1.80	STK4392	£7.50	TA7640AP	£1.75	BU208D	£1.80
AN5722	£1.60	BA314	£2.20	HA11221	£2.75	LA4032P	£1.90	M51514	£1.95	STK4803	£8.50	TA7658P	£1.75	BU326A	£1.95
AN5730	£1.85	BA318	£1.50	HA11223W	£3.80	LA4100	£1.20	M51515BL	£2.50	STK4833	£9.50	TC9106BP	£4.95	BU500	£1.80
AN5732	£1.85	BA328	£2.50	HA11225	£1.95	LA4101	£1.00	M51516BL	£2.80	STK4843	£8.95	TD62105P	£3.50	BU508A	£1.80
AN5750	£3.75	BA333	£1.50	HA11226	£4.50	LA4102	£1.40	M51517L	£2.80	STK5211	£6.75	TDA1010A	£2.25	2N3055	£0.50
AN5753	£1.95	BA335	£3.60	HA11235	£2.30	LA4110	£1.75	M51518L	£2.20	STK5315	£6.75	TDA1011A	£2.50	2N3773	£1.50
AN6250	£2.30	BA340	£2.50	HA11251	£2.75	LA4112	£1.75	M51521L	£1.90	STK5324	£5.75	TDA1074A	£2.75	2SA733	£0.40
AN6326N	£3.70	BA343	£2.75	HA11401	£2.80	LA4120	£2.95	MB3705	£1.80	STK5325	£6.75	TDA1151	£1.20	2SA1104	£2.50
AN6327	£4.75	BA402	£0.95	HA11423	£4.75	LA4125	£2.20	MB3712	£1.50	STK5421	£6.50	TDA1170N	£1.50	2SA1106	£2.75
AN6328	£4.20	BA403	£1.95	HA11440	£3.95	LA4126	£2.60	MB3713	£1.60	STK5451	£6.75	TDA1170S	£1.50	2SB536	£0.95
AN6330	£2.95	BA511A	£1.85	HA11701	£3.50	LA4137	£1.95	MB3714	£2.95	STK5471	£6.50	TDA1510	£4.50	2SB546A	£1.50
AN6340	£7.85	BA514	£1.90	HA11703	£4.50	LA4140	£0.90	MB3722	£3.50	STK5476	£6.75	TDA1515	£4.50	2SC461	£0.35
AN6341N	£4.00	BA516	£1.90	HA11704	£5.20	LA4145	£1.70	MB3730	£2.50	STK5720	£6.80	TDA1515A	£4.50	2SC1364	£0.50
AN6342N	£2.50	BA521	£1.80	HA11705	£6.95	LA4160	£2.40	MB3731	£3.50	STK5730	£4.25	TDA1908A	£1.75	2SC1942	£2.95
AN6344	£4.75	BA524	£2.75	HA11706	£4.75	LA4170	£3.50	MB3756	£2.60	STK7216	£6.50	TDA2002	£0.80	2SC1969	£1.75
AN6350	£7.50	BA526	£3.50	HA11710	£3.75	LA4178	£2.50	MB3759	£2.30	STK7308	£5.95	TDA2003	£0.90	2SC2166	£1.00
AN6356N	£3.85	BA527	£1.75	HA11711	£9.50	LA4182	£2.20	MB8719	£3.85	STK7404	£6.95	TDA2004	£2.20	2SC2580	£2.75
AN6357N	£4.95	BA532	£1.60	HA11713	£6.50	LA4183	£2.95	STK011	£3.95	STK8250	£8.95	TDA2005	£2.75	2SC2581	£2.95
AN6360	£4.50	BA536	£2.50	HA11714	£5.95	LA4192	£1.95	STK014	£7.25	STK8250II	£10.75	TDA2006	£1.50	2SC3156	£3.50
AN6362	£5.50	BA546	£2.20	HA11716	£4.75	LA4201	£1.60	STK015	£5.20	STR380	£5.80	TDA2020	£1.50	2SD401A	£1.50
AN6363	£8.50	BA547	£2.50	HA11717	£5.75	LA4220	£1.50	STK016	£6.25	STR440	£5.80	TDA2030	£1.50	2SD1398	£2.50
AN6371	£4.25	BA612	£1.80	HA11718	£4.75	LA4230	£2.25	STK025	£7.50	STR441	£5.80	TDA2170	£2.75	2SD1453	£1.85
AN6387	£5.95	BA631A	£5.75	HA11724	£9.25	LA4420	£1.75	STK043	£10.50	STR451	£5.80	TDA2581	£2.50		
		BA656	£4.50	HA11727	£6.50	LA4422	£1.75	STK077	£6.50	STR2012	£6.75	TDA2611A	£1.35		
		BA843	£4.50	HA11745	£9.00	LA4430	£1.50	STK078	£6.75	STR4090	£6.75	TDA2653A	£3.80		
		BA1310F	£1.75	HA11747	£9.50			STK080	£7.50	STR4211	£6.75	TDA3505	£5.20		

T. POWELL

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

VIDEO HEADS

JVC/FERGUSON 3HSS	£16.00
PANASONIC 4HSS	£16.00
HITACHI VT11/14/33	£21.00
HITACHI VT5000	£22.00
HITACHI VT8000/9000	£21.00
HITACHI VT7/17/19	£38.00
SHARP Most models not 6300/7300	£22.00
SANYO VTC5000	£36.00
AMSTRAD/SAISHO	£22.00
SONY DSR36	£20.00
TOSHIBA 9600	£23.00

VIDEO SPARES

JVC Idler PU47752	£4.95
JVC Pinch Roller	£2.95
HITACHI Idler VT11-14-17	£1.75
HITACHI Idler Play VT8000	£2.75
HITACHI VT8000 Idler F/F/Rew.	£1.85
HITACHI VT9000 Play Idler	£2.95
HITACHI Pinch Roller 8000/9000	£2.95
SHARP Play Idler	£1.95
JVC Drum Motor	£22.50
SANYO Capstan Motor	£29.50
SANYO Reel Motor	£8.00
SANYO Reel Drive Pulley	£5.00
SANYO Pinch Roller 5000/5300	£5.95
SANYO Pinch Roller 9300	£4.95
SONY Capstan Motor 1100	£28.75

ENQUIRIES OTHER ITEMS

UNIVERSAL TRIPLERS £5.50

CASSETTE MOTORS

6-9-12-13.2 Volts C.W.	£3.45
12-13.2 Volts C.C.W.	£3.45

CASSETTE HEADS

Mono	£1.50	Auto Rev.	£2.75
Stereo	£2.50		

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.

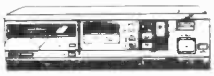
VISA/ACCESS ACCEPTED MIN. TELEPHONE ORDER £5.00

SETS & COMPONENTS

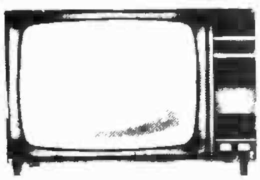
OCHRE MILL TECHNICAL SERVICES. Are now on 0666 (Malmesbury) 823228. Grundig TV spares all models to 1983. Fast friendly, helpful service, sensible prices. Gt. Lype Farm, Charlton, Nr Malmesbury, Wilts SN16 9DR.

