JUNE 1988

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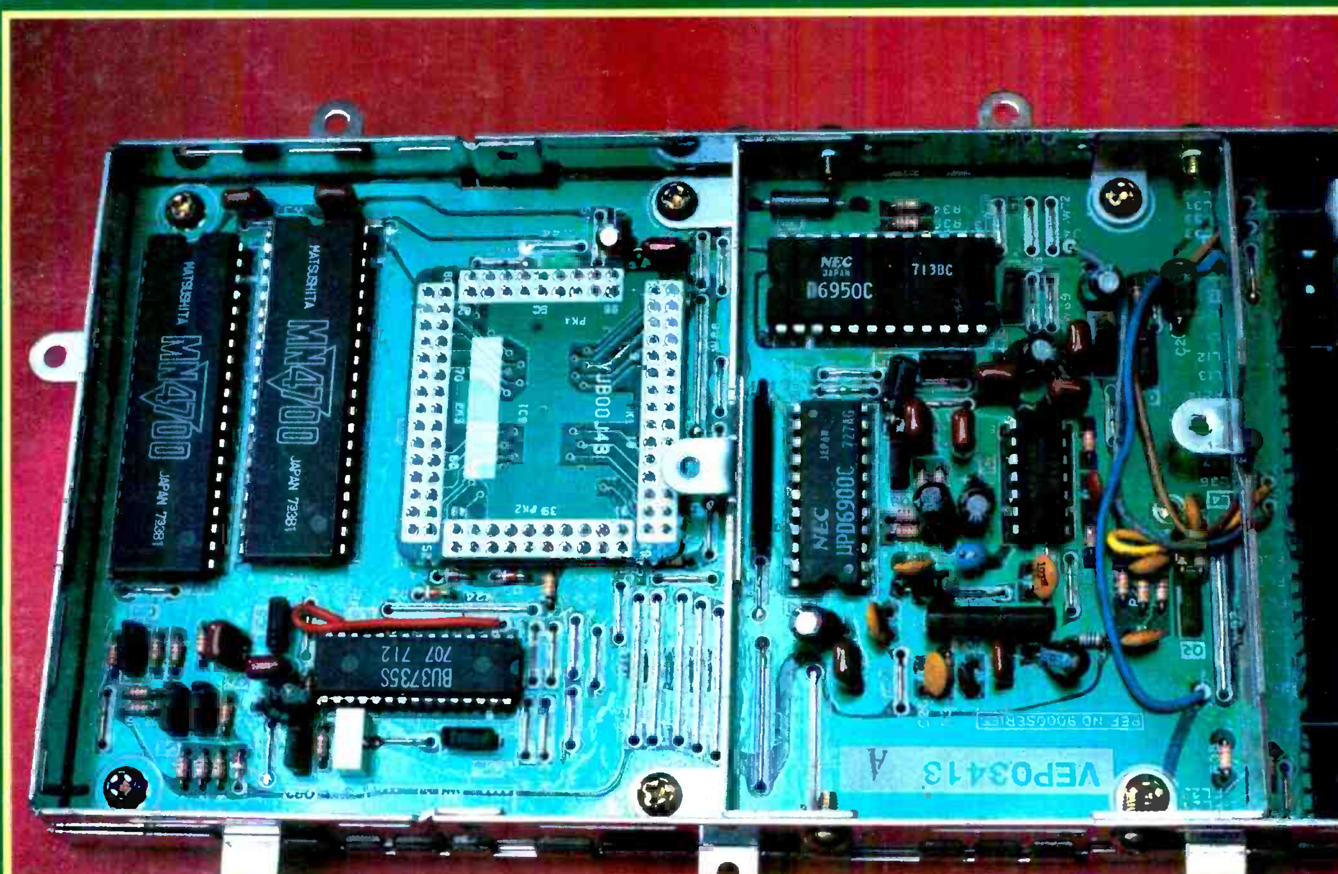
TELEVISION

SERVICING·PROJECTS·VIDEO·DEVELOPMENTS



Storing TV Pictures in Chips

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TV Fault Finding • DX-TV

Conditional Programme Access

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TELEVISION

June 1988

Vol. 38, No. 8
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On sale May 18th

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

SUBSCRIPTIONS
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BACK NUMBERS
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INDEXES
Indexes to Vols. 35 and 36 are available at 80p each from the Editorial Office (address above).

QUERIES
We regret that we cannot answer technical queries over the telephone nor supply service sheets. We will endeavour to assist readers who have queries relating to articles published in *Television*, but we cannot offer advice on modifications to our published designs nor comment on alternative ways of using them. 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

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24hr. answer service

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RING FOR SERVICE

TELEX: 635562 GRIFFIN G FOR P.V.

CALLERS ALWAYS WELCOME

ACCESS – VISA

EXPIRY DATES NEEDED ON CREDIT CARD ORDERS.

EXPORT ENQUIRIES WELCOME

Video Head Cleaning Tapes

VHS	£6.25
Beta	£7.41

VIDEO TAPE

★ "DOWN IN PRICE" ★

SKC

E60	2.00
E120	2.30
E180	2.45
E240	3 45

MEMOREX

L750	2.70

SCOTCH

E30	2.90
E60	3.05
E120	2.89
E180	3.50
L750	3.65
VCC360	6.59
VCC480	7.50

VIDEO SPARES

WE HAVE A LARGER RANGE LISTED UNDER SPECIFIC MANUFACTURERS IN CATALOGUE FOR THORN, SONY, HITACHI, FIDELITY, NATIONAL PANASONIC, PHILIPS.

REFURBISHED HEADS (Exchange) Equivalents Chart in Catalogue

THORN NEW LIFE (Most VHS types)	22.95
THORN NEW LIFE (National Panasonic)	24.95

REPLACEMENT VIDEO HEADS

AKAI

VS1	3HSSV	21.95
VS2	3HSSV	21.95
VS3	3HSSV	21.95
VS5	3HSSV	21.95
VS10	3HSSV	21.95
VS77	3HSSV	21.95
VS88	3HSSV	21.95
VS7100	3HSSV	21.95
VS7200	3HSSV	21.95
VS9300	3HSSV	21.95
VS9500	3HSSV	21.95
VS9700	3HSSV	21.95
VS9800	3HSSV	21.95

FERGUSON

3V00	3HSSV	21.95
3V01	3HSSV	21.95
3V06	3HSSV	21.95
3V16	3HSSV	21.95
3V22	3HSSV	21.95
3V23	3HSSV	21.95
3V24	3HSSV	21.95
3V29	3HSSV	21.95
3V30	3HSSV	21.95
3V31	3HSSV	21.95
3V35	3HSSV	21.95
3V36	3HSSV	21.95
8903	3HSSV	21.95

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

ORION

VH1	3HSSN	21.95
VH2	3HSSN	21.95

JVC

HRD110	3HSSV	21.95
HRD111	3HSSV	21.95
HRD120	3HSSV	21.95
HRD121	3HSSV	21.95
HRD220	3HSSV	21.95
HRD225	3HSSV	21.95
HR2200	3HSSV	21.95
HR3300	3HSSV	21.95
HR3320	3HSSV	21.95
HR3330	3HSSV	21.95
HR3350	3HSSV	21.95
HR3360	3HSSV	21.95
HR3660	3HSSV	21.95
HR3860	3HSSV	21.95
HR4000	3HSSV	21.95
HR4100	3HSSV	21.95
HR7200	3HSSV	21.95
HR7600	3HSSV	21.95
HR7610	3HSSV	21.95
HR7650	3HSSV	21.95
HR7700	3HSSV	21.95

NEC

PV760	PS3BS	23.95
PV764	PS3BS	23.95
PV774	PS3BS	23.95
N830	3HSSV	21.95
N831	3HSSV	21.95
N832	3HSSV	21.95
N833	3HSSV	21.95
PV2300	PS3BS	23.95
PV2400	PS3BS	23.95

SONY

SLF1	PS4B2S	29.95
SLC5	PS3BS	23.95
SLC6	PS3BS	23.95
SLC7	PS3BS	23.95
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
SL8080	PS3BS2	25.00

NATIONAL PANASONIC

NV100	3HSSU1N	25.99
NV230	3HSSU2N	36.97
NV250	3HSSU2N	36.97
NV270	3HSSU2N	36.97
NV280	3HSSU2N	36.97
NV300	3HSSN	21.95
NV322	3HSSN	21.95
NV330	3HSS3N	35.99
NV333	3HSSN	21.95
NV340	3HSSN	21.95
NV370	3HSSU1N	25.99
NV380	3HSSU1N	25.99
NV390	3HSSN	21.95
NV450	3HSSU2N	36.97
NV470	3HSSU2N	36.97
NV480	3HSSU2N	36.97
NV600	3HSS3N	35.99
NV777	3HSS3N	35.99
NV861	3HSSN	21.95
NV2000	3HSSN	21.95
NV3000	3HSSN	21.95
NV7000	3HSSN	21.95
NV7200	3HSSN	21.95
NV7500	3HSSN	21.95
NV7800	3HSSN	21.95
NV7850	3HSSN	21.95
NV8170	3HSSN	21.95
NV8200	3HSSN	21.95
NV8400	3HSSN	21.95
NV8600	3HSSN	21.95
NV8620	3HSSN	21.95

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

NEW Philips VHS Idler

4822 522 203 34	£4.16
4822 528 704 84	£4.16

TOSHIBA

V31	PS3BT	30.00
V33	PS3BT	30.00
V55	3HSSV	21.95
V57	3HSSV	21.95
V5470	PS3BS2	25.00
V9600	PS3BT	30.00

SANYO/FISHER

FVHP615	3HSSSF	35.00
FVHP910	3HSSSF	35.00

PHILIPS

DV462	3HSSU1N	25.99
6460	3HSSU1N	25.99
6520	3HSSU1N	25.99

GENUINE HEADS

SONY 8000UB	49.39
SONY SLC9	49.39
SHARP 3300/9700	56.00
TOSHIBA 9600 (upper cylinder) (not the heads)	14.50
HITACHI VT33E/GEC 4004	35.62
SANYO 9300/9435/9500	53.00
SANYO 5000/4700/5300	53.00
PHILIPS V2000/V2023	64.00
PHILIPS 1700	71.00

VIDEO IDLER TYRES

	O.Dia	I.Dia	Width	
SONY	23 7	17 4	4 9	50p
SONY	24 2	18	5 1	50p
HITACHI	31 8	25	4 9	50p
PANASONIC	37	29	3 9	52p
AKAI	26	20	3 9	50p
JVC	39 3	32 8	3 9	56p
JVC	33	23 9	4	56p
NATPAN	31 2	25	3 1	56p

VIDEO PINCH ROLLERS

PANASONIC	NV7000	3.75
SANYO	VTC9300/VBS7000	3.75
SONY	C7 J7/SL17	3.75
JVC	1CE3V00/01/06 16/23/24	3.75
JVC	HR2200/3320/3330 3660/1100/7700	3.75
AKAI	VS9700	3.75
HITACHI	VT5000	3.75
SHARP	VC6300/6500	3.75
SONY	C6 GEN	3.75

★ PRICES DOWN ★

P.V. TUBES FOR ALL YOUR COMPONENTS

THORN/FERGUSON
SONY
AMSTRAD
FIDELITY
HITACHI/GEC
PHILIPS
DECCA
SINCLAIR
COMMODORE
ANTEX
DYNASCAN
EVER READY
LABGEAR
NEWLIFE
AMPROBE
SERVISOL
ARROW
SCOTCH
SKC
SPARKOMATIC

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Scart plugs £2.95
Scart sockets £85p
Scart kits £6.44

POST & PACKING 87p + VAT UP TO 1 KILO

FULL RANGE OF VIDEO LAMPS UNDER SPECIFIC SPARES IN CATALOGUE ★

VIDEO BELT KITS

★ PRICES DOWN ★

VKIT 1	AKAI	9300/9500/9800	2.40
	JVC	HR3300/3320/3360	
	TCE	8903/3V00/16/22	
VKIT 2	PANASONIC	NV7000/7200	1.45
VKIT 3	SONY	SLC5/7	2.25
VKIT 4	SONY	SL8000/8500/8600	3.60
VKIT 5	SONY	SL3000UB	2.10
VKIT 6	PANASONIC	NV3000B	1.99
VKIT 7	SANYO	9300P	2.75
VKIT 8	PANASONIC	NV2000B	1.45
VKIT 9	PANASONIC	NV8600/8610/V011	1.50
VKIT 10	TOSHIBA	V8600	1.45
VKIT 11	SHARP	VC7300	1.50
VKIT 13	SANYO	VTC5000	0.95
VKIT 14	SANYO	VTC5300	1.85
VKIT 15	JVC	HR7650-3V31	2.00
VKIT 16	HITACHI	5000	1.90
VKIT 17	SHARP	8300	1.76
VKIT 18	SHARP	9300	1.47
VKIT 19	HITACHI	VT8000	1.05
VKIT 20	HITACHI	VT11/33	1.50
VKIT 21	HITACHI	9500	1.12
VKIT 22	SONY	SLC6	1.90
VKIT 23	SANYO	5500	1.05
VKIT 24	PANASONIC	NV300/333	1.55
VKIT 25	TOSHIBA	V7540	1.90
VKIT 26	JVC	HR7000	0.96
VKIT 27	THORN	3V29/HR7200	1.75
VKIT 28	AMSTRAD	7000	1.45
VKIT 29	PANASONIC	NV777	1.80
VKIT 30	SONY	T9	2.20
VKIT 31	TOSHIBA	9600	1.20

★ PRICES DOWN ★

GEN PURPOSE VHS LAMP ONLY	50p

WE HAVE A FULL RANGE OF VIDEO LAMPS AVAILABLE UNDER "SPECIFIC SPARES"

NAT. PAN/SHARP VIDEO LAMP	1.30

SUNDRIES

VHS DRUM MOTOR	25.50
VHS CAPSTAN MOTOR	25.50
SANYO REEL MOTOR (5000)	12.95
SHARP REEL MOTOR	19.50
VHS (Gen Purp) THORN/JVC TAKE UP CLUTCH ASSY	4.95
SHARP TAKE UP IDLER 0005/GEZZ	2.20
0006/GEZZ	2.20
SANYO REEL DRIVE PULLEY	5.10
HITACHI F/F IDLER VT11E/33E	2.90

P.V. TUBES TEL: 0254 36521
TELEX: 635562 GRIFFIN G 390936
FOR P.V. 32611

24hr. ANSWER SERVICE

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We have a full range on display at our trade counter Call and see us anytime. Quantity prices on request Please ask if what you require is not listed.

LABGEAR

CM7261 P.U.	11.80
CM7262 P.U.	12.86
CM7065 UHF/VHF WB	15.05
CM7066 UHF/WB	14.04
CM7068 VHF H.Gain A/B/CD	16.74
CM7253 Behind Set (mains)	15.06
CM7243 Second Set Amp	14.03
CM7093 Three Set Amp	16.83
CM7063 Dist. Amp VHF/UHF	25.77
CM7108 8+1 Dist. Amp	45.42
CM9700 27MHz CB Suppressor	4.90
CM6011 Outdoor Splitter	8.22
CM9003/00 Flush Sing. Outlet	1.95
CM9003/01 Flush Sing. Out. Isolat.	2.15
CM9010 Flush Twin Outlet	2.25
CM9034 UHF Filters A/B/CD	8.89
CM9033 6 Way Pass Split	10.72
CM7042 TV Games Combiner	3.24
CM9009 Flush TV/FM Emulator	3.53
CM9006 VHF/UHF Diplexer	4.17
CM7122 Televerta Up VHF to UHF	39.91
CM7057 Televerta Down UHF to VHF	45.21
CM7294 Dist Amp. UHF/VHF	23.78
CM7274 4 Way Dist Amp	21.45
CM7082 UHF/VHF Dist. Amp	68.98
CM7080/10 UHF MHA	15.71
CM7271 UHF Wideband 15db	8.66

BELLS/BOXES

GG1	CHALLENGER PANEL BKII	27.95
A75	SHORROCK ACORN 75 PANEL	32.50
B1	EUROBELL (No. S.A.B.)*	21.00
B2	EUROBELL (with S.A.B.)*	26.95
BV	6V BATTERY FOR EUROBELL	3.75

*Price includes Multi Adaptor to use with "C" type bell boxes

T1	12V BELL (Tan)	12.95
B5	'C' TYPE Polyprop. Boxes (comp)	4.55
B6	'C' TYPE Polycarb. Boxes (comp)	7.80
B12	'C' TYPE DUMMY COVER (no back)	3.25
B13	'C' TYPE Translucent	7.80

SOUNDERS/SIRENS

S2	712 EXTERNAL SIREN	(116db)	5.75
S4	1010/2010 EXTERNAL SIREN	(116db)	5.96
S22	DYNABLAST	(127db)	18.14
S13	SOUND BOMB 1	(104db)	3.37
S14	SOUND BOMB 2	(111db)	5.17
S15	SOUND BOMB 3 MULTITONE		4.50
S16	PZ28	(105db)	4.61
S17	MIKRO	(110db)	5.28
S18	362 PIEZO	(110db)	7.80
	12V MUSICAL BUZZER		1.56
M801	722 BUZZER		0.60
802	PMB27 BUZZER		0.70

INFRA RED/SECURITY LIGHTS

817S	SHORROCK	P.I.R.	22.50
815S	SHORROCK	P.I.R.	41.50
817SM	SHORROCK	P.I.R.	24.15
815SM	SHORROCK	P.I.R.	43.57
01	ORION	P.I.R.	24.00
04	ORION EXTERNAL	P.I.R.	48.00
05	ORION EXTERNAL with built in Floodlight		60.00
SL5	HALOGEN FLOOD with Lamp		17.74
SL5R	SPARE LAMPS SL5		4.50
SL8	INFRASCAN EXTERNAL	P.I.R.	62.94
ST	TASLEY AUTO LANTERN		27.00

WE ARE AUTHORISED DISTRIBUTORS FOR SHORROCK SECURITY PRODUCTS

SUNDRIES

XENON FLASHERS

XE1	12 PCL 128 Red/Amber/Blue	6.75
XE3	LOW PROFILE 121PCL Red/Amber/Blue	6.90

TAMPER SWITCHES 2.5" 0.60

SELF CONTAINED ALARM 25.00

CONTACTS

C10	5 TERM FLUSH	0.56
C11	4 WIRE FLUSH	0.62
C12	5 TERM SURFACE	0.59
C13	4 WIRE SURFACE SLIMFIT	0.62
C6	ROLLER SHUTTER CONTACTS	6.10
C9	ROLLER SHUTTER CONTACTS PLASTIC	2.28

PRESSURE MATS

PM1	STAIR MAT	1.35
PM2	STANDARD MAT	1.50

ACCESS VISA

RECHG. BATTERIES

12V 1.2A	7.23
12V 2.6A	7.87
12V 6A	10.73
12V 1.9A	7.77

S.A.B. MODULES

SHORROCK S.A.B.	8.76
SHORROCK DE LUXE	11.49

PANIC BUTTONS

STND. 2.88

CONFUSED?

DON'T BE – IT'S EASY!

TYPICAL PACKAGE FOR 3 BED HOUSE

£120

Includes:
- 2 Zone Panel with connection diagram ★
- Rechargeable Battery ★
- Outside Bell Box with Bell ★
- Inside Multitone Sounder ★
- Roll 6 core cable ★
- 2× Infra Red Detectors ★
- 5 Pairs Window Contacts ★
- Panic Button ★
- Buzzer ★
- Tamper Switch ★

JUST ASK!!

ANTEX

C15 Iron 240v	6.20
C240 Element	2.75
Bits 102, 106, 820, 821	1.10
CS 17W Iron 240v	6.40
CS240 Element	2.75
Bits 1100, 1101, 1106	1.10
XS25W Iron 240v	6.50
XS240 Element	2.75
Bits 50, 51	1.10
Temperature Control 30W Iron CSTC	16.95
40W Iron XSTC	16.95
Unit TCSV1	68.95
Antex Stand	2.10
MLXS Auto Rep. Kit	8.40
Cordless Gas Iron	15.99
Tips for Gas Iron	5.00
Turbo Rech. Iron Kit	16.99

NEW

PORTASOL PROFESSIONAL. FULLY PORTABLE GAS IRON, BLOW TORCH, HOT BLOW, HOT KNIFE

ALL IN ONE KIT

£27.95

FOR 1 MONTH ONLY

Antex temperature controlled irons CSTC & XSTC & the unit TCV1 are all half price.

★ NEW WICKMANN WERKE FUSE KITS ★

These are a new range of sub-miniature, circuit protection Fuses, and are used in most modern TVs, Videos, etc. This kit has 170 asstd. plug in Fuses and 10 holders.

Q.B. 250ma 1A, 1.25A, 1.6A, 2A.

A.S. 160ma, 200ma, 315ma, 500ma, 630ma, 800ma, 1A, 1.25A, 1.6A, 2A, 2.5A, 3.15A, 4A.

YOU'LL NEED SOME!! £33.95

LINKABLE SMOKE DETECTORS	£9.75
NEW SMOKE DETECTORS	£8.75
PERSONAL ALARM/TORCH	£1.90
DOOR CHAIN/LOCK ALARM	£2.75
SMOKE DETECTORS WITH LIGHT	£12.50

SERVISOL

Freeze It	1.34
Super Servisol	1.18
Foam Cleanser	1.18
Plastic Seal	1.26
Silicone Grease	1.46
Silicone Grease (Tubes)	1.82
Aero Klene	1.04
Excel Polish	1.08
Video Head Cleaner	0.96
Super 40	1.80
Fire Extinguisher	3.80
Heat Sink Compound	1.20
Solda Mop Std	0.78
Hylosil Silicone Rubber	2.98
Aero Duster	1.40
Coldklene 110 Degreasing Solvent	1.78
Antistatic Spray	1.18

NEW FULL RANGE OF TELESCOPIC AERIALS IN STOCK. SEE CATALOGUE.

NEW FULL RANGE PLANET AUDIO PRODUCTS. ASK FOR LIST.

RECTIFIER TRAYS

Thorn 1500 3 Stick	5.20
Thorn 1500 5 Stick	5.99
Thorn 3500	7.98
Thorn 8000	6.95
Thorn 8500/8800	7.15
Thorn 9000	8.70
Decca 1730/1830	5.48
Decca 30	6.76
Decca 80	7.12
Decca 100	7.50
Decca/Tatung 120/130	6.50
GEC 2100	7.40
GEC 2200 (20AX)	6.50
GEC 2040/2028	6.60
GEC 2110 (pre Jan '77)	7.00
Philips G8 Short Focus Lead	7.12
Philips G8 Long Focus 550	7.12
Philips G9	6.37
Pye/Philips KT3	7.00
Pye 691/3	7.58
Pye 713 4 Lead	8.79
Pye 713 5 Lead	8.79
Pye 731/25	8.75
R.B.M. A823 plug in	8.75
Rank T20/22	7.12
ITT CVC5/9	7.50
ITT CVC20/25/30 (Mullard)	7.12
ITT CVC45	8.65
Universal ★ See Special Offer	
TV 13	1.26
TV 14	1.29
TV 18	1.10
TV 20	1.43

PUSH BUTTON ASS.

Hitachi 4 way	12.36
Philips G8 (early)	17.82
Philips G8 (late)	18.97
Philips G11 Tip Switch unit	29.09
Philips KT3	16.67
Philips K30	13.22
Thorn 9000 6 way	20.60
Pye 697 repair kit	10.35
Pye 725-735 (also Red Mk. 1)	12.60
Pye 725-735 tuning head with PCB	12.50
Decca 4 way	7.93
Decca 6 way	9.17
Decca 4/6 way conversion kit	17.50
Decca 7 way piano key rep. kit	15.62
GEC 2110 6 way	10.92
GEC 6 way slim	10.29
GEC/ITT/PYE 7 way	16.67
GEC Conversion kit	16.50
Rank A823	12.36
Rank T20A	11.21

LINE OUTPUT TRANS.

Philips 210/300 Mono	10.00
Philips G8	8.75
Philips G9	9.50
Philips KT3	15.95
Philips K30	25.75
Philips TX2	13.39
Philips TX3	14.41
Philips G11	15.58
Pye 713/715	10.00
Pye 725 90°	10.50
Pye 169	10.00
Pye 741	9.90
Bang & Olufson (2000,3000)	14.69
Decca 80	8.58
Decca 100	8.58
Decca 1700	9.00
Decca 1730	8.58
Decca 2230	8.58
GEC 2110	16.75
GEC 2040	9.50
ITT CVC 1/9	10.85
ITT CVC 25/30/32	8.65
ITT CVC 20	8.60
ITT CVC 45	9.50
R.B.M. T20	13.95
R.B.M. BUSHRANGER T16A	10.00
R.B.M. BUSHRANGER T18A	10.00
Thorn 3000 EHT	9.95
Thorn 3000 SCAN	7.95
Thorn 8500	17.50
Thorn 3000/3500 Mains	10.00
Thorn 1615	12.50
Thorn 1691	9.68
Thorn TX9	23.85
Thorn 9600 (Gen Thorn)	21.79
Thorn 9000	25.53

VARICAP TUNERS

ELC1043-05	8.40
ELC 104305 Mullard	12.50
ELC1043-06	8.40
ELC2003	19.50
Philips G8/G9	10.50
Philips G11 (U321)	9.90
TX90	18.34
U322	10.50
U341	9.50
U342	8.50
U411	13.50
U343 (2A chassis)	16.50

Push Button (Cont.)

ITT CVC 8/9 (mod)	13.80
ITT 6 way with VCR	8.90
Thorn 8500	6.50
GEC 7 B/P c neons	10.50

AERIAL EQUIPMENT

10 Ele. UHF	1.62
3 Ele. VHF	6.70
4 Ele. VHF	8.03
Omnidirect (Round) F.M.	8.93

SET TOP AERIALS

Olympic II	2.30
Loop Aerial	1.00
Anti-Silver Sensor	7.40
Anti-Super Set Top	6.50
Anti-Caratenna	7.20
Anti-Traveller	11.50

FULL RANGE LISTED IN CATALOGUE.

NOTE:

Most aerial equipment has to be sent by carrier (not set tops) £7.50 + VAT

NEXT DAY DELIVERY

P&P 87p +VAT up to 1 kilo

TELEPHONE ACCESSORIES

Phone Ext. Kit	7.50
Cable Ext. Kit	5.95
Ext. Socket Surface	1.68
Ext. Socket Flush	1.75
Cable Tidy	0.99
5m Ext. Lead	2.95
3m Ext. Lead	2.23
Dual Adaptor	2.50
4 Way Line Plug	0.25
Line Cord (4 Spade)	1.35
I.D.C. Inserter	0.35
Tone Ringer	5.50
Phone Saver Phone Lock	4.00
Phone Extension Reeler	7.95
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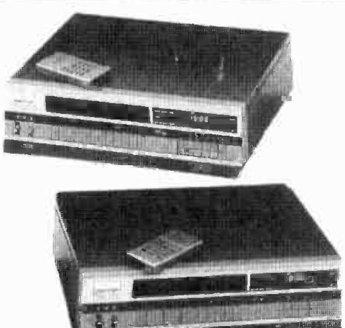

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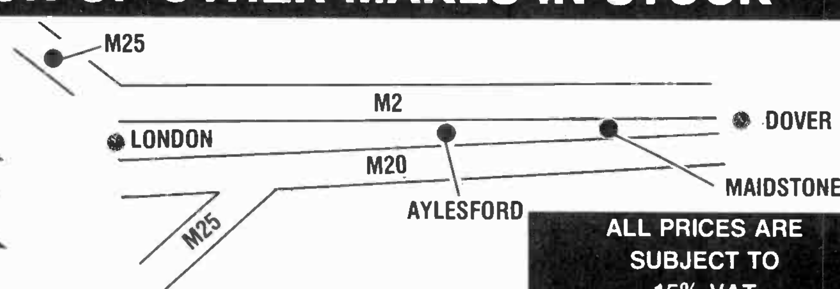

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COVER PHOTO
This month's cover photograph shows the memory module used in the Panasonic Model NV-D80 VCR. The two 1Mbit memory chips can be seen on the left: the memory control gate-array chip is to the left of centre. An account of the digital video signal processing made possible by the use of these chips will be featured in Part 2 of our new series "Storing TV Pictures in Chips" next month. Part 1 starts on page 584.

Over to You

What's this? – a questionnaire (see pages 599-601). Your first reaction might be to suspect that the magazine is a bit uncertain about what it's up to. Not so, really: our main concerns are and will as always be to keep readers abreast of technical developments in the TV/video field and to pass on hints and tips of help in servicing and making use of domestic TV/video equipment. But we need help to ensure that we are doing this in the most effective way that serves readers best. Hence this month's questionnaire, which gives you a chance to tell us what you think about the magazine and will thus help us to formulate policy in the immediate future.

We have included reader questionnaires before. The last time was in September 1981. Some readers at the time may not have been aware of it, since the questionnaire was included as a loose item in only some one in six copies. This time we thought it best to enable all readers to record their views. We hope you will do so: the more replies we receive, the more accurate our picture of readers and their requirements will be. The questionnaire has been designed to provide us with information that will serve as a guide to policy in general, not just editorial policy. So if you are wondering why on earth we should, for example, be interested in the daily newspaper you read, well the aim in this case is to obtain information that will suggest suitable places in which to advertise the magazine.

Last time we had a gratifyingly large response – it was also reassuring to us that most readers indicated satisfaction with the magazine as it was at the time. But nearly seven years is a long time in electronics and much has changed. The magazine has certainly had to change, in particular to cater for the growing importance of video equipment. Perhaps we have not changed in the ways you would prefer. If so, you now have an opportunity to tell us.

There are several "open" questions that have been included to enable you to pinpoint your particular likes and dislikes. These are going to be difficult for us to handle, because the answers we receive will be statistically analysed by a computer, and computers like everything to be cut and dried. So we must ask you to be concise with such comments you may wish to make. If you want to go into detail you can always drop a line to the editor. Letters and the information and views they provide are always welcome.

There is one fatal flaw for us in this sort of exercise. Most of those who reply will be committed readers. We'd also like to hear from those who might be interested but don't get to see the magazine. There is of course nothing we can do about this. It's also a fact that any publication has to be a compromise to some extent. We'd like the magazine to be twice the size with wider coverage, to appear say fortnightly instead of monthly, printed on glossy paper and so on. But to remain viable we have to accept that there are constraints on what we can do. This does not imply that you should feel there is any limitation on the views and opinions you may wish to offer: we mention the point only to explain why it may not be feasible to follow up some suggestions, however sensible and well meaning they may be.

We already receive letters from readers offering their views. One point that has been made on several occasions is that we don't at present publish many articles on servicing particular TV sets/chassis. This is not however a result of deliberate editorial policy but reflects the vastly increased reliability of the TV receivers produced in recent years. We have at various times dealt with all the better known older chassis and their quirks. If you handle a variety of makes and models it's hard, with recent products, to build up a history of recurrent faults. We suspect that with modern sets it would be necessary to handle really large numbers to be able to write about general fault diagnosis rather than particular faults. It's also a fact that many sets use similar circuitry and tend to suffer from just one or two types of failure – all those models with TDA4600-based power supplies for example. Be that as it may, there is probably a lot of experience readers could pass on to others. So if any of you can fill in the gaps, please don't hesitate to do so. All articles included in the magazine are paid for shortly after publication. We've had little to say about many ranges, such as Mitsubishi, Toshiba, Sanyo and so on. We know that these are reliable products, but if anyone wishes to contribute any know-how they would be more than welcome to do so. Typing is not essential, and rough sketches or references to manuals are acceptable by way of illustrations.