LINCOLNSHIRE AREA

FED UP WITH TRAVELLING FAR AND WIDE FOR YOUR EX-RENTAL TV AND VIDEO'S?



THEN WHY NOT TRY US FIRST?



BUDGET TV

Unit 4,
Exchange Road
Lincoln LN6 3JZ
Tel.
Lincoln 500413

JOMILL ENTERPRISES

173 Dalston Lane, Hackney, London E8
Tel: 01-533 2229

VHF/UHF TELEVERTAS £14.50 TRADE ONLY. Quantities P.O.A. ceramic filters for UK and export conversion NTSC decoder for replacement of chip TDA3560/1 £47.50 add cost of posting and packing. All prices plus VAT.

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 £8.50 per single column centimetre (minimum 2.5cms). Classified advertisements 55p per word (minimum £10)

WIZARD DISTRIBUTORS MANCHESTER

TV & VIDEO SPARES

We stock spares for PHILIPS, PYE, RANK, GEC, SHARP, SONY, HITACHI, SCHNEIDER, HINARI & DECCA
And also THORN & 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
VIDEO HEADS	TELEPHONE ACCESSORIES

Counter open Monday-Friday 9am-4.45pm
Mail Order-Access/Visa

TRADE ONLY

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

PANASONIC'S ETC.

EXAMPLES

TC2205 remote	£50
TX2200 22 inch text	£110
NV333 elect. Video	£90
Slim front loaders	£105

Superb and working
Many other models/makes
More profit, less headaches
Regular supply – Quality Discount

Repossessed TV Centres Ltd
Daisy Works
345 Stockport Road,
Longsight, Manchester.
(A6 between M/c and Stockport)
Mr Poole or Mr Ricketts
Tel. 061-273-2854/274-3409

T.V. SPARES, PANELS AND MANUALS PHILIPS

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

Colour TVs from *Clean and tidy* **£5 each**

G11s 20" 22" & 26" FROM **£12**

KT3 FROM **£25**
Philips and Pye types

Teletext FROM **£30**

Always around 200+ fully working colour TVs and Videos available. All in clean condition and ready for immediate sale or rent.

Phone us for models available today.

Cash sales only
Prices based on quantity plus VAT

Video 2000 system FROM **£15**
Phone for availability

Video Beta FROM **£8**

VHS Video FROM **£20**
Spares machine electronic

Electronic VHS FROM **£50**
Various makes — changing daily

GENERAL FACTORS

UNION STREET, DONCASTER, SOUTH YORKS
Excellent motorway access from M1, M18, A1M

0302-349583

(24 hour Ansaphone Service)

SERVICE PAGES

box number £1.00 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 2331, IPC Magazine Limited, Kings Reach Tower, Stamford Street, London SE1 9LS. (Telephone 01-261 5942).

SUFFOLK TV & VIDEOS

Large stocks always available

GEC, Fineline KT3, KT30, Hitachi, Nat Pan, working stocks in our showroom from **£20.00.** Text **£85.00** with handset.

0394 670115

Bridge Road, Felixstowe, Suffolk 1P11 7FL

COLOUR TV's FROM £5
VHS VIDEOS FROM £20
BETA VIDEO £10

BUDGET TELEVIDEO
HERNE BAY (0227) 740240

D.I.Y. SCRATCH REMOVAL + TUBE POLISHING KIT

First class results can be obtained every time with this kit. The kit, which comes with full instructions is especially useful on ex-rental work for those sets with excellent cabinets and good but scratched tubes which may be had at very much reduced prices. The kit could pay for itself with your first job!

£36.00 + £2.50 pp **Electric drill required**

PC TV SERVICES

8 ORCHARD CLOSE Tel. 0920 871474
Stanstead Abbotts, Herts SG12 8AH

★ MAIL ORDER ★
★ CALLERS STRICTLY BY APPOINTMENT ★

NEW FERGUSON SPARES, original Ferguson heads £10.50, 3V23 original handsets £16.00 plus many other items e.g. idlers etc. Ring for details 0532 444195 prices exclude VAT.

RCS VARIABLE VOLTAGE D.C. BENCH POWER SUPPLY

1 to 24 volts up to ½ amp. 1 to 20 volts up to 1 amp. 1 to 16 volts up to 1½ amps D.C. Fully stabilised. Twin panel meters for instant voltage and current readings. Overload protection.

Fully variable. Operates from 240V A.C. Compact Unit: size 9×5½×3ins.

£39 incl. VAT + Post £2

RADIO COMPONENT SPECIALISTS

ACCESS — 337 WHITEHORSE ROAD, CROYDON SURREY, U.K. Tel: 01-684 1665 — VISA

List, Large S.A.E. Delivery 7 days Callers Welcome Closed Wednesday

MERSEYSIDE & NORTH WEST DEALERS
TRADE WORKING PRICE LIST

STANDARD	
DECCA 80 · 100 · Mk III	£15.00
ITT 32 · 45	
G11 PHILIPS	£16.00
G11 PYE + GEC PIL	£18.00
K30	£25.00
PAN 2205	£25.00
ITT TRIMLINES	£35.00
MANY OTHERS AT	£10.00
REMOTES	
Mk III	£20.00
G11	£25.00
ITT TRIMLINES	£35.00
K30	£35.00
TEXT	
PAN 2285	£80.00
G11 IR	£70.00
ITT TRIMLINES	£80.00
Mk III	£70.00
Mk IV	£80.00

DISCOUNT TV SERVICES
29 CHURCH ST., RUNCORN
Tel: (0928) 577203

Thorn 3000/3500
Thorn 9000
UNIVERSAL
1 year guarantee

TRIPLERS £4.95 inc. p&p

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

WING ELECTRONICS

15 Waylands, off Tudor Rd., Hayes End, Middlesex

SALE SALE SALE SALE SALE SALE SALE

INDEPENDENT TELEVISION & VIDEO COMPANY

SUPER SPRING SALE — SUPER SPRING SALE

WE HAVE A LARGE SELECTION OF EX-RENTAL TELEVISION & VHS VIDEO RECORDERS. TESTED TO A VERY HIGH STANDARD AT THE LOWEST PRICES POSSIBLE

GET INTO SPRING 89 WITH EXCELLENT STOCK

WE'VE CHECKED THE REST NOW VISIT THE BEST

BEAT THIS

FERG TX TESTED £35 —	**VHS VIDEO TESTED £75**	**TOSHIBA TESTED £40 —**
IN-LINE TESTED CTVs £18 —		**CTVs FROM £5 —**
KT3 TESTED £35 —		**LARGE SELECTION OF TELETEXT T.V.'s AVAILABLE**

MANY MORE LATE TVs TO CHOOSE FROM

WE ARE EXPERIENCED AND CURRENTLY EXPORTING REFURBISHED TELEVISIONS & VIDEOS — ENQUIRES WELCOME C.I.F. & F.O.B. PRICES
TELEX 378414 BLBIRDG — FAX 0602 861027
NO ONE's OR TWO's — BULK PRICES
ALL PRICES ARE SUBJECT TO 15% V.A.T.