One thing that has become clear from the recent correspondence on servicing in our letters pages is the wide diversity of approaches and requirements today. No one wants to encourage the bodger, that's for sure, but there is a wide range of servicing activities that extends from specialist handling of the latest and more sophisticated equipment at one extreme to getting the most out of older sets at the the other. This brings into focus the fact that what's economic to repair in one context differs considerably from what's feasible in another. If you've invested in a lot of specialised equipment and employ highly trained staff you probably won't welcome a stream of hybrid colour sets with worn tubes. Nevertheless some people like to and others have to keep the older sets going. There is thus a place for a wide range of activities in the servicing field.

The job of an editor is to be responsive to the needs of his readers. You can help by sending in completed questionnaires. Strict confidentiality is assured: nearly all the work of assessing the replies will be done by computer. So it's over to you.

Servicing the Decca 80 and 100 Chassis

Nick Beer

While these sets are now getting on a bit, many are still in service. Most continue to give excellent results, particularly 20in. 80 series sets in which the displays produced by a lot of the c.r.t.s have remained as crisp and sharp as when new.

Sets fitted with the 80 series chassis have 18 or 20in. tubes of the Toshiba SSI type. The 88 variant has a 20in. PIL tube. By far the most common sets you come across these days are the 20in. ones. The 100 series chassis was designed for use with the 20AX tube, mainly 22 and 26in. types. These are the general rules but you may, for example, come across a 100 series chassis with a 20in. tube.

The chassis themselves differ in the number of panels – the 100 chassis has an extra panel which contains mainly convergence circuitry. The power supply, decoder and i.f. panels are interchangeable between chassis. Fig. 1 shows the basic layout of the 80 and 100 chassis. These views are with the chassis in the fixed position: raising the chassis will reveal the line output panel (with the 100 series the field output transistors are also mounted on this side of the chassis).

Power Supply Faults

The power supply panel is responsible for the most tricky faults, but even these are usually quickly sorted out once you get to know these sets.

In the event of a dead set the mains fuse will almost certainly be open-circuit (but see also the timebase chassis with the 80/88 chassis). If this is the case, check the bridge rectifier diodes D600-603. They usually go short-circuit in pairs and are ordinary BY127s. Note however that some of the diodes nowadays supplied as BY127s do not last in these positions and are considerably smaller than the originals. My rule is to ensure that the replacement device is as big as the original.

If these are in order and the mains filter capacitor C8 on the mains input/tuner panel is o.k., proceed as follows. Open link TP600-601 on the power supply panel, wire a 100W bulb across it, disconnect the e.h.t. tripler's input lead, replace the fuse and switch on. If the lamp lights up the fault is still present and attention should be turned to the line output panel (see later). If the lamp doesn't light, replacing the tripler should cure the fault – but leave the lamp connected until the point has been proved. When the repairs have been completed, restore the link – it's the enabling link for the crowbar trip.

The power supply panel usually contains the answer to intermittent fuse blowing – the time intervals can be anything from several minutes to several months. The first thing to do is to check whether a 12kΩ, 1W resistor is fitted in series with D617. This usually ends the story, but if the problem persists check the following points.

(1) The h.t. setting. The correct voltage depends on the c.r.t. size, and is critical. With the 80/88 chassis the reading across C801 should be 165V. With the 100 chassis it should be 168V.

(2) Check that the covering of the degaussing coils has not been pierced and that the coils are well clear of the e.h.t. cap at the top of the c.r.t. Clean the cap as a matter of course.

(3) If the fault persists, replace the following items on spec: D617 (186V zener diode), TY600 (DEC1), TY601 (DEC2) and the 6·8Ω section of the dropper resistor (R801).

All this assumes that you've isolated the fault to this panel – see also the timebase panels for further information on these symptoms.

On rare occasions a blown mains fuse is caused by TY600/TY601 going short-circuit – sometimes one goes, sometimes both. They are special Decca types (DEC1 and DEC2).

The only other point worth making about this panel is to resolder the legs of R601 whenever one of these sets comes in. This is the large wirewound resistor in the middle of the panel, on stand-off pillars. Dry-joints are becoming a problem here.

The IF Panel

The i.f. panel is the second interchangeable one and is relatively reliable. Intermittent sound, intermittent vision and uncontrollable volume are all caused by its main failing – dry-joints on the two multi-pin plugs and sockets. A solder around these is always worthwhile, whatever the fault.

Distorted sound is not uncommon. Half the time the cause is the 16Ω, 7 × 4in. loudspeaker. The other main cause is the TBA800 audio output chip IC104 which is under the silver fin type heatsink. Occasionally the BD533 37V shunt regulator transistor Tr801, which is bolted to the chassis under the tripler, will give similar symptoms. I've found that the speaker is becoming somewhat difficult to obtain from general suppliers, but is no problem from Decca (D and S Electronics).

A.G.C. faults have always been similar and have been caused by IC102 (TCA270S). Replacing this i.c. has also cured the very few cases of a negative picture I've encountered.

The Decoder Panel

The decoder panel is the last interchangeable one and is probably the most trouble free. The vision signal from the i.f. panel enters at P200 – the single red and white lead goes to the bottom right-hand corner of the panel. Pulling this provides a convenient way of getting a raster with which to set the grey scale in the field.

Assuming that the tube is all right, if one primary colour is missing the cause is usually the relevant BF458 R/G/B output transistor Tr204/6/2. For some reason, this is becoming a less common fault these days. By far the most common fault with this panel is no luminance due to dry-joints on the luminance delay line DL200 – I've also had the odd one go open-circuit.

Intermittent black lines on the picture are usually caused by dry-joints on the single socket on this panel. The same trouble can cause intermittent colour. Careful resoldering will very often save call-backs. No colour at all is generally due to the 4·43MHz crystal Z200, but this fault is not common. The i.c.s on this panel seem to be very reliable.

An over-bright raster with flyback lines probably means that the 7·5V zener diode D207 is faulty. If the set is left on in this condition the mains fuse will blow. D207 can also be responsible for no picture (RGB output transistors cut off) or varying brightness. The 6·8V zener diode D200 can also be the cause of excessive brightness while D202 (25V) can give the no raster symptom (check whether R246 has sprung open).

Timebase Panel – 80 Series

There are four plugs and sockets on the 80 series timebase panel and the most common trouble is, you guessed it, dry-joints! This is the other cause of intermittent fuse blowing.

It's not uncommon to find no sync after replacing the tripler. In this event the most likely cause is that IC300 (TBA920) has been dealt a deathly blow by the offending tripler. It plugs in, so replacement is very straightforward.

There are two slightly different versions of this panel. The 80 chassis panel for use with SSI tubes has three separate R/G/B first anode controls. With the PIL tube 88 chassis the panel has a single A1 potentiometer which is referred to as the preset brightness control. These potentiometers are all 2·2MΩ types and all suffer form noisy tracks. The result is varying brightness or grey-scale as relevant. I always replace rather than clean them as experience has proved that this saves call-backs.

If the set is dead and the mains fuse is intact the 5·1kΩ, 5W start-up resistor R324 is probably open-circuit.

For field distortion you won't go far wrong by replacing IC301 (TDA1170). If there's no field scan at all R342 (repairable fusible) will probably have gone open-circuit, indicating a fault in IC301.

Line Output Panel – 80 Series

Access to the line output panel in 80 series sets is obtained by raising the chassis and removing the single screw that holds the screening can. Removing the two small bolts on the side of the chassis will then allow the panel to be lifted out. To remove the panel completely, the two plugs, the tripler's input lead, the leads to the line output transistor and the c.r.t.'s heater leads all have to be disconnected, making this the least serviceable panel.

This panel may well hold the key to a blown mains fuse. If you find that a bulb fitted to the power supply (see earlier) still lights after replacing the tripler, the line output transformer could well have gone down as well. If the tripler proves to be blameless, the transformer is the next most likely cause – a clue is provided by the fact that the windings will get warm rapidly if the set is left on with the bulb connected. I always leave the bulb connected to ensure that the tripler isn't also faulty. One piece of information gained over the years is that the bright blue Siemens triplers rarely fail.

A fairly common trouble spot is D400 (BYX55-600) which goes open-circuit, removing the 37V rail. As a result there's no supply to the timebase panel or the signals panels.

If dry-joints develop on the plugs and are not repaired quickly they will flare up, the result being a melted plastic plug and shrivelled print.

Convergence Panel – 100 Series

The convergence panel in the 100 chassis always looks as if most of the components are missing! A lot of the same rules apply as for the 80 series panels – dry-joints etc. The line scan correction capacitor C508 (910nF) is a regular fuse blower and most times you won't need to be a Sherlock

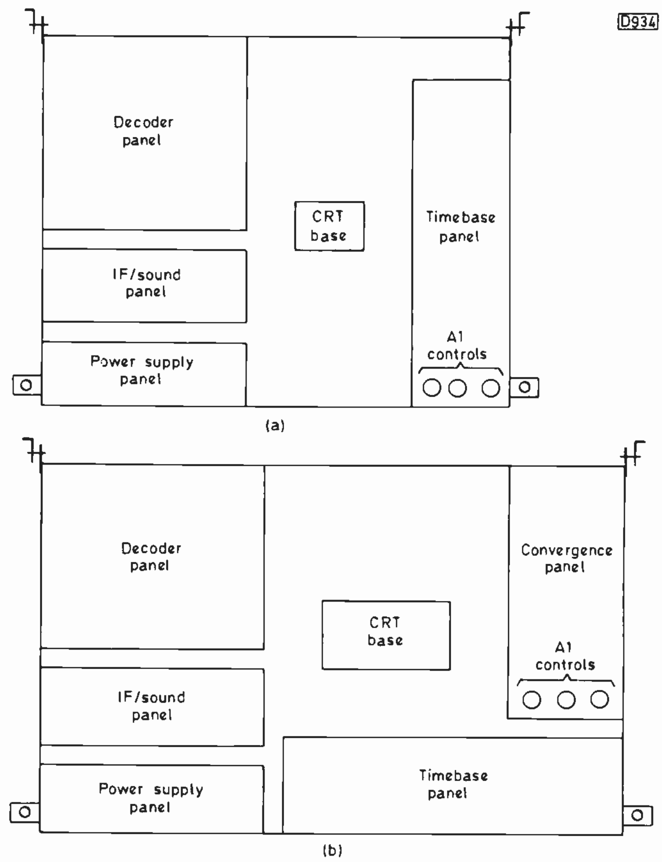

Fig. 1: Basic chassis arrangements, (a) 80 chassis, (b) 100 chassis. The 88 chassis is as shown at (a) but with a single preset brightness control replacing the A1 controls.

Holmes to find this out as it has a habit of melting all over the panel. It's of the same type as in the Philips G11 and the Bang and Olufsen 35XX chassis.

The 2·2MΩ first anode potentiometers are the same as in the 80 chassis and suffer from the same ailments – but I have seen some fitted with a gun switch arrangement as in the G11.

Timebase Panel – 100 Series

The main cause for concern in the timebase section of the 100 chassis is the BD278A field output transistors, which are mounted on the black heatsink behind the panel. They cause all manner of faults depending on whether or not they both go short-circuit. Complete field collapse will very often blow the mains fuse as the fusible link (R510) in the supply to the field timebase won't open in time.

The TBA920 chip provides the sync and line generator functions as in the 80 series and can again suffer when the tripler fails. For VCR compatibility, earth pin 10 of this chip.

A common fault in the past has been failure of R371 (2·2kΩ) which was originally underrated. By now most sets will have had a 1W replacement fitted.

Line Output Panel – 100 Series

The line output panel in the 100 chassis is somewhat easier to remove since the line output transistor is mounted on the panel rather than the chassis, but this means reduced reliability – the BU205 line output transistor in the 80 series chassis hardly ever fails, but the BU208A in the 100 chassis goes as often as you would expect it to. As with the 80 series, tripler and line output transformer failures are not uncommon. There are one or two other trouble spots in the 100 chassis however. The main problems concern the two diodes in the EW modulator circuit, D401 (BY223) and D402 (BYX71-600), and the 37V supply reservoir capacitor C407 (680μF, 40V). You may well find that the capacitor has leaked physically. It should be uprated to 63V. The two diodes either go short-circuit, blowing the fuse, or open-circuit, with the result of bowed picture edges.

The extra plug (no heater connections on top of the line output transformer) represents another chance for dry-joints to develop. All sockets should be checked each time.

General Points

A few final points. When replacing the chassis, make sure that the R/G/B leads don't rest on the dropper resistor or they will melt. The 470Ω log. slider volume control used in the 80 series tends to become very noisy – 7mm plastic nuts hold the front panel on which it's mounted. Tuning drift is normally caused by a noisy button unit. Replacement is straightforward: after removing the previously mentioned front panel there are only three leads to solder. The ELC1043/05 tuner can cause snowy pictures. A repair is usually possible by resoldering the connections around the input. Decca even provide slots in the PCB to push the leads away when desoldering, in case you forget your braid and sucker!

The base panels for the various tube types differ but suffer from the same very minute faults – mainly clogged spark gaps that arc (SG700 etc.). In the 100 chassis the fusible resistor (R709) in the heater supply tends to become dry-jointed. The result is fading or no picture.

The Mullard A56-500X and A66-500X 20AX tubes by now tend to be low in emission. Reactivation works well most times. The Toshiba 510JKB22 tube has two weaknesses. The heater can go open-circuit, giving the no picture symptom, and intermittent shorts between electrodes can produce a bright red, green or blue raster.

For no tuning, suspect the tuning voltage supply resistors R4 and R5, one 12kΩ and the other 15kΩ. One or other will usually be found open-circuit.

A rattling mains transformer is not uncommon: plastic seal left to set will provide a lasting cure. Always check the main reservoir/smoothing electrolytics C800/801. This combined unit is bolted to the chassis and tends to bubble out causing, eventually, a hum bar.

As you can see, there are varied faults with these chassis. None cause real problems apart from the odd case of intermittent fuse blowing. These receivers make excellent rental sets, having a convenient panel arrangement and being very easy to repair. For a more detailed treatment of faults etc., refer to the November and December 1980 issues of *Television*. The official Decca spares source is now D and S Electronics, Building 15, Unit 4, Stanmore Industrial Estate, Bridgnorth, Salop WV15 5HR, telephone 0746 766 641 (Tatung no longer hold spares for sets of this age).

Long-distance Television

Roger Bunney

March is often said to come in like a lion and depart like a lamb. Unfortunately from the DX viewpoint conditions remained akin to the latter animal throughout, and very little to excite us was seen. The weather gave scant encouragement, with winds and rain, though a settled period over the 8-9th produced a slight tropospheric lift, with reception in Band III and at u.h.f. from Holland, Belgium, Luxembourg, and West Germany just making it. Several enthusiasts welcomed sightings of the new Dutch NOS-3 transmitters on chs. E30, 34, 35 and 42, though it must be said that our Benelux counterparts are far less impressed since it leaves them with fewer channels for DXing.