NOTTINGHAM
(10,000 SQ. FEET WAREHOUSE)
UNIT 3-3A MEADOW TRADING EST.
MEADOW LANE
NEAR NOTTS. COUNTY FOOTBALL GROUND
IN NATIONAL TYRE YARD, NOTTINGHAM NG2 3WQ.
TELEPHONE: **(0602) 864627**

SHEFFIELD
(6,000 SQ. FEET WAREHOUSE)
2 MIN FROM JUNC. 34 OF THE M1
UNIT 17, MEADOWHALL TRADING EST.
27 AMOS ROAD, SHEFFIELD 4
TELEPHONE: **(0742) 422633**

FOR SALE

EX GRUNDIG POWER SUPPLIES 0-15 volt 1.5 amp. Cased with meter/overload protection £14.95 inc p&p. ISOLATION TRANSFORMERS 240 volt 300 watt £6.95 inc p&p. SAE for lists. S.H. ELECTRONICS, 5 St Josephs Park, Ballycruttle, Downpatrick BT30 7EN.

FREE BAGFULL COMPONENTS with 26 page Components Catalogue. Including valves (rare & modern). SAE: KENZEN (TV), Unit 9, 16/20 George Street, Birmingham BL2 9RG.

TWO DC-15MHz OSCILLOSCOPES. Solatron CD1400 and Telequipment D43. Both with service data and working to specification. £75 each. Farnham (0252) 711060.

TEXTRONIX OSCILLOSCOPE 465/B. 475 dead? free quotation. Same bought for cash. Phone 0793 528383

REPAIR SERVICE

AVO'S OSCILLOSCOPES & TEST EQUIPMENT Repaired. Manuals available. J.R. COAD ELECTRONIC SERVICES Phone 01-340 0230.

METERS

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

SERVICE SHEETS

ACCESS **TECHNICAL INFO SERVICES (T)** **MASTERCARD EUROCARD**

76 Church St., Larkhall, Lanarkshire ML9 1HE

Phone 0698 884585 Mon-Fri 9-5, 0698 883334 any other time FOR FAST QUOTES

IMMEDIATE DESPATCH of all Phone Orders by ACCESS, etc. or to Listed Customers

WORLD'S LARGEST COLLECTION OF SERVICE MANUALS . . . from £3.50 to £50 . . . Most unobtainable elsewhere

Every issued FULL SIZE SERVICE SHEET in stock; CTV's or Combinations £3.50/Singles £2.50; Plus LSAE

LSAE for any Quotation, plus FREE large Catalogue, STREE Review, Pricelists, etc.

Almost any original Video Service Manual from J.V.C. or Siemens at £15 each

A small selection from titles in stock . . . many only obtainable from TIS via mailorder POST FREE:

Practical TV Repairs by Tunbridge	£12.95	Newnes Guide to TV & Video Technology	£8.95
Mobile Radio Servicing Handbook	£25.00	IEE Wiring Regs Explained & Illustrated	£7.95
Practical Radio, Repair & Service Course	£9.95	Servicing Personal Computers by Tooley	£20.00
Video Recorders, Servicing by Beeching	£20.00	Spectrum Repair & Service Guide	£5.00
Oscilloscopes, How to Use/How they Work	£6.95	Servicing Radio, HiFi, TV Eqpt by King	£9.95
Servicing Mono Portable TV by Wilding	£20.00	Video Techniques 2nd ed by G White	£30.00
Computer Engineers Pocketbook	£9.95	Refrigeration & Air Conditioning	£7.95
1987 Brit CTV Repair Manual by Tunbridge	£8.95	Domestic Eqpt Repair & Service	£16.95
Principles of Compact Disc	£2.95	VHS Common Faults	£3.50
The PAL System from Thorn Research	£6.50	Practical Transistor (Clearance offer)	£1.95
Audio & HiFi Engineers Pocketbook	£9.95	TV & Video Engineers Pocketbook	£9.95
Questions & Answers on Radio Repair	£4.95	Audio Equipment Tests by King	£12.95
Video Service Manuals	each £15.00	Colour TV Service Manuals	each £9.50

Integrated Circuits Technical Data Manuals **from £5 to £7.50 each,** full list on application

12 Big Colour TV Repair Manuals covering the British & many Foreign from 1970 to 1988	£99.95
20 Fault Finding Booklets covering most Videos from 1979 to 1986 to match circs below	£48.00
The Set of Thorn's own 10 Video Circuit Description Manuals from 3V00 to 3V43	£40.00
10 Giant Binders containing Circuits & Layouts for Brit & Foreign CTV from 1974-1989	£225.00
4 Giant Binders containing Circuits & Layouts for most Videos from 1979 to 1986	£95.00

Send now for

Full details of our Famous Complete Integrated Repair Systems for TVs, Videos & Domestic Equipment

These systems contain all the circuits & data needed to cover repairs and servicing for anyone in business or wishing to start up their own business. All the Diagrams, Repair, Service & Technical Data needed. At a fraction of the normal cost of buying such data. Terms are also available.

The Circuit/Layout Set for almost any Video . . . £7 each, CTVs . . . £4 each

For £3 . . . Comprehensive Service Manuals & Sheets Catalogues PLUS 1988 Chassis Guide & £4 Vouchers

WORKSHOP SERVICE MANUALS

Video Recorders – £12.50

Most other equipment, Colour Television, Mono, Audio, Music Systems, Test Gear, Vintage Valve, Military surplus etc. etc. £6.00.

Please state Make/Model/Type with order.

Most available from stock or obtainable to order.

FREE Catalogue Unique Repair and Data Guides with all orders or LSAE for your copy.

MAURITRON ELECTRONICS (TV)

8 Cherry Tree Road, Chinnor, Oxon. OX9 4QY.

Telephone: (0844) 51694

SERVICE MANUALS

VCR – CTV – MTV – AUDIO etc.

Examples – VCR

VSP10X = Saisho VR1200HQ/Matsui VX820	£12.75
Memorex VR1200/Casio VCR6500 – Daewoo VCR30/50 – Funai VCR4000	£14.75
Sharp VC581-582-583-585 – VC.5F3	£10.50

CTV manuals for

NEC/Loewe/Metz/Seisho/Casio Orion/Otake/Admiral etc. **from £4.50**

Manuals for many other makes and models well known or obscure – some unobtainable elsewhere.

Prices are all inclusive. No VAT or P/P.

For list send £1.00. No SAE required.

DATA-GO 112 AMEYSFORD RD., FERNDOWN, DORSET BH22 9QE. Tel: 0202 894207

GERMAN SERVICE SHEET SPECIALISTS

Our connections are world-wide. We furnish any kind of German, European and Japanese service sheet or manual. Thousands of different sheets and manuals in stock. For any enquiries:

DÖNBERG ELECTRONICS

Schoolmasters House, Rannafast, Co. Donegal, Republic of Ireland.

Phone: 075 48275

BOOKS AND PUBLICATIONS

Satellite TV Installers

"Well produced and extensively illustrated ... a thorough, practical guide ..." **TELEVISION**

"... an invaluable guide ... takes the reader methodically through how systems work and are installed ... in our opinion, this is a most valuable reference book ... We highly recommend it ..." **INDEPENDENT ELECTRICAL RETAILER**

"... presented in an approachable and understandable way ... plenty of easy to follow illustrations ... adopted by the Confederation of Aerial Industries as the study manual for approved City & Guilds courses ..." **WHICH SATELLITE**

"... Covers all practical aspects of getting direct-to-home satellite pictures ... written specifically for European installers ... includes angle settings covering the whole of Europe." **ELECTRICAL RETAILING**

'Satellite Television-Installation Guide'

by John Breeds. Price **£11.95**

p&p paid UK (Europe+£1.00)

Swift Television Publications, 17 Pittsfield, Cricklade, Swindon, Wilts. SN6 6AN.

BUSINESS FOR SALE

TV/VIDEO/AUDIO Retail and Repair Business, West Yorks area. Ill health forces sale. Offers. Telephone 0924 363143.

TELEVISION REPAIR SHOP/FLAT for sale. East Birmingham, including stock, carpets. £48k. Tel. 021 786 1969 evenings.

TV/VIDEO/AUDIO BUSINESS in Thornton Heath, Surrey. Large shop/workshop on main road. Location needs vigorous management to increase turnover. No debts. Rent £7,150 p.a. 7 years lease £35,000 secures all. Tel: 01-684 7313.

Ku BAND SATELLITE TV THEORY, INSTALLATION AND REPAIR

This 383 page manual by Baylin & Gale of USA covers dish theory, uplinks, footprints, site survey, installation and adjustment, descrambling, cable TV, even includes a computer program for finding your satelite. Second Edition **£23.**

SATELLITE AND CABLE SCRAMBLING AND DESCRAMBLING. Basic theory. 2nd Ed. 280p	£19
VIDEO SCRAMBLING & DESCRAMBLING. Advanced theory and circuits, 246 pages by Graf & Sheets	£21
EUROPEAN SCRAMBLING SYSTEMS. Circuits, Tactics & Techniques, by J. McCormac, fascinating information for the service engineer	£29
HOME SATELLITE TV INSTALLATION VIDEOTAPE, 40 minutes. VHS PAL	£27
HIDDEN SIGNALS ON SATELLITE TV. Teletext, telephone channels, teletype	£20
SATELLITE, OFF-AIR & SMATV. By F. Baylin	£25
WORLD SATELLITE ALMANAC. All footprints, 650 pages, second edition by M. Long	£32
COMMUNICATION SERVICES VIA SATELLITE. By G.E. Lewis. Microwave, TVRO, Encryption	£45
SATELLITE TV INSTALLATION GUIDE. 2nd edition by John Breeds	£12.00

Price includes P&P UK. Airmail Europe £2. Outside Europe £6.00 extra per item.

Pay by cheque, ACCESS MASTERCARD, or COD J. VINCENT TECHNICAL BOOKS,

24 RIVER GARDENS, PURLEY, READING RG8 8BX. TEL: 0734 414468 (Answerphone)

FOR VALES, SERVICE DATA, Amplifiers and Radios. Try the Vintage Wireless Co. First send for free information package. 1989 Catalogue available April £4.00. Cossham Street, Mangotsfield, Bristol BS17 3EN. Tel. 0272 565472.

THE DOMESTIC VIDEO RECORDER SERVICING BOOK

3rd EDITION IN HARDBACK
— THE ENGINEERS BIBLE —

With chapters on Hi-Fi, Digital Servos, Fieldstores, Luminance & Chrominance Signal Circuits, CCD's, Camcorders, 8mm, S-VHS & VHS 'C' Formats, Auto Focus Systems, Camera Signal Processing.

A MUST FOR ALL VIDEO REPAIRERS AND STUDENTS.
THE COMPLETE REFERENCE TO VIDEO CIRCUITS.

ORDER YOUR COPY NOW
(while stocks last)

£21.00 inc. P&P (UK + N.I. only)
From: NEWARK VIDEO SERVICES
GROVE FARM ESTATE, LONG LANE,
BARNBY-IN-THE-WILLOWS, NEWARK,
NOTTS. NG24 2SG.
Access & Visa

Tel. 0636 84327.

The Theory and Practice of PAL Colour Television in three important Video Cassette Programmes

Part 1.
The Colour Signal
Part 2.
The Receiver Decoder
Part 3.
Receiver Installation

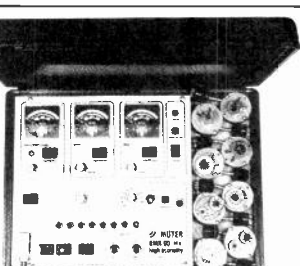
VHS★★★V2000★★★
BETAMAX★★★UMATIC

For full details telephone
0253 725499 (Day)
0253 712769 (Night)
Or send for precise details
FLINTDOWN CHANNEL 5
339 CLIFTON DRIVE SOUTH,
LYTHAM ST ANNES FY8 1LP
(encloding this advert)

NAME..
ADDRESS..
....TEL:....................

MÜTER BMR

NEW
BMR-90-Hi-Ec



Europe's most frequently bought CRT-Regenerator-Analyzer; pays itself within 4 weeks; regenerates picture tubes even better; removes shorts filament-cathode, cathode - grid 1, grid 1 - grid 2; carries gas to getter; 131 adaptors available; has 11 heating-voltages; new adaptor-list with more than 8000 tubes-types; also available: BMR 107 Regenerating-Computer and BMR 44 Regenerating-Automatic-Machine. Please, ask for catalogue.

BLENDOWN LIMITED, Bank House, 17 Rhos Road, Rhos on Sea, Clywd, Wales
Fax No (0492 47880) Phone 0492-49246

SITUATIONS VACANT

In-House Engineering Excellence

Bring your Bench Engineering skills to a more progressive technical environment

- *Comprehensive delivery, installation and repair service to a number of leading electrical retail clients including Rumbelows.*
- *Young, progressive and fast-growing company*
- *A team of 400 skilled engineers*
- *Nationwide network of service centres*
- *Advanced workshop and bench facilities*
- *Varied and stimulating work on the widest range of products*
- *Sophisticated in-house computer support systems*
- *Integral part of the Thorn EMI Group.*

Based at the Oxford Centre, you will use the very latest engineering technology in carrying out the more complex service and repair jobs on the variety of electrical goods returned to the centre. Industrious, reliable and thorough, you will be able to manage your time well and work confidently on your own initiative.

A C&G in Electronic Servicing or the equivalent is a pre-requisite together with substantial experience in either colour T.V. and video, or audio. A clean driving licence would also be advantageous.

With Solutions you can look forward to an attractive salary and a generous set of benefits which includes staff discount, 4 weeks' holiday and a contributory pension scheme. Plus, of course, the outstanding opportunities you will enjoy at a company with our outlook and stature, an important part of the internationally renowned Thorn EMI Group.

S·O·L·U·T·I·O·N·S
ELECTRONIC SERVICES
We have the answer

Bring your skills to where they'll work hardest for you by calling Colin Smith on 0865 340995, Oxford Service Centre, Tower Road, Berinsfield, Oxford OX9 8QF.

TV SERVICE ENGINEERS

Due to our involvement in satellite TV, we urgently require experienced bench and field TV engineers. Bench engineers will work in fully equipped workshops in Mitcham and field engineers service areas in Greater London and home counties. Top salaries are offered and a 'better-than-average' estate car provided for field engineers. Existing holiday arrangements will be honoured.