There was minimal Sporadic E reception, though short-duration signals lasting for several minutes were noted. The log, such as it is, follows:

3/3/88	TVE (Spain) ch. E2; SR (Sweden) E3; RUV (Iceland) E4, TSS (USSR) R1.
4/3/88	CST (Czechoslovakia) R1; NRK (Norway) E2.
6/3/88	TVE E2, 3, 4.
7/3/88	CST R1; TVP (Poland) R1.
8/3/88	TVE E2, 3.
9/3/88	SR E2, 3.
16/3/88	NRK E4.
17/3/88	TVE E3; TVP R2; CST R2.
18/3/88	RAI (Italy) IA; TVE E3.
20/3/88	TVE E2; SR E2.
21/3/88	CST R1.
23/3/88	TVE E2.
24/3/88	TVP R2.
25/3/88	TVE E2, 3, 4; SR E2, 3, 4.
28/3/88	CST R2; NRK E3.
29/3/88	TVP R2; CST R2; NRK E4.
30/3/88	SRG (Switzerland – German language service) E3; TVP R2; CST R2; NRK E4.

My thanks to Simon Hamer (Powys), Bill Cotterill (Tipton), Roger Fussell (Torpoint) and David Oliver (Birmingham) for sending in details of their loggings.

Hugh Cocks writes from the Algarve, Portugal with brighter news. He reports that TE (trans-Equatorial skip) propagation was active during March. On several afternoons he received signals, at times strong, from ZTV (Zimbabwe) on ch. E2, with the familiar Z caption. There were no signs of ch. E2 signals from NTV (Nigeria) or GBC (Ghana) however. On March 26/27th Hugh logged Brazilian TV on ch. A2, with Portuguese sound. The signal was fluttery, becoming a viewable picture at times, and was present from around 2200 to about 0100. Weak sync pulses were present during this period in ch. A3. Apparently weak sync pulses in ch. A2 are quite common and can be heard at "scanner" level. On the same night Hugh received tropospheric signals from the Canary Islands in ch. E3. Since Brazil is in the same direction he wonders whether the signals from that country received tropospheric enhancement at the end of their journey.

Robert Copeman at Mount Waverley near Melbourne, Australia reports increased activity towards the end of the SpE season there. He logged Malaysia ch. E2 via multiple-hop SpE – this signal was seen simultaneously by Todd Emslie in Sydney. Another first for Robert was full colour from SAS-7 Adelaide while the local HSV-7 station was off-air. SAS-7 previously used the identification ADS-

7. A pirate frequently operates on ch. 11 in the Melbourne area, with programming (mainly films) for the Greek population.

More news about the aurora, which seemed to be particularly intense during its afternoon phase, on February 22nd. The RSGB v.h.f./u.h.f. newletter reports that UK amateurs had contacts with Norway, Sweden, Denmark, Finland, Austria, Switzerland, Italy, Czechoslovakia, Yugoslavia, Poland, Estonia, France, Belgium, Holland, Eire, Northern Ireland, Scotland, Wales and Jersey in both the 50 and 144MHz bands. In addition the 50MHz Greenland beacon was heard at very high levels. The aurora was preceded by a short-wave fade out and flare on the 20th. On the following day a solar storm occurred. This developed into a magnetic storm during the late morning of the 22nd, the aurora following from that.

I've at last got a working satellite TV receiver in operation. Signal information (TV or telecom traffic) has been noted from the satellites at 34·5, 27·5, 24·5, 18·5 and 1°W and 7, 10 and 13°E. Gorizont at 14°W was also logged, though with an 11GHz carrier only. New Italian cable TV channels were noted intermittently at 18·5°W, at times on test pattern. Ian Waller in Lincoln recently logged various UK outside broadcast links at 34·5°W. The various downlinks at 7°E are mainly used for news distribution but offer many test cards prior to news items. RTM (Morocco), RAI and ORF (Austria) are often seen: more unusual was the USSR 0167 pattern on April 4th. Satellite TV reception has proved to be more rewarding than I'd expected – it's amazing what can be seen, even with a budget set-up employing a 90cm dish.

News Items

New Zealand: Television New Zealand is to adopt a dual-sound system to provide stereo sound, alternative commentary information or the addition of Maori language sound. The extra subcarrier will not involve extensive modification to the existing main transmitters and relays.

The new TV3 service has produced channel allocation problems. BCNZ occupies most of the available v.h.f. spectrum space and has suggested that TV3 uses u.h.f. – though most receivers in NZ are capable of v.h.f. reception only.

Poland: Following two years of experimental transmissions over TVP-1, full-time teletext transmissions are to start this summer, with about 100 pages.

Gibraltar: The Spanish Cadena SER network has put forward proposals for supplying programming to the financially strapped GBC-TV, which has just signed an agreement with ITN to take the 2200 UK news live via satellite.

Sunspot cycle: The sunspot count in the present cycle (22) is rising rapidly, more so than predicted, following the minimum reached in September 1986. The latest forecast from Melbourne is that a high maximum of around 160 mean should be reached in late 1989 or during 1990.

Satellite News: The US FCC is seeking to establish a "high power" Ku band slot between 87-93°W, with only 1·5° orbital spacing. Satellites with 60W TWT amplifiers would give reception over wide areas using small dishes of 1m or less. To cope with the close spacing the satellites would employ cross-polarisation with respect to their neighbours.

The PAN-AM satellite is due to be launched via Ariane in May, with services starting a month after. For the European (Ku band) coverage of this US satellite, see page 522 last month.

Canal 10, the Spanish-language cable service available at 27·5°W, has started to use sat-save scrambling (similar to that used by the BBC/Premiere).

After nearly eleven years in operation the Indonesian Palapa A-2 satellite has been retired to make way for Palapa B-2R.

SpE Reception from the Middle East

As the season of SpE propagation starts, thoughts amongst DXers often turn to "what can be received other than TVE and RAI every night?". For many of us, reception of Arabic stations in the Middle East adds an element of romance. In Europe, the closure of Band I transmitters continues while 50MHz amateurs and other non-TV users have come to occupy parts of the spectrum, but in the Middle East Band I is firmly established for TV use and the good news is that an increasing number of transmitters are coming into operation. Information on these stations tends to be unreliable – in several instances specific details are not known. So the following must be taken as a general guide rather than a definitive listing! All the transmitters listed could be received in the UK via single- or double-hop SpE. The transmitter power doesn't have to be great for SpE reception: in the early seventies I recall receiving an RUV (Iceland) 10W relay station in Southampton, on ch. E4.

Turkey (TRT): Bagisli ch. E3, 5kW e.r.p. horizontal (one source suggests 2·5kW). Istanbul University (campus transmitter – may be closed) ch. E4, 0·5kW horizontal. There have been no UK reception reports of these transmitters.

Syria (STC): Abou-Kmal 200kW and Nabi-Saleh 100kW,

both ch. E3. Hassakeh 200kW and Salkhad 0·64kW, both ch. E4. Signals on both channels have been received at good strengths in the UK and Low Countries.
Jordan (JTV): Suweileh ch. E3, 104kW e.r.p. This station is commonly received via SpE.
Lebanon (TL): Fih 1·1kW, Beit Mery 1kW and Jounieh 1kW, all ch. E2. Masser el Chouf 60kW ch. E4. The situation in this country is of course rather confused. The ch. E4 transmitter has been received in the UK, with confirmation from TL. French language programming heard in ch. E2 may come from this country.
Egypt (ERTU): Dumyat chs. E2 and 4, both 0·9kW. Port Said ch. E3. The ch. E2/4 transmitters are known to be on-air but Port Said may be closed, though it's been seen in the UK in earlier years. A "mystery" ch. E3 FUBK test pattern sometimes seen during SpE openings may come from either Egypt or Libya.
Saudi Arabia: Dahran ch. E3, 12kW e.r.p. – the Aramco outlet. This station has been received in the UK and the Low Countries on several occasions, with both English and Arabic programming, opening with the Koran. All Middle Eastern stations, including English-language services, open with the Koran. English-language services often have sub-titles.
Iran (IRIB): Shiraz 20kW, Boushehr, both ch. E3. Hamedan 108kW, Ilam and Shah Nakhjer (possibly 200kW e.r.p.), all ch. E4. Iranian stations have been received in the UK several times.
UAE: Dubai 240kW e.r.p., ch. E2. Abu Dhabi 1kW ch. E3. Dubai has been received in the UK.
Bahrein (BT): Isa Town 120kW, ch. E4. Thought to have been received in the UK and the Low Countries.
Yemen (YTV): Al-Ainah ch. E4, 0·4kW e.r.p. No reports of this one ever having been seen!

Arabic stations closer to home include Ramada, Tunisia (RTT) ch. E4 and Laayoune, Morocco (RTM) ch. E4. The 40kW Ramada transmitter is often received, using the FUBK pattern; Laayoune uses the PM5544 pattern and is less often received.

For those who go in for satellite TV reception, Iran can be seen via an 11GHz downlink at 63°E. It's just receivable over the horizon in east/SE UK.

Information in the above listings was obtained from the *World Radio/TV Handbook*, the European Broadcasting Union's *List of VHF/UHF Television Stations* and the Benelux DX Club. Additional information would be welcome.

Book Review

Books on satellite TV have in the past always seemed to be rather pricey. Bernard Babani (Publishing) Ltd. however has just published *An Introduction to Satellite Television* by F.A. Wilson at a very reasonable £5·95 (order code BP195, from Babani Publishing at The Grampians, Shepherds Bush Road, London W6 7NF). The book is in A4 format with 104 pages and a blue hard cover. It's easy to read, though the author does in places use a lot of mathematical formulae to prove specific points or characteristics.

The book assumes no knowledge of the subject. It starts with the basics, working its way through signal characteristics, how satellites are put into orbit and work, downlink characteristics and footprints and, very important, information on home TVRO installations. A series of appendices provide detailed calculations. Much of the information is presented in an informal manner, which makes it easy to follow – for example the section entitled "The Uninvited Guest" gives information on unwanted noise and other interference arriving from space. Good also to see a vast gain chart for dishes of various efficiencies at different frequencies. Did you know for example that the gain of a 70cm dish with an efficiency of 65 per cent is 37·2dBi at 12·3GHz? The book deals mainly with K/Ku band operation, with only bare mention of C band.

There are numerous illustrations, charts and graphs throughout, though I would have liked to see a few photographs of reception, showing noise degradation at various levels etc. Commercial equipment is not featured, which means that the book will not date. I feel that it's very good value at the price and should serve as a useful reference work.

From our Correspondents . . .

Steve Giess has written drawing attention to the cheap ($4·95) "TV modulator with antenna switch" marketed in the USA by Radio Shack, order no. 277-1015. It's compact, metal cased and takes a video input at 1V, 75Ω with audio at 1V, 39kΩ, the output being on either ch. A3 or 4 at 300Ω. It can be easily retuned from system M to system I sound spacing. The modulator is made by Texas Instruments, with Astec components. Steve also comments on computer interference: his Atari 520STFM has minimal emission in Band I and just a little more in Band III – but vastly below the levels from BBC, Electron and Sinclair models.

Brian Renforth, an active DXer for many years, seeks contact with others in his area. Write direct to him at 174 Helmsley Road, Sandyford, Newcastle upon Tyne, Tyne and Wear NE2 1RD.

Jean-Louis Dubler writes from Montreux that the high powers being used by Swiss TV are causing severe adjacent channel interference to several Italian outlets in the Milan area, while the French CNCL (equivalent to the UK DTI) has closed down three illegal French f.m. transmitters that were being used to broadcast to Switzerland across Lake Geneva. The Swiss government has forced the TV channel Telecine to end its agreement with Canal Plus since the latter doesn't adhere to guidelines for subscription TV issued in Switzerland. Telecine's finances now look decidedly dodgy.

Book Review

Principles of Domestic Video Recording and Playback Systems by K. Shipman, LCG, Eng. Tech. Published by Dickson Price Publishers Ltd., Hawthorn House, Bowdell Lane, Brookland, Kent TN29 9RW at £15·95.

We are told that this book "is primarily intended to provide those interested in video cassette recorders with a basic appreciation of their fundamental operating principles, the depth of coverage also being appropriate for students studying for the City and Guilds Part III Video Recording and Playback certificate". There are nearly 300 large pages, and the book tackles the subject matter very thoroughly. We found it easy to follow and were impressed by the wealth of excellent technical diagrams – the electronic, mechanical and computer control aspects of VCR operation are all comprehensively illustrated. The book covers the VHS, Beta and V2000 systems, though the latter is now obsolete. It does not cover the 8mm system. We feel that the book is very good value at the published price.

What's up Doc?

Les Lawry-Johns

You may remember the articles "What's up Doc?" parts one and two that I wrote some while back. They related to an examination (painful) I had to have and a prostate operation to help remove a swelling on my right-hand side. I still have the swelling, but at least I know that it's nothing to worry about. What has been worrying me is this heart trouble I've mentioned from time to time recently. My doctor made an appointment for me to see a heart specialist about my muzzy head, which doesn't allow me to think straight – or to write straight either.

It took some time for the date of my appointment to come round. I went along to the hospital on March 30th and after a while I was weighed and measured. Then I went in to see the specialist. He asked me what the trouble was and I told him I couldn't think straight because my doctor thought my heart wouldn't pump enough blood up to my brain.

"How long has this been going on?" he asked.

"Since last October" I replied. "I seem to be muzzy most of the time."

So he asked me some questions to see whether my brain was working.

"Who's after Neil Kinnock's job?"

"Tony Benn."

"Who's helping him?"

"Some left-winger. I forget the name."

"How many children has the Queen got?"

"Four, I think."

"Name them."

"There's Charles and Ann and the one in the Fleet Air Arm, my old mob, that's Andrew. And one who wants to be on the stage, er, I forget his name."

"Edward."

That's all he asked. I think. Then he gave me a brief check over and some chits of paper to go and have tests. As I made my way down the corridor I kept seeing people I knew I should have known, but I couldn't think of their names. One of them told me to pop into the X-ray room first and give them my name and one of the chits, then to go to the blood test department to get that over with, after which I'd be first in line for the X-rays. It nearly worked out like that.

I told them in the blood department that they'd find it was largely whisky, and that raised a laugh. But I think I'll get a ticking off from the specialist when I see him again. It's just that I don't like the idea of swallowing a lot of rat poison to keep my blood thin. Well, that's my story anyway.

The girl in the X-ray room told me to undress, upper part only. After the X-rays I dressed and was then called back and told to get undressed again as the machine hadn't seen enough.

The tablets I was given to take are very small white ones. It says on the bottle take half a tablet twice a day. The job is cutting each one in two. Oh well, all in the cause of science I suppose. Back to work.

This Skantic set had a Luxor chassis inside and I spent quite a long time trying to find out why it wouldn't start. Eventually I gave up. When its owner came back I explained that I wasn't thinking too clearly and couldn't do it. I put it on the bench to show him. Switched it on and a beautiful picture appeared, with good sound. I told him to take it away as I wasn't feeling up to it all.

But if there's one set that doesn't worry me it's a G11. Until this one came along, I'd resoldered all the joints, fitted a new line output transistor, and had the set on test. After a while the picture faded. The sound faded too. Attention to the video panel restored a good picture, but the sound remained low. As it was a remote control version I first tested the audio section on the lower left side – this responded well to tests – then turned my attention to the extreme left side remote control panel. After a lot of seeking I replaced the resistor that feeds the volume control. This restored normal sound, and the set was collected shortly afterwards. It came back next day with the complaint "no sound". I switched it on and received full sound. Oh well . . .

Philips KT3 Drill

Some of our usual stock faults are changing slightly, though they still come in often enough. Take the Philips KT3 chassis. It was common for the tripler to cause audible tripping. We now more often get complete shut down. If the h.t. is present at both ends of the 4·7Ω surge limiting resistor in the power supply, don't waste time – disconnect the line output transistor (remove the connecting screws to its collector). If this restores some signs of life, disconnect the tripler's input lead and replace the line output transistor. If the line output stage now works, bring the tripler's disconnected lead back near to it (beware of the high voltage). If the result is tripping, replace the tripler and write out the bill.

Remember the drill. If the set is tripping, disconnect the tripler. If this was the cause of the fault the tripping will stop and the tube's heaters will light up. If the set is dead, check the 4·7Ω resistor on the power board then, if necessary, disconnect the line output transistor (I didn't say the BU208A, because alternatives are sometimes fitted). It's also wise to disconnect the tripler to prevent the new transistor going up the creek. It may not do so, but it's sensible to protect it in this way.

Is This a Record?

Something that I might claim to put in the book of records has just happened. A car drew up outside and the driver left its engine running as he carried in an old Decca Bradford. He left the door open as well.

"I'd like you to look at this and tell me how much it would cost to repair it."

"If you'd like to leave it, I'll look it over and tell you this afternoon."

"Could you look at it now?"

So I looked, having removed the rear cover. I switched it on and the tube's heaters glowed but the valves didn't light up. I thought I'd start at the beginning, so I switched off and removed the PY500 boost diode, whose heater comes first in the heater chain. The top cap came off and there was a hole in the glass. A check on the heater confirmed that it was open-circuit.

I fitted a new PY500 and switched on again, keeping my eyes on the heaters, ready to switch off in a hurry. The heaters all glowed but there was no sign of life at the PY500's top cap. So I turned the set on its side and carefully slid the chassis out. The 500mA fuse in the supply to the PY500 was open-circuit. I fitted another and turned the set upright. When the set had been switched on again and the valves had warmed up, life returned to the line output stage. Connecting an aerial produced a picture. The tube was in good order and the sound was clear.

"How much?" he asked.

"Twelve quid" I replied.

"O.k., I'll have it done."

"It is done."

"Make out the bill then."

So I made him out a bill. He paid up and carted the set out – after I'd replaced the rear cover. He put it back in the car, closed the door (at last), jumped in the driver's side and drove off.

I ask you. Draw up, leave the engine running, leave the door open and have the set repaired before closing the door again. Can I claim a record – for being a fool?

Practical Computer Programming

Part 5

Mike Phelan

It's time we considered the steps involved in designing, producing and testing a typical computer application. As an example we've selected a repair history database covering customers' equipment. We want to be able to store data on the types of faults dealt with, actual repairs carried out, parts fitted, charges made and so on.

Before deciding to go ahead it's worth considering whether the use of a computer to do the job is appropriate. If the use of a computer entails extra cost, time spent or any other debit aspect, it may be better to do the job manually. If, on the other hand, a computer is available, the volume of work is such that keeping paper records is not really feasible, or you wish to be able to extract much more information than could readily be done with a manual paper system, then the use of a computer is worth consideration. A direct comparison is usually difficult, because the computer system will end up giving you more than the manual one it might replace. Another point, though an obvious one, is that the amount of detail required in any output, whether on a screen or a print-out, must at some stage be keyed in.

This raises the question the amount of data to be held. A database system reads the information from tape or disk and holds some or all of it in memory. Is there enough room for this? Maybe we shall have to sacrifice some of the data – or not store it for ten years! Generally it's not necessary to keep data for too long, but in the present example it would be nice to record the history of a set during its lifetime – whatever that may be.

System Specification

Assuming we've decided that a computer system is appropriate, we can go ahead with its design. You may be surprised that we've not so far mentioned anything about the choice between an off-the-shelf package or dedicated software, and in the latter case which computer language to use. We will not be going into this for some time yet. At this stage, the truth is that it doesn't matter. These questions will be taken up at the end of the design stage.

In this context, design is what is called a "system specification" as opposed to a program specification. The system specification covers things like which items of data are to be stored, how the system must appear to the user and what comes out of it in what format. After doing this we can decide on which package or language to use, taking into account the budget, expertise available and the possible limitations of a particular language.

Now down to it. We start at the back end. What do we want out of the system? Fairly typical things on the list would be: (1) a complete service history of any set; (2) turnover in a given period; (3) the progress of a particular job (in a large or medium business); (4) parts used; (5) call rates per annum for a given make/model. Items (1) and (3) could be available on-screen only, items (2) and (5) printed, while (4) might need to be interfaced with some form of stock control should the system be expanded. In our example, we'll leave out (4).

Design Procedure

The next stage is to design on paper the five types of report required, detailing each item of data and whether it is to be entered directly or calculated from other data. Following this we list all the data items that need to be stored on disk, excluding those that can be calculated on the spot (call rate percentages and so on). We also need to specify the type of data (numerical or character) and its width, i.e. how many digits per item.

A first attempt might look like this:

1	Name	16
2	Address line 1	24
3	Address line 2	24
4	Address line 3	24
5	Address line 4	24
6	Postcode	9
7	Telephone number	12
8	Make	10
9	Model	10
10	Repair description	50
11	Net cost	10
12	Price charged	10

which amounts to a space requirement of 223 digits (bytes) per record. We now have a database consisting of one record per repair job, which is the level of detail we need. The record has twelve "fields".

Suppose that we have 200 customers, each with a rather troublesome video, TV set and radio receiver, and that each of these items generates five service calls a year. Over a complete year we would have 200 × 3 × 5 records of 223 bytes each, which would take up 653K bytes of disk space! As this is beyond the limits of most disk systems in our range, we must clearly cut down somewhere.

It will help if we can reduce the size of some of the fields in each record. Each item needs only sufficient information to make it unique. This is an important point. For example, we don't actually need 9 digits for the postcode since it's not necessary to store the space between the two parts, so 8 will do. Likewise a phone number requires only 10 digits, or we might decide to omit this item – there's an excellent database called the telephone directory. We will normally need to phone the customer only while a repair is in progress. The job will have some sort of ticket attached to it, and we can write the phone number on this when given. Other savings can be made on things like the make and model – using the first three or four letters of the maker's name should be enough for identification purposes.

Fifty bytes for a repair description is extravagant: a series of codes, each one representing a particular type of repair, could be used. More than one repair may be carried out on a piece of equipment at a particular time, so we need room for more than one code. Up to five simultaneous faults per item should be sufficient. We need to know what the codes mean, but more on this later.

We don't need to use ASCII code to represent each individual digit in a number. After all, a byte in itself can represent any number up to 255. If we need decimal places, each type of computer has its own way of storing such numbers. Typically, "real" numbers (those with decimal places) are stored as four bytes. We could of course store monetary values as integers (pence).

After applying this logic, the database may look like this:

1	Name	12
2	Address line 1	24
3	Address line 2	24
4	Omitted	
5	Omitted	
6	Postcode	8
7	Omitted	
8	Make	3
9	Model	8
10	Repair description	5
11	Net cost	4
12	Price charged	4

which has reduced the total space per record to 116 bytes. By assuming the same total number of repairs per year as before, i.e. 3,000, we arrive at a storage requirement of 339K bytes (remember that 1K = 1,024). This is better, but could we save any more without losing anything? The answer is yes.

So far the customer and equipment details have been repeated for each repair. Thus much of the data is redundant. What we need is a way of identifying the customer without repeating his name and address etc. We can't use any of the existing fields to do this, because the name for example is not unique. Neither are any of the address lines. Hold it, I hear you say – why not use the first address line? The possibility of having two of these in the same area is remote to say the least, but it's possible. We could maybe use the name and one address line, but this would not save much space.

Use of Linked Files

The answer is to use a customer identification field. We still need to store the other details – name and address – but these can be in a separate file, as long as both files contain the customer identification field. The identification could be numeric, but as most computers store numbers as four bytes it would be better to use a character field of two bytes. By using only the upper case letters of the alphabet we could store 26 × 26 (676) customers. If we need to store more, use of lower case and numerals gives us a maximum of 12,996 (114 × 114). If you need to store more than this you can probably afford a larger computer! So our customer file has only one record per customer now, and things are arranged as follows:

Customer file

1	Name	12
2	Address line 1	24
3	Address line 2	24
4	Address line 3	24
5	Postcode	8
6	Customer identification	2

which is 94 bytes per record, giving a storage requirement of 18·35K for 200 customers, plus

Repair file

1	Customer identification	2
2	Make	3
3	Model	8
4	Repair description	5
5	Net cost	4
6	Price charged	4

which, at 26 bytes per record multiplied by 3,000 repairs, is a storage requirement of 76·17K.

It's obvious then that by rearranging the data in two files we've effected a considerable saving in space – now only some 94·5K bytes in total are required. This technique of using more than one file, linked in some way, is known as a *relational database*. The customer file has one record per customer and all the fields that are unique to a customer are in this file. Each customer record "owns" one or more records in the repairs file, which contains only the fields relevant to each repair plus the important linking field.

Use of Alphabetical Code

As previously mentioned, to save space repair descriptions can be replaced by alphabetical codes. We could possibly record the fault descriptions supplied by the customer in a similar way, as the two often don't relate! One way to do this would be to keep a printed list of the codes and descriptions by the keyboard. We would need to refer to this on data entry and also when looking at the computer's output.

We could get the computer to do the work of supplying a fault description when given a code but the converse, converting a description to a code, would for several reasons be impractical. The descriptions would have to be consistent, correctly spelt, and would take longer than a code to enter. An effective compromise would be to enter the code, with the key to the codes being displayed on the screen or available upon pressing a particular key. The key could be kept in the form of a file with two fields (description, code) or embedded in the program. If the list is fairly constant, the latter would suffice, but if changes are envisaged files must be kept together with the facility to add, amend or delete a record. This system is known as a *look-up table* – the data is not directly involved in the processing but instead forms a sort of dictionary. The add/amend etc. facility is known as a *file maintenance* routine. This could be a single program for both repair and fault descriptions, as both files have the same structure.

Situation So Far

We have now seen that it's possible to arrange data so as to save space, by having more than one file. The language or package eventually selected might not allow this, a factor that may limit the amount of data stored. Next month we'll take the design process a stage farther, by deciding what sort of screen displays and reports are required. The actual program design, if we adopt the homebrew approach, comes later.

Storing TV Pictures in Chips

Part 1

Eugene Trundle

Basically, TV and video systems are of analogue type. Light values and colour values can be measured, stored and moved around in digital form, but at either end of the signal chain the transducer – the pick-up sensor and display device – must be of analogue form to interface with the world we inhabit, including the human eye which is the final arbiter of all our efforts in TV and video.

In the recent past, developments in TV technology have tacked various digital items on to the basic analogue signal in peripheral roles - examples include engineering control signals, teletext and NICAM stereo sound signals. The same thing is starting to happen with broadcast radio, where radio data signals are now being added to some of the v.h.f. carriers. Digital technology had already taken a firm hold in the control systems used for domestic electronic equipment: remote control, frequency-synthesis tuning and the mechacon systems of video equipment are prime examples. As the microprocessor, originally developed for computer use, sought new applications, so versatile, convenient and sophisticated systems undreamt of a few years ago have become a part of the domestic TV/video field.

The first example of true video signal processing in digital form in a domestic TV set came with the ITT Digivision range of colour TV receivers. While this was an admirable concept, initially the price of memories capable of storing a TV field was too high to make it feasible to incorporate such a device. Thus the many possible advantages of digital video signal processing could not be exploited. Because the basic constraints of the analogue broadcast system and the conventional c.r.t. remained, the Digivision pictures hardly differed in appearance from those produced by a conventional receiver.

Recently however the cost of memory chips has fallen dramatically – as mass-production yields have improved and as markets have expanded. This has been reflected in the vastly increased storage capacity of modern home computers, in the very low premium charged for Fastext decoders and now, suddenly, in the availability of TV and video products incorporating digital storage features. The cover of our July 1987 issue showed the PIP display on the screen of a Sanyo TV receiver, and almost overnight several video manufacturers introduced "digital" VCRs with field-store memories. Initially the main use of these was to freeze off-tape or off-air pictures with much better quality than had been possible with previous still-frame systems, in which the tape transport system is stopped and a single tape track is scanned continuously. Apart from this obvious application, a digital storage facility with a versatile control system has the potential for strobe, zoom, mosaic and paint-box effects, "fast shutter" and time-lapse tricks, multiple picture displays and, more usefully, reduced picture flicker and noise cancellation. With sufficient memory capacity it's also possible to achieve a subjective increase in definition: this is done by interpolation between the picture elements in successive frames and fields.

Since the analogue TV transmission system will continue, for both terrestrial and satellite TV transmissions, for the foreseeable future, it does seem that digital picture processing is the way forward for domestic TV and video equipment.

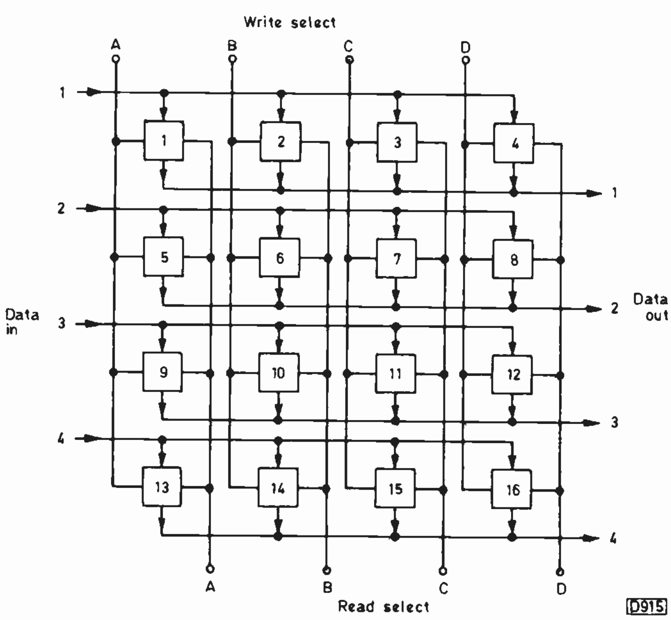

Fig. 1: Basic form of 16-cell memory array.

Memories

Before getting involved with techniques we need to know something about how a digital memory works and how it's arranged. A bit (binary digit) is a single piece of data and can have a value of only 0 or 1. To store a bit, a single memory cell is used. A bistable (flip-flop) can be used as the cell, held latched in one of its two states. This would typically be in a volatile bipolar memory, from which the data is lost as soon as the operating voltage is removed (hence the term volatile). An alternative type of cell consists of a field-effect transistor memory, in which the data bit is temporarily held as a charge on the insulated gate of a MOS transistor. Both these types of memories are referred to as RAMs (random access memories), which means that data can be written into or read out of the cells at will. A memory chip's storage capacity depends on the number of storage cells it contains. This is always quoted in bits, e.g. 64K or 512K. It is the convention with memory devices that K = 1,024. Thus a 64K memory has 65,536 cells, i.e. locations, and a 512K memory has 524,288 cells. The reason for this is that with binary numbers we have to think in terms of powers of two, not ten.

For the purpose of reading or writing, a cell must be addressed individually before data transfer can take place. The addressing procedure depends on how the memory banks within the chip are arranged by its manufacturer. Fig. 1 shows an elementary 16-cell memory array arranged in four rows and four columns. To write data to cell 6 a 1 is put on write select line B and the data to be stored is then applied to data input line 2. At this time input lines 1, 3 and 4 are kept open-circuit so that only cell 6 can be written into. Now assume that we want to read from cell 15. A 1 is put on read select line C and the data is read from data output line 4, all the other output lines being held open-circuit.