Write or telephone:
Dennis Fairweather,
Triadcolour TV Service Limited,
189/191 London Road,
Mitcham, Surrey CR4 2JB
Telephone: 01-640 5521/2

Triadcolour TV SERVICE LTD

RING NOW FOR FURTHER INFORMATION ON SERIES DISCOUNTS AND CURRENT RATES

TV & VIDEO ENGINEER

Required by a small independent business situated in a small rural town in

ALBERTA, CANADA

The applicant must be flexible, have City & Guilds qualifications or the relevant experience. A work permit is available.

For further details concerning job description, the attractive salary etc please apply to:

WAINWRIGHT TV & VIDEO SERVICES
F.A.O. MR. M. JORDAN,
BOX 1574, WAINWRIGHT,
ALBERTA, CANADA T0B 4P0

SKILLED TECHNICIAN WANTED. Good pay rates apply. JOMILL ENTERPRISES, 173 Dalston Lane, E8. Tel. 01-533 2229.

Access

MIDLAND TELEVISION

BARCLAYCARD VISA

QUALITY SETS SINGLES OR QUANTITY SUPPLIED AT THE BEST PRICES

C.T.V.

Phillips	Non Working	Working
KT3 Basic	£15.00	£25.00
K30 Basic	£20.00	£30.00
KT3 Text	£50.00	£68.00
KT30 Text	£55.00	£75.00

BUSH		
T20, T22, T24, T26	£10.00	£20.00

THORN		
8800	£5.00	£9.00
9000 R/C	£12.00	£18.00
9600 R/C	£14.00	£20.00
TX9-TX10 Basic	£25.00	£35.00
TX9-TX10 Text	£55.00	£70.00
TX9-TX10 R/C	£30.00	£40.00

VHS

Ferguson	Non Working	Working
3V23	£55.00	£80.00
3V30	£55.00	£80.00
R/C 3V31	£60.00	£85.00
R/C 3V35	£65.00	£90.00

SHARP, HITACHI, ETC FROM:
Non Working £55.00, Working £80.00

Buy 15 or more of any item and receive 10% reduction

i.e. 15 × 3V30 in full working order £72.00 each + VAT

TRADE REPAIR SERVICE
CTV & VHS Securicor collection & delivery available. Also panel exchange service – ring for details.

ALL REMOTE & TEXT SETS SUPPLIED WITH HANDSETS

15 MIN M1 JUNC. 22
Nationwide Delivery Service Available
UNIT 11, MARKET STREET, COALVILLE, LEICESTERSHIRE
TEL: 0530-810836/7

ALL PRICES SUBJECT TO VAT AT 15%

FOR FURTHER DETAILS CONTACT CLASSIFIED ON 01-261 5942

AERIALS

SATELLITE TV RECEPTION EQUIPMENT

LNB's, Receivers, Dishes, polar mounts and accessories

Japanese LNBS from	£95 00
Japanese RX from	£169 00
Ku Band feedhorns from	£5 99
'F' Connectors only	0 20
'N' – 'F' Adaptors only	£1 40
10db line ampls only	£12 00

Prices excl VAT SAE for leaflets

DX ANTENNA

KESH ELECTRICS LTD.
Main St., Kesh, Co. Fermanagh, N.I.
Tel: 03656 31449 Tlx: 747412

WANTED

SURPLUS/REDUNDANT ELECTRONIC COMPONENTS WANTED

I/Cs – Tuners – Transistors – Valves – Diodes etc, any quantity considered – immediate payment.

ADM Electronic Supplies
Tel. 0827 873311. Fax 0827 874835

STOCKS ARE GETTING LOW ORDER NOW

1987-88 TELEVISION SERVICING BOOK

80 colour TV circuits condensed down to a manageable 3 kilos

Apart from essential circuitry we have included setting up information fault finding trees, oscilloscope readings etc.

Printed on big A4 keep clean glossy pages, which then open up each side to even bigger A3 (no split circuits)

Then superbly presented in a maroon and gold top quality hard cover with a main index covering 100s of models brought out since January 1987.

The book has been produced with the invaluable help of the following manufacturers and contains the number of circuits below. *Covering over 400 models.*

AMSTRAD	1	HITACHI	3	SALORA	3
FERGUSON	3	ITT	9	SAMSUNG	4
FIDELITY	6	MITSUBISHI	2	SANYO	5
FINLUX	1	N.E.C.	2	SHARP	5
FISHER	1	NIKKAI	5	TATUNG	2
GOLDSTAR	3	PANASONIC	7	TOSHIBA	7
GRUNDIG	7	PHILIPS	5		

Plus references to: AKAI, BOOTS BRAND, ETRON, G.E.C., KINGSLEY, LUXOR, MURPHY, OLYMPIC, PYE, REDIFFUSION, SOLAVOX.

To order send £55 which includes packing:

INTERNATIONAL STANDARD BOOK No. IS: ISBN 0 9513897 OX

1987-88 VIDEO SERVICING

OUT THIS SUMMER

NEW - REGUNS - USED

TUBES

F.S.T.s PORTABLE 14" & 16"
PLUS ALL OTHER SIZES

BROKEN TUBE WE CAN HELP

RADIO TELEVISION SERVICING

76-77-77-78 £19 79-80 £19
84-85 £29 85-86 £25

INCLUDES DELIVERY

JVC/FERGUSON UNIVERSAL NEW THORN

VIDEO HEADS £14.75

PLUS VAT = £16.96 each

ONE YEAR GUARANTEE

INCLUDES POST & PACKING

ALL OTHER MAKES RING

U-VIEW

29 WARMSWORTH ROAD, DONCASTER, YORKSHIRE, ENGLAND DN4 0RP.
0302 855017 7 DAYS

INDEX TO ADVERTISERS

Hill Intercom £10

Philips small stereo headphones £2.50

Rank UHF 4 push button tuner £4

GRC power supply PC743B £10

Rank front panel Z950 £5

GEC IF tuner panel PC786B £12.50

Rank IF 742 £3

TX10 8 Button Unit £10

6 Button Unit Rediffusion Mark 3 £5

Rediffusion Mark 4 & 7 Push Button unit £10

Tuner IF Cans ITT CMR200 £10

ITT SEL HF Modul 2 UK IF Tuner £8

4 types of front panels Fidelity 2000/3000 types £5

CVC20, CVC32 I.F. CVC40 Cans £5
CMR800/3 NEW £20

CMR800/3 £20
CMR803/2 £20

20AX Line lin coil 50p

GEC switch mode trans 20AX
ITT mains CVC9 to CVC33 print type 60p

ITT 2,800 mains remote switch 50p

NEW

2110 GEC Sound O/P Panel £1

2110 GEC L.O.P.T. Panel £6

2110 GEC Power Panel £5

Line o/p frame panels GEC 20AX £10.00

ITT CVC40 Push Button Unit & Mains Switch £12

Tuner & IF Panel. Complete 6 button and preset IF with s/wave filter and tuner. Mullard M342 5"×6½" £6.00

POTS

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
TA 7265	£3
TA 7699P	£3

The Service Engineers Guide to Teletex £2

4 Types Fedility front panels with i.c. & pats £2 each

BB 103	10p
BB 105A×12	£1
BB 105B×12	£1
BB 105G×12	£1
BB 121a	10p
47	10p each

1A/1600V 10p

DG3P EQV-BY228 10 for £1

2 amp bridge rec. wire end 15p

SKE4G2/02 15p
Eqv. BYX71/600 500ns.

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.	
STR454	£2
STR6020	£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	60p
BU 205	75p
BU 206	£1
BU 207	£1
BU 208	80p
BU 208A	75p
BU 208D	90p
BU 222	£1
BU 326	£1
BU 407	60p
BU 426A	45p
BU 426V	60p
BU 500	£1.10
BU 500D	£1
BU 508A	90p
BU 508V	£1
BU 705	£1
BU 807	£1
BU 824	50p
BUT 11	50p
BUT13 600V-28A	£1
BUW 11	50p
BUW 84	60p
BYW 20-08-9	£1
BYW 95	10p
BUX39 25A-150V	£1
BUX84	50p
BUX85	50p
BUY49	20p
TIC 106a	30p
TIC 116m	30p
TIC 116n/Y 1003	30p
TIC 126N	30p
TIC 225S	30p
TIC 226E	30p
TIC 226m	30p
TIC 236m	30p
TAG 226/600	30p
TICV 106D	
(T092 case 2A/400V)	10p
TIP 29	25p
TIP 30	25p
TIP 30A	25p
TIP 30B	25p
TIP 30C	25p
TIP 31	25p
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 41	15p
TIP 41B	40p
TIP 41D	70p
TIP 42	10p
TIP 42/BRC 6109	10p
TIP 48	40p
TIP 49	30p
TIP 57	30p
TIP 110	20p
TIP 100	30p
TIP 102	30p
TIP 115	50p
TIP 117	50p
TIP 125	35p
TIP 126	40p
TIP 127	40p
TIP 130	30p
TIP 131	6p
TIP 136	30p
TIP 140	50p
TIP 142	80p
TIP 640	50p
TIP 2955	35p
TIP L761A-1000V/4Amp	75p
T 6032	30p
T 6036	40p
T 6040	40p
T 6047	40p
T 6049	40p
T 6051	40p
T 6052	40p
T 6054	40p

T 9004	40p
T 9005	40p
T 9051V	£1.00
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
300M + 700 320V	£1.80
200 + 100 + 100 + 50 300V	50p
150 + 200 + 250M 300V	50p

Computer Transformer 20v/2.25A; 20v/1.5A; 17/.5A; 19/.5A; 28/.05A £3

OLD TYPE TEX. I.C.

TX004F	£3.50
TX005GN	£3.00
TX904	£3.00
X908	£4.00
MM2102AN	£2.00

Voltage Regulators

+5V/UA78PO5SC	30p
−8V/79M08c	30p
+6V/78M06c	30p
+10v/78LA10	20p
LM 317T	30p
LM 337	30p
LM 342/18	30p
LM 340T 5.0	50p
+12V/LM 340T12	50p
+18V/MC78M18	20p
+24V/78M24	30p
MC 7724cp	40p
MC 7824	40p
TIS 90	10p
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	10p
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
BYW 29/50	15p
BYW 95C	10p
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

Infra red led LD57CA 15p
15K-20 turn pots 20p
Thorn 3500 2A cut out 50p

BBH/SAFETY MAINS ISOLATING TRANSFORMER
250V-250V/A £10

BRIDGES

KBL 005	30p
KBL 02	30p
KBP 04	30p
W02	15p
W004	15p
W005	20p
800V Bridges 2½ Amp	30p

MAINS MICRO SWITCH
GEC & Double etc. £1

Varta Batteries 2.4V 100M/A 50p

TV Battery 50p
1.2V NC. 2.4V NC. each

4 amp-1.2V Nickel Cadmium Battery D Cell £1.00

3.25V Battery 50p
12V Video Battery Packs 4Amp U2 Cells £10

24V 4Amp (100VA) Trans £4.00

Mains 240V (100VA) to 240V out fully shrouded £5.00

ITT CVC45 8 way resistor unit for v/cap £3

CVC40 8 button unit with mains lead & slider pots with sockets £10.00

Book on An Introduction to Satellite TV £5.95 No VAT

Book TV DX Handbook by R. Bunny £5.95 No VAT

Electronics Hobbyists Handbook £4.95 No VAT
Hills £4.50

NI.CD 5 Hours Battery Charger with battery test £6

Hill Deluxe Universal Ni-Cad Charger £6

Nickel Cadmium Battery Charger AA-C-D-PP9 £4.50

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

6 Push Button Unit for GEC 2100 Series Replacement for Touch Button Unit £8

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

PHILIPS'
MIN. HEAD PHONES
£1.50

Electronic Buzzer
6 volt, 12 volt 40p

15V, 015V, 1A £1
Print Type Trans

12v DC Relay 1½×1½×2 print type 10 amp D.P. Changeover £1

Regulated Power Supply
3-12 volts 1 amp
in box with switch and
mains lead £4

Philips' Video Cleaning Cassette SBC461 £6

Philips' Headphones
Compact Disc Stereo Type £10

ITT Display Tube 58705 50p

8 Seg Display FND500 20p

Model 3000
Pocket Personal D.M.M.
Volts range AC, DC 200M/V to 400V. Res. 2000Km £20

Export PYE731
6 Push Button unit with (UHF-VHF) band switch £4

ITT Micro Phone M5 50p with switch

1½ Volt Sub Min Relays 25p

Philips Solar Scientific
SBC1730 Calculator £12

15v-0-15v 1 Amp
Transformers £1

RGP30K	10p
RGP30G	8p
RGP10B	5p
RGP15	10p
RGP15G	6p
T6024WGI	10p
GP10	5p
GP15Q	5p
THORN RGP80G	30p
DUBLE 7 SEG Displays	15p
LN5 26RA	or 10 for £1

Multi Core £4.50
60-40 Soldar 500G 20 SWG £5.00
15 Watt Stereo Amp Sanyo Module with Data 50p

PHILIPS
25 Watt Solder Iron £4.00

Various Tools and Accessories

Self adjusting cutter stripper	£5.00
10 mixed tube bars	£4.00
5000 Diodes-Resistors	£3 pack
T/V V/Aerial 300Ω or 75Ω	£1.50
* D/P push mains switch	20p each
Mains lead & two pin socket for radio cassette	35p
T/V loop aerial	75p
Radio Telescopic Aerial	£1.00
Philips Neon Lamps for TV sets	5p
Freeze Philips	£1.20
Foam Cleaner Philips	£1.20
Contact Cleaner Philips	£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
Red E.H.T. LAED and Anode Cap	£1.00
Weller solder iron 25 watt	£4.00
Hitachi Silver Oxide Battery G13 UCC357 IEC SR44 1.5V	60p
100 Coax Plugs	£12.00
De-solder pump + 2 nozzels Philips	£4.00
Flat Red LED and Green	5p
500gm 60/40 solder reel	£6
Solder 1 kilo reel	£5.50
Dual v/u meter -20 – +10db	£1
K30 thermistor 23226298009	75p
De-solder Pump	£2.50
Portasol Flameless Gas Soldering Iron	£16.00
Green & Red, LED pack mixed	100 for £1.00
Hill Meter Leads, S/Rubber and Probes	£4.00