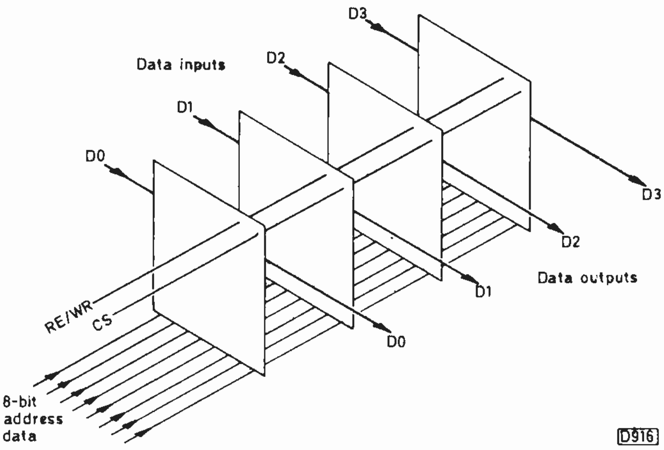

Fig. 2: Parallel addressing and control of a multi-array memory system.

This row/column matrix system is universally used for RAMs of the type we are dealing with. Consider a 1K memory arranged as 32 rows and 32 columns. This would call for 32 data input lines, 32 data output lines, 32 write select lines and 32 read select lines, i.e. a chip with at least 128 pins, which is clearly impractical. It's possible however to define the 1,024 separate locations in terms of a 10-bit binary word, so that with a suitable address decoder within the chip the addressing information can be conveyed on ten lines. Since only one bit at a time can be handled, the data input can be routed via a single pin and then sent to its destination via internal switching. Similarly a single data output pin suffices. The read/write command can be sent as a binary signal to a single i.c. pin. Thus at the expense of some added complexity within the chip the number of pins required is reduced to 10 for addressing, two for data, one for read/write, the supply voltage and earth pins and, usually a chip enable line which we'll come to in a moment. The arrangement of this memory chip is 1K × 1 bit.

Let's see how we would store data in this chip. The input data will have to be in serial form as there is only one line for it. As each bit appears on the input data line an appropriate address is sent along the address bus by the memory control chip, which in a computer is the microprocessor CPU and in a TV receiver or VCR effects generator will be a complex gate array. The bit is stored at the designated address in the memory, then a new address designates a new destination for the next bit in the serial data stream and so on. Thus the memory becomes filled with data which is held as long as power is applied. The data can be read out in the same serial sequence only if the addresses follow the same sequence as before.

Note that the write and read operations don't have to be at the same speed, so the data rate can be compressed or expanded as required – so long as the rate doesn't exceed the chip's access time. Bipolar (TTL) memories are fast, about 40nsec compared with some 250nsec for most FET types. The latter are slower because of the time-constant represented by the high gate resistance and storage capacitance. The latest types of FET memories have much faster access times, achieved by reducing the size of the cells and their connections.

Parallel Addressing

It's rare that we would need to handle one bit at a time. Most digital information is in parallel form, typically 4-bit nibbles or 8-bit bytes. So our 1K memory could alternatively be arranged in 256 × 4-bit form, as shown in Fig. 2. Here the cells are arranged in four arrays of 16 × 16 cells, with their address, read/write and chip select lines all connected in parallel. Each of the data input and output lines is connected to one array, so that the four bits of each nibble are separately stored at identical addresses on different "layers" of the chip. We now have to be able to specify only 256 addresses, for which eight address lines are sufficient. If required, the four-bit data nibbles (D0-D3) can enter and leave the chip via the same four pins – by using an I/O (bidirectional) port programmed by the RE/WR (read/write) signal. The 1K memory we are using as an example could also be arranged as a 128 × 8-bit device, with eight data I/O pins and a 7-line address bus, and so on. The same applies of course to the larger capacity memories that are used in practice.

The CS (chip select) line is used by the memory control chip to select one of several memory chips whose data, control and address buses are connected in parallel. For instance, a 1Mbit memory bank can be made up of four 256K memory chips connected in parallel, with only one of them in operation at any one time. Until its CS line is activated, each chip is effectively disconnected from both the data and address buses and has no effect on either.

Digital Video

A colour video signal can be digitised in either component or composite form. With component coding the individual Y/U/V or R/G/B waveforms are digitised separately to produce three streams of data pulses. With composite signal coding the complete CVBS (composite video, blanking and sync) signal is sampled and quantised as a single entity. For good special effects, component coding is essential in studio practice. For productions where high-quality chroma-key work is required wideband RGB coding may be necessary.

So long as complete, real-time pictures are being dealt with composite coding is quite adequate in domestic equipment, where cost is a vital factor and performance can to some extent be traded off for other benefits. This greatly simplifies the electronics and minimises the memory capacity required. Digitising a composite colour CVBS signal calls for a high sampling rate, so that the higher luminance frequencies are adequately defined and the chroma subcarrier frequency is described in sufficient detail, though there is room for compromise in the number of amplitude levels used. For broadcast-quality pictures about 220 levels must be separately defined, and in professional practice 256 levels are used. This calls for an eight-bit word to describe each picture element. If fewer bits are used the number of brightness and colour levels available is reduced and the reproduced picture becomes coarser – the noise figure also rises. A six-bit system will enable an acceptable picture to be reproduced however, with 64 signal levels defined. At present most home-video digital processors are based on a six-bit system. The first to be described is used in the Toshiba DV-80 series of VCRs, but others are similar.

System Overview

An overall block diagram of the digital section of the system is shown in Fig. 3. The composite video input signal is passed into an analogue-to-digital (AD) converter from which it emerges as a stream of parallel six-bit words at intervals of about 75nsec. These enter the memory control chip, which first slows down the data rate by a factor of four

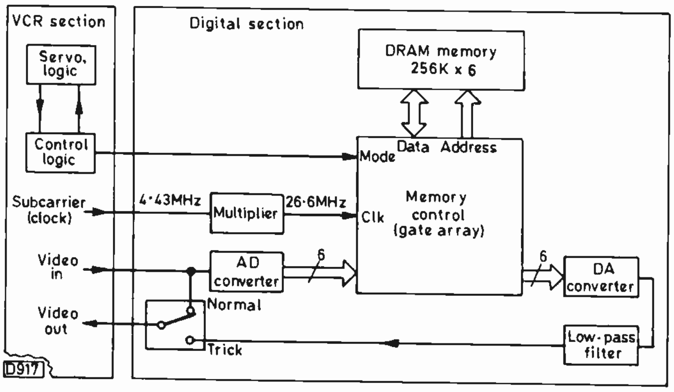

Fig. 3: Outline of the digital video processing section of the Toshiba Model DV-80 VCR.

to suit the access time of the memory bank. Data is passed to the memory in 4 × 6-bit parallel form, under the control of address instructions from the memory control chip. The memory consists of six 64K × 4-bit DRAM chips, giving a total capacity of about 1·5Mbits (DRAM = dynamic RAM – the MOS transistor charges have to be "refreshed" periodically, a process that's done automatically).

In the read mode data is taken from the memory in 4 × 6-bit parallel form and converted to the original 6-bit words by the memory control chip. The 6-bit data is restored to analogue form by a DA converter, the following low-pass filter being used to remove vestiges of the clock pulses. It now forms the video output signal. The system clock runs at 26·58MHz, which is derived from the 4·43MHz chroma subcarrier by means of a times six multiplier.

Sampling and Quantisation

The first step required is to convert the signal to digital form. Fig. 4 shows a short section of the video waveform, which contains luminance and chrominance information. The section of signal is of about one microsecond duration, and thus represents about 1/52nd of the active duration of a single TV line – say 9mm with a 56cm c.r.t. screen. The signal is sampled by opening a gate at intervals of about 75nsec, under the control of a clock pulse train running at three times fsc (the colour subcarrier frequency). These samples then have to be quantised, i.e. their amplitude is measured against a yardstick having, in this case, 64 divisions. The results are expressed in terms of binary numbers. The first three samples in Fig. 4 are 27, 44 and 57, which in binary terms are 011011, 101100 and 111001. Because the system is a "closed-circuit" there's no risk of damage to or corruption of the bit stream, so there's no need for extra parity or other protection bits – quite unlike teletext, audio CD and Video 8 PCM systems which require heavy protection.

AD Conversion

There are many ways in which AD conversion can be carried out. The choice depends on the speed and accuracy required for the signal being processed. In this application a fast simultaneous converter (sometimes called a "flash" converter) is used. It takes the form of sixty-three separate comparators as shown in Fig. 5. One input of each comparator is connected to a tapping point along a potential-divider chain consisting of 64 separate resistors strung between precision reference voltages of 5V (VRT) and 3·992V (VRB). Thus the voltage applied to the

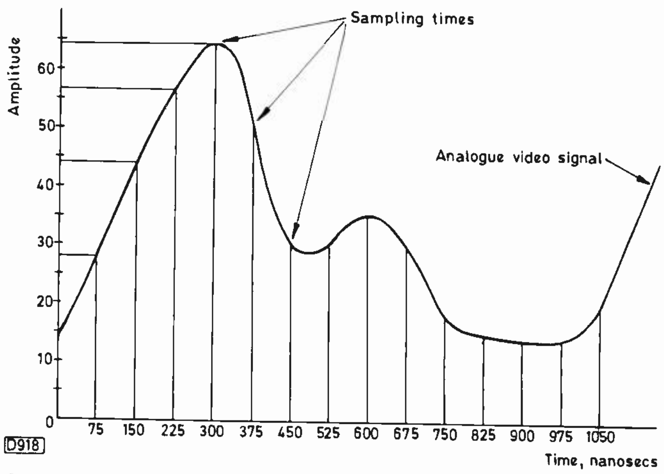

Fig. 4: Sampling an analogue waveform, in this case at a 75nsec interval rate.

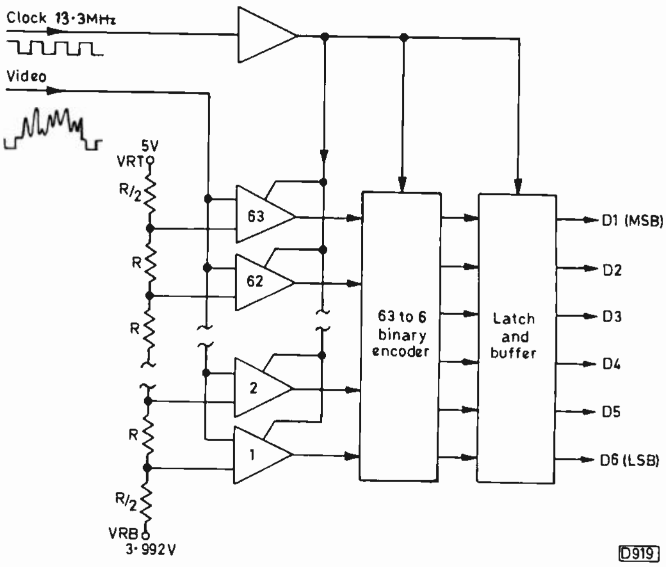

Fig. 5: Analogue to 6-bit digital converter arrangement using comparators.

reference input of each comparator in the group increases in 16mV steps over a range of just over 1V. The sync tip level of the video input waveform, which is of nominally 1V peak-to-peak, is firmly clamped to the AD converter's 3·992V reference voltage and is simultaneously applied to the sampling inputs of all the comparators – these inputs are connected in parallel. As the video input level rises above 3·992V, progressively more of the comparators will conduct.

Samples are taken on each rising edge of a 13·3MHz clock pulse train, so that going into the binary encoder we have a chain of "snapshots" of the amplitude of the video waveform at each sampling instant. The encoder converts these quantised samples into 6-bit words which are then passed to a latched buffer. All the blocks shown in Fig. 5 are incorporated in a 16-pin AD converter chip, type MB40576.

Serial-Parallel Conversion

At the AD converter chip's six output pins we have data emerging at a rate of 13·3Mbits per second. This is too fast for transfer into the memory bank used. The speed is reduced by a factor of four in a serial-to-parallel converter in the memory control chip – see Fig. 6. Each of the six streams of incoming data is fed into a four-stage shift

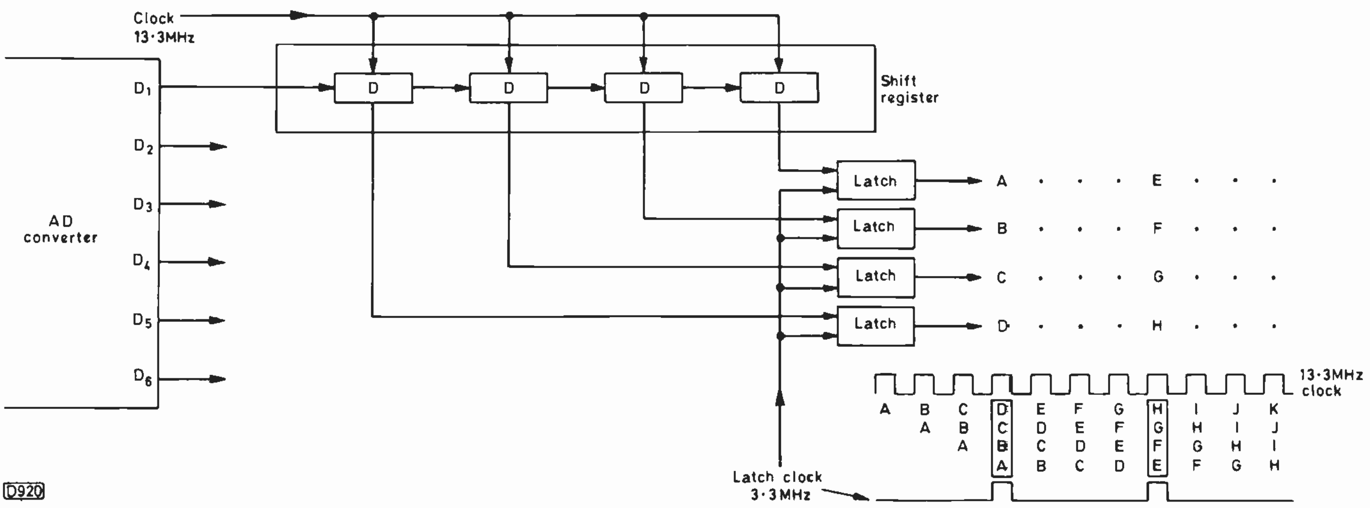

Fig. 6: Serial-to-parallel converter for bit-rate reduction. The time-related chart shows how four bits are accumulated and are simultaneously transferred to the memory at each latch clock pulse.

register which is controlled by the 13·3MHz clock signal. As you will see from the chart in Fig. 6, following every fourth clock pulse the register will be full. At this point the 3·3MHz latch clock freezes the data from a register in four latches. For each of the six input data lines there's a separate series-to-parallel converter of the type shown in Fig. 6. The result of this operation is 24 output lines carrying binary data at 3·3Mbits per second instead of the original rate of 13·3Mb/sec. These 24 parallel outputs are passed direct to the memory via the memory control chip's 24 output pins. Thus the data is now being transferred four samples at a time (hence 4 × 6) at a speed of about 300nsec, which is well within the capability of the memory chips whose access time is about 250nsec.

Memory Store

The memory consists of six type MB81464-12PSZ 64K × 4-bit DRAMs. This type of memory chip was chosen for its low power consumption and high storage density characteristic. It's of the type in which each bit is stored in the form of a charge in the stray capacitance existing at the gate region of a NMOS transistor. This capacitance is tiny, so the charge will soon leak away – this is why the refreshing process previously mentioned is necessary. It takes the form of an automatic internal read/rewrite cycle at intervals of a few msecs.