HILLS

Miniature Linesman Pliers £2.20 Miniature Pliers £2.20
Miniature Side Cutters £2.20 Miniature End Cutters £2.20

KT3 PANELS
Sound Output RGB Output Chroma Panel, I.F. Panel and Line OSC £7.00 each

PYE 6 Key Switch & Panel
G11 Front Panel £10

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

GEC Decoder Panel PC772A3
PC446A5 £6

12 Volt Mains Trans 500M/A £1.00

Double 1.5 Digital Display. High brightness 20p

Quantity Reductions

BY204/4	25 for £1.00
BY206	25 for £1.00
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
BF458	10 for £1.00
BF224	20 for £1.40
OA90	40 for £1.00
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 Philips	40p
GEC-Hitachi Thick Film Frame	£5

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

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
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

Red & Green LED on Panel 1p each

Mixed 100 Transistor B.F. and B.C. and PET £1.50 1000 for £10.00

12 Volt 4 Amp Video Battery Pack 10 of Type D Cells £8.50

40 glass reed switch	£1
10 press to make switch	70p
40 Pots	£1.50
With Focus Pin, 10 Tube Bases, mixed	£2.00
1,000 Diodes, Condensers, Resistors on Bandolier	£1.00
20mm Fuse Holders	
Chassis Mount	20 for £1
EHT Diodes, small	20 for £1

300 Mixed Diodes £2

100 500M/A Fuse £1
Mixed V/Cap Pots ITT-GEC-Hitachi-Philips etc, 20 for £1
ITT Mains Switch with Remont CMC113 £1

12v DC relay 1½×1½×2 print type 10 amp D.P. change over £1

SENDZ COMPONENTS
TO ORDER SEE BACK PAGE

SENDZ COMPONENTS

TO ORDER SEE BACK PAGE

Matsushita PY34220 Tuner	£7
C. Cam Decoder with TDA3591	£5
Toshiba VHF/UHF EG522F	£6
Mitsumi MEC1-F51	£5

K35 Decoder	£8.00
K35 Sound OP	£4.00
Thick Film Daughter KT3 3122-127-43891	£3
12 C H K30 Tex Rec Front Panel with I C	£5
K35 IF	£5.00

Thorn Spares

New 9000 Decoder	£8.50
9000 Frame panel	£8
9000 Cyclops panel	£1.50
8800 convergence panel	£6
8500 convergence panel	£6
4000 Power supply	£3
1600 Mains lead, switch	
T605 1vNPN 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
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
KT3 12 Push button unit	£2.00
KT3 (Export) 12 P.B.u	£2
6 Push button Unit Thorn	£1.00
6 Push button GRC	£6.00
6 Push button PYE 731	£6.00
Hearing aid unit	£3
Rank Z718 4 P/B/Unit MECH	£4
7 Button Unit GEC with Lamps	£7
697 Push Button Unit	£6.00
Z916B panel	£5.00
T513AP panel	£5.00

Plug In

K4 Focus Pot	£1.00
Fidelity Tube Base with transitor & focus pot	£1.50
Bush Tube Base on panel	£1.00
TX10 Tube Base on Panel	£3.00

Line Transformers

Line O P Trans Mono T X 12" 14" Philips	
27482	£10
4822	£10
10273	£10
Thorn 1690 LOPT	£7.50
2 3/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 AD5308I – Stik + Lead	£1.50
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 1704A	£3.50
Split Diode Trans	£7.00
GEC 20 AX Rank Z522	£3.00
Rank L O P T Z970	£3.00
CVC32	£6.00
CVC30 ITT	£7.00
CVC32 Line Tran	£7.00
CVC800 Line Trans	£6.00
CVC825 Split Diode	£10.00
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 £2.00
LOPT Rank Z763	£5.00
K35 Split Diode 3122/13835930	£10.00

Mains Droppers

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
Ae Socket & Lead GEC, ITT, Philips, Pye	25p
7×3¾ Thorn	£1
Thorn 1600-1700	£1.50
Rank Toshiba Tube Bases	30p

Universal Tripler

with small focus pot. Green type	£7.00

20,000 Per Volt
HT420 Hills Meter
10 Amp AC/DC
1,000 and ohmes range **£10**
4 ohmes ranges 0-1000 volt AC/DC
AEG KT2000/641-005

Hand Sets

Fidelity All Types
£15 to £35

KT3-K30

OF-425		
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 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 – BY 407 Eqv	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 1500v	20p
Flat BY229 black	15p
BY 299 Red	20p
BY 229/400	30p
BY 299/60p Tag	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 448	10p
BY 527	10p
BY 602	10p
BYV 26C	10p
F 247	10p
GP20G	5p
GRP80G (TX10)	30p
XK 3102	50p
BYV 28/200	20p
Bridge TX10 800/3 amps	30p
KBPC35-02 Bridge	£1.50
Bridge Rec. D35B10	40p

Black Triplers

KT3 Triplers	£6.00
S I C Universal Tripler	£6.00
11 TJT	£2.50
11 TGA	£2.00
ITT CVC 5-8-9	£3.50
Rank T25LT Tripler	£2.00
Rank 111CP A823	£3.50
TC 25 30K Rank	£3.00
11 TFZ Rank	£3.00
G9 Philips	£4.00
GEC 2110	£4.00
3500 Thorn	£3.00
8500 Thorn	£4.00
9000 Thorn	£7.00
9500 Thorn	£4.50
9600 Thorn	£4.00
2040 GEC	£3.50
GEC TVM25 Tripler	£2.00
Universal Tripler	£5.00
G8 Tripler	£5.00
CVC20-32	£5.00
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
I P 1193/63	£4.00
BG 100/41	£3.25
ERO Tripler print type with foacs PO7 BG2087	£5
T/text ultrasonic rec'r panel	£14.00
12-14V 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 AF 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 1O66 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
LM337M Reg	30p
20 GEC Black Spark Gaps	£1.00
KT3 Front Panel Control Assy	£2.50
BTW 30/50	50p
International Rectifier EHT Diodes G770/HV34 6KV	3 for 8p
BTW 92/800R	£3
25A473 PNP C/P	10p

6A/600V Stud Diodes	20p
6A/1000V Stud Diodes	20p

25% OFF ALL PANELS

G8 LOPT Panel	£12.00
Rank T20 Z136 Panel	£6.00
NEW GEC 20AX Power Supply Switch Mode	£12.00
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 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
GEC portable chassis + LOPTI 2114 New	£4.00
G9 Power Panel	£6.00
Mono RANK Chassis 127A NEW	£10.00
NEW G9 Frame Panel	£4.00
NEW G11 IF Panel	£10.00