Each memory chip has four I/O pins and 64K addresses. A 16-bit word would normally be required to define these addresses, but some economy is possible here. In this application we don't need the speed and versatility of true 16-bit addressing, nor could the number of chip pins and bus lines be easily accommodated. Instead, the memory locations are arranged as 256 × 256 squares of rows and columns within each chip. An 8-bit row address word comes along the address bus first. It's latched into the row address store within the chip by an externally applied pulse called the row address strobe (RAS). The 8-bit column address word comes along the address bus next and is latched into the column address store within the chip by a column address strobe (CAS) pulse – these strobe pulses come from the memory control chip of course. The trailing edge of the CAS pulse activates the row and column address decoders, enabling data to be written into or read from the specified addresses. The timing of the RAS and CAS pulse chains is such that the address multiplexing operation occurs outside the critical path timing sequence for read or write data access. Thus only ten pins are required for addressing – A0-7, /RAS and /CAS. In addition each memory chip has an input pin for read/write (/WE), an output enable pin (/OE) plus supply and earth pins. The four data pins are bidirectional, under the control of the /WE pulses.

Storing a TV Field

The actual capacity of these 64K × 4-bit DRAMs is 262,144 (64 × 1,024 × 4), so the six chips used provide a total capacity of 1·572864Mbits. We must now relate this to a single field of TV information. The sampling frequency is 3 × fsc, and there are six bits per sample. A total of 3 × fsc × 6 = 79,805,142 bits per second is thus being generated. The duration of a TV field is 20msecs or 1/50th of a second, so to accommodate this the memory must be capable of holding 79,805,142/50 = 1,596,103 bits. The available capacity of the six DRAMs is about 98·5 per cent of this, implying a shortfall of about four TV lines. This problem is overcome by writing the first 308 lines or so into the memory then discarding the information at the very bottom of the picture.

Thus during readout (see Fig. 7) lines 309-312 are missing. To avoid upsetting the sync and clamping of the display, this "blank" period must contain video information. With a VCR-derived picture the four lines prior to this, approximately 304-308, occur during the head changeover period and thus contain noise and jitter. Rather than repeat these poor quality lines the shortfall is made good by re-reading clean lines from the centre of the field, tacking these on at the bottom of the picture. In a correctly adjusted TV set or monitor they will be outside the viewing area. To prevent interference to the PAL phase sequence during these four lines the chroma information is

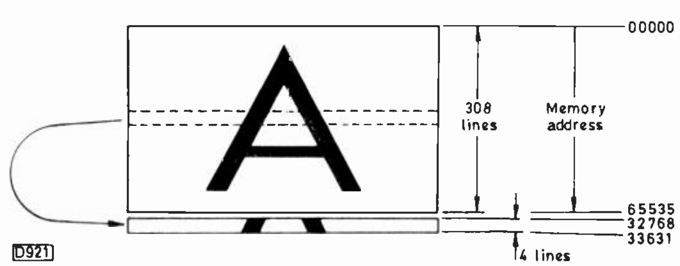

Fig. 7: To make up the four-line shortfall in the capacity of the memory a "slice" from about the centre of the picture is tacked to the bottom of the field.

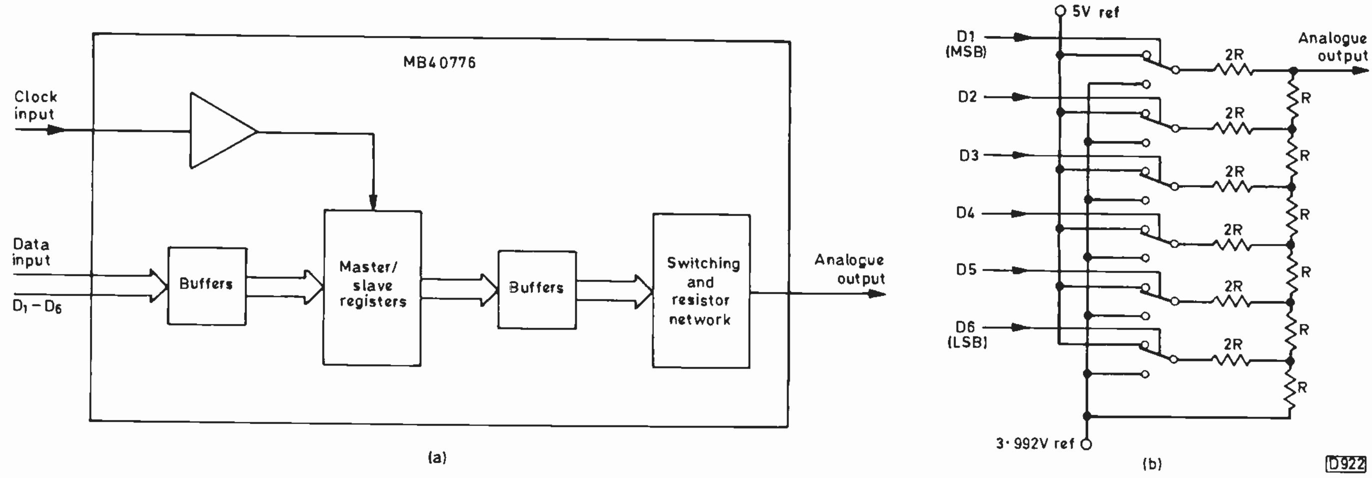

Fig. 8: Block diagram of the DA converter chip (a), and the switching/R-ladder system (b).

removed by a low-pass filter which is brought into operation by a suitably timed 260µsec gating pulse from the memory control chip. It's important with the PAL system to maintain the correct subcarrier phase sequence from field to field: to meet this requirement the number of memorised lines per field is set at an even number – 312 – in the still mode, when the contents of the memory are continuously read out to form a repeated-field still frame.

Read Mode

When the freeze button is operated, the writing process stops and the content of the memory is read out into the memory control chip via the same input/output data pins which are now programmed as inputs. The addresses are generated in the same sequence as before, so the data enters in the same 4 × 6-bit parallel form in which it was written. It's reconverted to the original 6-bit word form by a shift register clocked at 13·3MHz and then emerges from the memory control chip's six output pins.

DA Conversion

Now that the digital data is back in the form of 6-bit words it can be converted to the original analogue signal. A block diagram of the MB40776 16-pin DA converter chip is

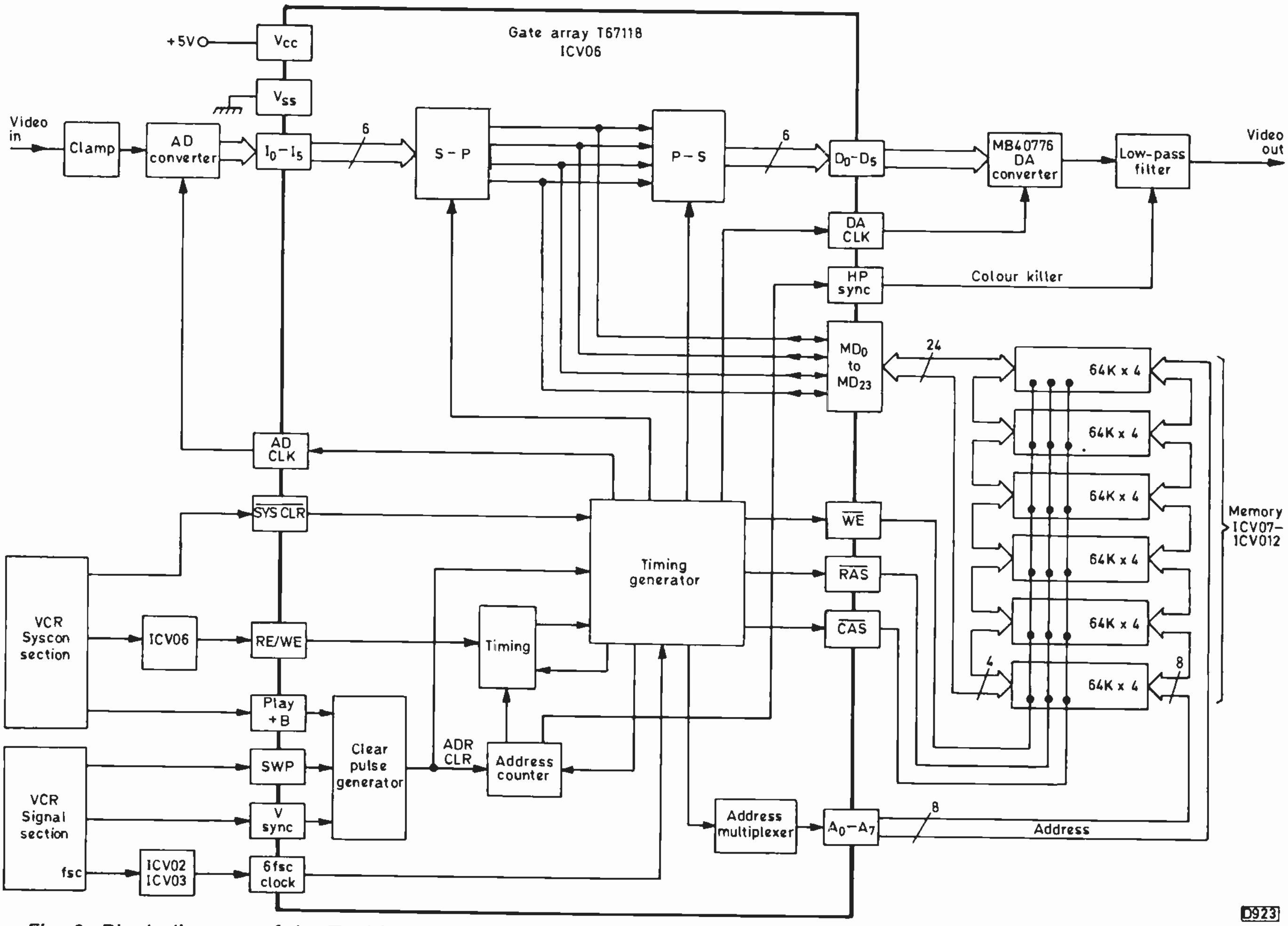

Fig. 9: Block diagram of the Toshiba memory control chip, showing its main connections to the rest of the circuitry.

shown in Fig. 8. The incoming data is first temporarily stored in slave registers then transferred, when a clock pulse arrives, to six buffer stages whose outputs govern the current flow to and from an R-2R resistor ladder network.

This form of DA converter is very common – such converters all operate using the same principles. In this case there are two reference voltages within the chip, 3·992V and 5V. The influence of each of the six bits in each word depends on the rung of the ladder network to which its output buffer transistor is connected. The bits are "weighted" so that the most significant bit (MSB) D1 can provide 50 per cent of the output voltage with D2 contributing 25 per cent, D3 12·5 per cent and so on down to the least significant bit (LSB) D6 which influences the output by only about 1·56 per cent, corresponding to some 16mV of the full 1V peak-to-peak output signal which ranges from 3·922V to 5V over the binary input range 000000 to 111111.

Memory Control Chip

The "brainbox" of this system is the memory control chip, a complex gate-array device, type T671118. Fig. 9 shows a block diagram, from which its internal arrangement and its interfacing with the other chips in the system can be seen.

The 6-bit data words from the AD converter enter at input port I, pins I0-I5, for serial-to-parallel conversion as described earlier. The 4 × 6 data is passed to the memory chips via I/O port MD, pins MD0-MD23 – there are four lines to each of the six memory chips. The data destination within the memory is determined by the address multiplexer in the gate-array chip: its 8-bit address bus, in conjunction with the /RAS and /CAS lines, control the memory chips simultaneously. Thus at any given moment all six memories are storing different 4-bit bytes at identical internal addresses. The memory control bus includes the write enable (/WE) line which is governed by the RE/WE feed from the VCR's syscon section. The latter also provides the Play +B line.

The timing generator within the chip is clocked at 26·6MHz, which is obtained by using ICV02 (TA7347P) to triple a 4·3MHz subcarrier signal from the VCR's signal section then using ICV03 (TA7320P) to double the result. Working from this, counters in the timing generator produce clock pulses for the AD and DA converter chips as well as the internal S-P and P-S shift registers.

The ADR CLR (address clear) input to the timing generator section of the chip comes from the clear pulse generator: the address counter is reset by the falling edge. This ensures that the read/write operation is synchronised to the head-switching flip-flop (SWP) in the playback mode or the V sync pulses in the E-E mode.

The system clear (/SYS CLR) input to the timing generator, from the VCR's syscon section, controls the use of the field memory: when the line goes high the digital mode is brought into operation.

The read/write (RE/WE) input is again from the syscon section and is initiated by the user's freeze key. ICV06 postpones switchover until the start of the next TV field.

Freeze Playback Operation

To freeze an off-air picture while in the E-E mode the digital circuit is activated and the memory system is next switched from write to read. The memory contents are then read out continuously, to be fed to the video output socket and the VCR's r.f. modulator – the sound continues without interruption.

For freeze frame operation during playback (digital still mode) the output from video head B is fed into the store while the tape transport system is still running normally. This ensures that the best possible off-tape signal is used, since there need be no compromises with tracking. Once the video information has been transferred to the memory the tape transport system is stopped sharply.

The digital freeze-frame system confers several other advantages: the transition from a moving to a still picture is virtually instantaneous, with no shunting or searching; there's no risk of vertical jitter; the system works equally well in the SP and LP modes; being digitally derived, the frozen picture is almost noise free; and the still picture can in theory be held for ever if required, without the three-minute constraint imposed by the risk of tape and head wear in conventional freeze-frame operation. This last feature is not necessarily incorporated in a VCR: because the usual requirement is to return to the normal playback mode quickly after viewing a still, the tape remains threaded and the head drum continues to rotate – this calls for automatic return to the playback mode after a few minutes.

Next month we'll look at some more systems and applications.

Teletopics

BROADCASTING IN THE NINETIES

The IBA has submitted to the Home Secretary a report detailing its proposals for TV in the nineties, when the next ITV franchises will come into operation. Rather than a franchise auction, as seems to be favoured by the government, the IBA suggests either a tax on advertising revenue together with the existing levy on profits or alternatively a form of tendering that would involve the valuation of each franchise. In addition a new type of franchise is suggested involving regional contractors who would buy in all their programmes, including news, sell their own advertising and operate without owning studios or employing any programme-makers directly.

The report, entitled *Independent Television in the 1990s*, criticises many of the policies that seem to be favoured by the government. It's aim is to initiate public debate on the future structure of the broadcasting industry. The status quo, it says, is not an option in view of the changes that are taking place. It puts forward new suggestions for controlling ITV contractors, including a system of issuing yellow and red warning cards. The IBA favours a fifth TV channel financed by advertising.

How much notice the government will take of these proposals remains to be seen. The government could well decide that the time has come to revise the operation and responsibilities of the IBA itself. During the next eighteen months the IBA intends to review the present regional boundaries and the question of change of ownership of ITV companies during the course of a franchise period.

The use of v.h.f. for additional TV services in the UK has been ruled out, primarily on the grounds of interference to other users. Lord Young, the Trade and Industry Secretary, making the announcement in a written reply in the House of Lords, referred to a technical feasibility study being conducted by the Home Office and the Department of Trade and Industry in conjunction with the BBC and the IBA. The question of using spare capacity in the u.h.f. TV spectrum for an additional TV service is still being considered. The advertising industry maintains that a fifth, advert-financed service would be economically viable and would not damage existing services.

TRADE NEWS

One of the best known names in the UK electronics industry, Mullard, has been dropped. The company name has been changed to Philips Components, to emphasise the fact that it is a part of the world's largest electronic components business, with annual sales of some £3,000m, and that it has direct access to the latest developments in component technology throughout the Philips group. The original company was founded by Stanley Mullard in 1920 and became a part of Philips in 1927.

CPC Ltd. of 194-200 North Road, Preston, Lancs PR1 1YP (0772 555 034) has been appointed official spares stockist for Hinari products.

As part of the rationalisation of Thomson's UK interests following the company's purchase of Ferguson, Paul Spring Electronics, the UK distributor for Thomson's Telefunken brand equipment, has been merged with Ferguson.