G8 Tuner Unit + Panel	£4.00
G8 IF & Chroma	£6.00
G8 Chroma	£3.00
G11 IF Detector	£3.00
G11 Selector gain module	£3
Complete CVC 825 Chassis	£15
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
CVC 20 Front panel with sliders + mains input panel	£4
CVC 40 PUSH BUTTON ASSY with sliders: complete with lamp assy + pots 8 button units	£9.00
CVC9 slider pots panel	50p
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	£8.50
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
Remo TV12SP	50p
1600 Thorn EHT Rec and Lead	50p
TV14	50p
TV20	£1.00
TV45	50p
Thorn 14/1500 rec stick	5p
TX10 8 Button Unit	£10.00
TX10/TX100 16 Button	£10.00
G11 drawer ASS 3 pots Mains switch and lead	£2.00
K30 Drawer Ass with pots cable forme	£1.00
TX10 Drawer with 8 way pots. ass	£2.50
TX10 Ex. port with band switch (drawer)	£2.50

PHILIPS BATTERIES (Small Types) HAND SETS

SR41	25p
SR43	25p
SR44	25p
SR54	25p
LR43	25p
LR44	25p
LR54	25p
CR2032	25p
10 500PF 2KV	20p
.22/1000	20p
TAA7750	£1.00
HA411485	£1.00
UPC1373	50p
M50143	£1.00
M491BB1	£1.00
M58657P	25p
M50441/550	3p
M58658P	£1.00
Delay Line TDK Small Gray	10p
TDK Blue Type	50p

420M 400V	£1.00
470M 380V	£1.00
220/400V	£1.00
1200PF 15KV	10p
01 2KV	10p
1+1 MFD Mains Filter ITT 3 Pin	15p
1/100 × 10	30p
22/100	10p
4 7M/100	5p
470/100	20p
4700/100	75p
47/160	10p
300 300/300V	80p
800/160	50p
1/250 Pulse	5p
2.2 250v	10p
7N5 1500V	15p
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
22/375	15p
220/385 (ITT)	75p
330/385 CVC 820HT	60p
0 1/400	15p
KT3 E/W .39/400	15p
.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
22/1000	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
2n2/1500	15p
.01/1600	15p
G11.8200/2KV	15p
0 1/2KV	20p
3n9/2KV	15p
0.0015/2KV	10p
6n2/2KV	15p
2n2/2KV	15p
470pf 4KV	10p
7500pf/2KV	10p
3000PF/3000V	10p
4n7/2KV	15p
6n2/2KV	10p
7n1/1500V	10p
8n2/1500V	10p
9n1/2000V	10p
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
Tube Thermpath 167	£1.00
Rank Secam Decoder Panel UHF & VHF T115A	£13.00
10 off 91 CAP G11	£2.00
Philips K4 CAP 150M/385V	50p

CVC 20-25-30 Mains Switches	60p
Infra Red and Ultrasonic G11 Teletext Decoder Panel	£30
RANK & ITT Mains Remote On-Off Switch (720R)	£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
G8 Mains Switch	75p
G11 Preh Red LED P/Button for C H. Change	20p
RANK TOSHIBA Transductors TPC-2C11	50p
Mains Switch ITT Long Type Print	75p
Mains Switch Philip Long Type TAG	75p
Mains Switch GEC Long Type TAG	75p
2000 Chassis Fidelity Mains Switch (4 TAG)	60p
250V/4A White Lorlin Mains Switch	60p
KT3-K30-K35 Full Remote Mains Switch (6 TAG)	£1
Teletext Adaptor Kit TY-500 Panasonic	£12
Philips Battery Tester All Types and charger vis	£6

Multi-Caps

220 MFD Sprague 385V	50p
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
KT3-K30 220+40+40	75p
200+200+75+25M 325V	£1.00
300+300+150+100+50MFD 350V	£2.00
G11 CAP 470/250	£2.50
47/220/350v	60p
150/150/100/100/100/320v	£2.00
2500/2500/63v	50p
150/200/200/300v	70p
300/100/100/16/275v	£1.50
100/200/325v	40p
150/150/100/375v	£1.50
200/200/75/25M 375V	£1.00
Thorn TX9 Caps 500+500M 175V	£1.00
300/300/100/32/32/300v	2.00
1500/2000/30v	50p
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
CMC 301 front panel	£5.00
CMC 303 front panel	£5.00
CMC 302 Panel with TC mains switch etc	£5.00
CMD 800 Decoder	£8.00
G11 1 I.C. Receiver Panel	£1.50
3 I.C. Power Supply G11 Full Remote Receiver Panel	£3.00
PHILIPS SBC 469 Stereo Microphone	£23.00
Meters Hills 520	£17.00
Meters Hills 420	£10.00
Hills HD5000 Digital Meter 1000V DC 750AC 10 Amp 20 MRG Rangers	£28
HT100 Multimeter	£6.75
HT300 Multimeter	£7.75
HT500 Multimeter	£9.00
HT700	£15.00
HD1000 Digital	£20.00
HD3000 Digital	£25.00
HD5000 Digital	£25.00
HD5500	£29.00
HD6000 Digital	£32.00
HD8000 Digital	£37.00
HD9500 Digital with capacity Temp Trans Volts Ohms and Amps ranges	£60

Infra Red Hanset Tester

Works at 24 feet – Sound repeater Works off 9 volt battery Fits in top pocket	£8.00
Handset Tester with LED	£4.50

Repaired Handsets

Philips K4-K35, RC5350-RC5300, RC5370, RC5375, repaired same day	£10.00
RC4001 Full Remote KT3 K30 Teletext Handsets exchanged	£15.00
NEW Type RC4001 9 CH not 12	£6.00
GEC Full Remote Infra-red, 1983 models	£15.00
Timers, 60 mins, small	£1.00

TOSHIBA HAND SETS

24 Button CT938 Fulremote	£5.00
32 Button CT983 Videotext	£6.00

THORN

VCR Front Display Panel	£7.00
Large type ITT TV and V C R Handset	£15.00
GEC Ultrasonic 8CH Full Remote	£10.00
G11 Full Remote Ultrasonic	£32.00
G11 Ultrasonic Teletext Handset	£20.00
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	£20.00
Dynatron-Full remote CTV 62, 63, 64	£19.00
Hitachi infra red handset	£18.00
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)	£18.00
GEC infra red full remote 8 channel (I C.SAA1250)	£14.00
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
GEC infra-red 2236-2026	£4.00
GEC 8 button full remote	£14.00
GEC push pad handset button blobs each	10p
Pye & Philips handset KT3-K30 chassis. No RC5150-RC5176-RC5171-RC5177. Special Price	£13.00
RC4001 KT3 and Teletex	£14.00
IT CVC 32 handset repaired	£15.00
CVC 32 Hand Set	£15.00
CVC 45 3 and 2 Pin	
TX10 Hand Set Text	£12.50
TX9 with Text	£12.50
TX9 & TX10 button print	£2.00

ITT

T/V & Video Processor. 1200 Type	£10.00

PHILIPS

UNIVERSAL HAND SET £12.00 RC5
KT3 – K45

We have all parts for Philips Handsets

RC5353	£15.00
RC5300	£12.00
Philips RC5	£15.00

TEXT-TYPE

Replace Hand Set for Philips KT3-K30, K4 etc	£12.30

THORN HAND SETS

9000 – 9600 – TX9 – TX10 – TX100 Text and Non-Text	£10.00

PHILIPS

RC5171	£12.00

K35-K4 HAND SET

Repaired for £5.00