As an extension to its Prestel-based MOVIES (multi-option viewdata interactive enquiry system) arrangement Philips Service has introduced PHASES — Philips advisor for service engineering support, an interactive technical advice system designed to help with fault diagnosis in Philips' consumer electronics products. The basic MOVIES system enables dealers to pass orders, enquiries and messages to the Philips Service computer. PHASES is a user-friendly system that leads the engineer through a series of menus, questions and explanatory text until the general location of a fault has been identified, in order to save time and avoid the frustration of following dead-end trails. The system can also provide details of testing procedures when the repair has been carried out. Initially launched as a pilot scheme, PHASES currently covers self-oscillating power supplies and fifteen types of Pye and Philips compact disc players. The system will, after satisfactory completion of the pilot project, be extended to include other Philips products, especially in the high-tech area.

Funai branded goods are to be marketed in the UK. They will be distributed by Goodmans.

SATELLITE TV

Eutelsat I-F5 is to be launched in July as a replacement for Eutelsat I-F1. It will be positioned at 13°E while Eutelsat I-F1 will be moved to 16°E. All Eutelsat I-F1 services will be transferred to the new satellite which will in turn be replaced by the first Eutelsat II series satellite in 1990.

Some details of the Philips/Plessey MAC decoder chip set, which can handle D-MAC, D2-MAC and C-MAC signals, have been released. The vision and data signals first pass to a microcomputer controlled TDA8734 MACAN (MAC-analogue) chip. This part of the system is completed by a control loop incorporating an MV1720 MAC control chip which also provides outputs to control other parts of the system. The vision output from the MACAN chip passes via an analogue-to-digital converter chip to the MV1710 MAC video processing chip, whose YUV outputs then go to a digital-to-analogue converter. The MV1710 also provides outputs to the sound and text processing chips. The system is completed by sound filtering, sound DA converter, memory and access control chips — some of the chips on the sound side were originally developed for use in compact disc players. It's expected that the chip set will be in production in six-ten months' time, hopefully about right for the launch of the Astra satellite.

DEVELOPMENTS

A prototype six-inch diagonal full-colour liquid-crystal display has been demonstrated at Philips' Redhill Research Laboratories. The display uses an active matrix array of amorphous silicon thin-film transistors arranged in 288 rows by 468 columns to control the light output. The resolution will thus be about half that of a standard PAL picture. The display is intended for use in compact portable TV sets with screen sizes up to ten inches.

Anisotropic liquid-crystal technology developed by the West German company Merck enables displays whose contrast level is independent of viewing angle to be produced. Three European consumer electronics companies are understood to be already using the technology.

Tandy Corporation has demonstrated a prototype record/playback compact disc system. The company maintains that the discs can be erased and re-recorded hundreds of thousands of times over. Development to commercial product stage is expected to take about two years. Several major consumer electronics manufacturers are working on re-recordable optical discs.

Toshiba intends to introduce a 3D camcorder in the USA this summer at a price of under $3,000. The camcorder will record left- and right-hand images on alternate fields on a VHS-C cassette.

Warner New Media intends to launch compact discs with added graphics in the USA later this year. JVC will be making CD players with the graphics feature. The graphics are displayed as still pictures on a TV screen: with simple graphics a picture change is possible every two seconds, about seven seconds being required for a more complex display. The idea is to reproduce matter relevant to the disc — photographs, lyrics, guitar cord sequences and so on. The basic CD specification includes subcarriers that can be used for the purpose.

Our thanks to the American magazine *Radio-Electronics* for these last two news items from the USA.

Sony has added a second videodisc player to its range of interactive video equipment. The new player, Model LDP-1550P, incorporates all the features of the LDP-1500P, adding a jump facility of ± 200 frames with a "worst case" access time of two seconds. The LDP-1550P has a recommended price of £1,395 plus VAT while the LCP-1500P's suggested price is £1,195 plus VAT. The two players operate in conjunction with Sony's SMC-3000VP video computer and associated software. A complete system, with 14in. monitor, costs £5,795 plus VAT when based on the LDP-1500P player or £5,995 plus VAT with an LDP-1550P player.

EASIWIRE ELECTRONIC CIRCUIT SYSTEM

A wiring kit called Circuigraph Easiwire has been introduced by BICC-VERO Electronics, Flanders Road, Hedge End, Southampton SO3 3LG (0489 288 774). It offers users a simple, versatile and low-cost means of building electronic circuits without the need for solder or chemicals. Connections are made by winding wire fed from a special pen around the pins of each component in the circuit. The technique is easily learnt and can be applied to circuits in TV sets as well as simpler applications. An instruction book is included with the kit.

BOOKS

The third edition of Steve Beeching's *Videocassette Recorders — a Servicing Guide* has been published by Heinemann Newnes at £20. A great deal of new material, particularly on 8mm video, VHS HQ and S-VHS, has been added. There's a new chapter on the VHS-C format, and the section on fault patterns and component changes has been considerably enlarged. There are over 80 new illustrations.

Heinemann Newnes has also published a second edition of *Video Techniques* by Gordon White, at £30. This book has been written for engineers and technicians working in the TV and ancilliary industries. It describes TV and video principles and shows how equipment is designed and functions in complete systems, its capability and limitations.

A second edition of Simon Hamer's *TV DX for Beginners* has been published at £2·95 including postage in the UK or £3·75 air mail world-wide by HS Publications, 7 Epping Close, Derby DE3 4HR. The completely revised and expanded 24-page (A5 format) book is primarily intended as a guide for newcomers to the hobby. It explains why DX signals occur at random and how to resolve them when conditions allow, presenting the subject in a practical way and providing reference material such as channel allocations.

TV Fault Finding

Reports from Eugene Trundle, Mick Dutton, Jo Cieszynski, Philip Blundell, Eng. Tech., W.H. Clarke, Ian Bowden, Phil. H. Ireland, Hugh MacMullen, Martin Pomeroy and J.L. Howard

Sony KV21XMU (AE1 Chassis)

On more than one occasion these sets have produced a "jagged picture" effect: the picture is broken into sawteeth, or "wriggles", in a random way, and the fault is generally intermittent. Each time we've found that the cause of the trouble has been the 10kΩ horizontal phase potentiometer RV502. A clean up will usually do, but to be sure of the job it's best to fit a new potentiometer. **E.T.**

Philips G11 Chassis

This chassis tends to suffer from field timebase faults. Here are some points worth noting.

You sometimes get horizontal black bars when the set warms up. To start with these appear only at the top of the screen, but as time goes on they move downwards, filling more of the screen. The lines are caused by the field flyback circuit turning the beam off because of a fault in the field output stage. If you scope the field output ramp when the fault is present you'll see that there are bursts of h.f. superimposed upon it. This is the reason for the blanking circuit being upset, but where is the h.f. coming from?

You may recall that the TDA2600 field timebase chip works on the class D principle. The output from an h.f. oscillator is mixed with a 50Hz ramp to produce a pulse-width modulated drive for the output stage. To drive the scan coils, the PWM output is integrated by a filter consisting of a coil and several other components. The fault occurs when one of the capacitors in the filter circuit fails. The usual culprit is C2107 (4·7μF): examination may show that it has dried up. Occasionally I've had C2072 (4·7μF) cause the same symptom.

Field flyback lines across the screen can be the result of Tr2164 (BC148) becoming leaky. It's one half of the delay multivibrator in the field blanking circuit.

Very occasionally failure of the TDA2600 results in R2066 (1·5kΩ) in its d.c. supply going open-circuit. The result of course if field collapse.

If the problem is persistent failure of the TDA2600 and you reckon you've checked all the stock faults, try putting new heatsink compound on the next TDA2600 you fit – having cleaned off the old, hardened compound. This chip runs very hot and relies heavily on the heatsink to keep it cool: many engineers don't bother to use new heatsink compound when replacing it. **J.C.**

Fidelity AVS1600

The original problem had been a shorted BU508 line output transistor. No cause could be found, and a replacement restored the picture. A couple of days later however we received a report that the TV was flashing over. Removing the back (18 screws) and switching on produced a single crack from the focus unit in the line output transformer, followed by normal operation. Again nothing else could be found, so a new line output transformer was fitted. This time switching on produced a few seconds of fireworks before I could reach the mains switch. A check on the h.t. line revealed that we now had over 130V instead of 119V, so I gave up and reluctantly transported the monster to the workshop. Those familiar with the AVS cabinet will sympathise deeply.

The culprit was found to be C91 (1μF, 63V) in the power supply, but the damage had been done. To restore full operation the TDA3562A decoder chip, the TDA8190G audio chip, the TDA2070 field timebase chip and even one of the TDA1908 audio output chips had to be replaced. **P.H.I.**

National Panasonic TC85G

The problem with this set was that the picture faded out after half an hour. We found that the cause of the trouble was the AN231 chip IC103, which is no longer available. On asking a friend whether he had a scrap set he told me that an AN331 could be used provided a 680kΩ resistor was fitted between pins 15 and 16. When these components were fitted the set worked perfectly. **W.H.C.**

Philips KT3 Chassis

We have always been fond of this chassis. Apart from the tube, the 4·7Ω surge limiting resistor and the plug in the socket on the decoder panel we have found that the reliability is good. A set recently came in with the complaint that it would go off of its own accord. On inspection in the house the set tripped soon after it was switched on, and we immediately suspected that damp around the e.h.t. cap was the problem. The area was cleaned and sealed but next day the customer reported that the fault was still present, so we collected the set for a soak test.

The fault proved to be very intermittent. Over a period of time we fitted a substitute power supply panel, tripler, line output transistor and even the main electrolytic capacitor (having had a faulty one a long time ago), but the problem persisted. We suspected the tube of arcing internally, so this was interchanged with one in another set. Still no luck. The customer then called in to ask about progress. During our conversation he mentioned that just after the set was new the tube had had to be purified. The problem had been put down to the proximity of the speaker in a radiogram. This led us to make a check on the degaussing circuit. For good measure we replaced the thermistor, and this cured the problem completely. It would seem that intermittent operation of this device was inducing a pulse in the power supply and that this was the cause of the random tripping. **M.D.**

Panasonic TC2622

It's quite common knowledge that the high-voltage capacitors used in the power supply circuits in Panasonic sets tend to give trouble. One of these sets would intermittently produce a blank raster and white flashes. The cause of the trouble was C326 (1μF) which is mounted on the tube base and decouples the 200V rail. **M.D.**

Toshiba Projection TV

We were recently asked to look at a projection TV set in a hotel. The problem was no colour. It was a multi-standard receiver with automatic switching between PAL and SECAM and a switch to convert to NTSC. The signals section seemed to be very similar to that in Toshiba domestic models. We replaced the decoder chip and the crystal but had no luck, so the unit was uplifted to the workshop.

We were able to measure the chroma output from the decoder chip, then the input to the control i.c. There was nothing at the output from this chip, which does the PAL/SECAM switching. Checking the voltages around it showed that the supply was missing. It comes via a flying lead from the main panel, the lead being pushed on to a metal post. This post had been pushed through but never soldered. Refixing it provided a cure. **M.D.**

Sanyo CTP7131

This set came in dead. There was h.t. at the collector of the chopper transistor but the power supply wouldn't start. Checking around the power supply failed to reveal anything obvious, so we started to fit substitute semiconductor devices. When D308 was replaced the set came to life, though on soak test we noticed that it was still sometimes sluggish to start. Replacing C312 (10μF) cured this problem. **M.D.**

Salora J Chassis

The problem was no colour. A check at pin 4 of the TDA3562A colour decoder chip revealed that the chroma signal was arriving from the filter circuit and was of the correct amplitude (500mV p-p). After passing through the gated chroma amplifier in the chip however only the burst appeared at pin 28 (the output to the delay line). It seemed reasonable to replace the chip but the results were as before. I then checked the d.c. levels at the relevant pins and discovered that the voltage at the chroma input pin 4 was only 0·7V instead of 3V. The cause of the trouble was a leak in CB209 (10nF) which when checked out of circuit measured around 250Ω. **I.B.**

Bang and Olufsen 37XX Series

The problem with this set was reduced width – only approximately 5cm overall, which couldn't be corrected by adjusting the width potentiometer. C32 (1·5nF, 1·5kV), which is connected from the collector of the line output transistor to chassis, was found to be open-circuit. **I.B.**

Salora 1G Chassis (Ipsalo 1)

This set would start up from cold, but if it was switched off completely after running for a few hours, or was switched to standby via the remote control unit, it would fail to start again. The cause of the trouble was TB15 (BD370B) on the timebase panel going base-emitter open-circuit when hot, as a result of which the 12V start-up supply to the Ipsalo and line oscillator chips was removed. **I.B.**

Philips CP90 Chassis

We have had several cases of no sound or picture with these sets. R3623 (8·2Ω) goes high in value, fuse 1640 stays o.k. but diode D6667 (1N4148) simultaneously goes open-circuit. This gives roughly half of 95V and 163V and the set is in the standby mode – when D6667 is open-circuit the voltage across winding 1-2 on the SOPS transformer is not rectified. This is why TS7677 (BUT11) doesn't conduct and the set remains in standby. **H.MacM.**

Grundig 7400

The cause of flashing horizontal red bars across the screen for the first five minutes took some time to locate. Eventually C1912, which couples the red output from pin 15 of the TBA530 matrixing chip to the red output transistor, was found to be intermittently open-circuit when cold. The fault was very misleading because the red bars superimposed on the other colours gave the impression of an off-tune reference oscillator. C1912 is the same notorious 4·7μF capacitor used in the Thorn 3500 chassis. **H.MacM.**

Philips 21CE1051

When the sound is o.k. but there's no picture it's common to find that the tube's first anode supply is missing: the weight of the heavy wire to the flimsy c.r.t. socket cracks the print where the wire is connected to the panel. **H.MacM.**

Philips TX Chassis

This set wouldn't come on, due to failure of the line oscillator to start up. We found that the voltage at the output from the series regulator was low at 4V, but no fault could be found in the power supply, whose output is smoothed by C113 (100μF). Unloading the line output stage by disconnecting the scan coils got the set going, with a line down the centre of the screen. When the scan coils were reconnected the set continued to work but couldn't be started again after switching off. It turned out that C113 had dried up, with the result that the average l.t. voltage was too low to energise the line oscillator. **M.P.**

Tandberg CTV3-4-172

Don't get caught out by these sets. You bring them out of standby by pressing button N, not the one with the standby symbol (that one puts the set into standby!). If the set is stuck in standby, search in the dust at the bottom of the cabinet for the two 125mA fuses. Both could well have blown. If so, have a good look around the line output and power supply boards for dry-joints. **P.B.**

Salora 1F3K

The problem with this set was field slip from cold, the symptom taking about ten minutes to clear. When I arrived at the house the set had been on for about an hour, so I changed the field timebase panel on spec. The following day the customer phoned to say that the fault was still present. Being determined to stop the trouble I took along an identical replacement set which, after a few days, produced the same symptoms! On returning to the house I saw that the cause was condensation forming on the top right-hand corner of the mother board – easily corrected by warm air from a hairdryer. We've since had the same trouble with a number of these sets. As you might expect, the heating used in the houses concerned was either a gas fire or a paraffin heater.

Another cold start problem with this chassis occurs when C8 (10μF) on board STPX27 fails. The result is a twenty minute start-up time. **J.L.H.**

Conditional Programme Access

Harold Peters

If you've mastered the finer points of satellite TV, to the point where you can explain the differences between D-MAC and D2-MAC, you may well feel that you can simply sit back and wait for it to come, confident that you're ready for it. Not so! MAC is only half of it. Lurking within the packets of digital information are instructions that determine whether or not you will be able to watch the programme of your choice. Conditional Access (CA for short) will sort out who watches what and how much they pay. If the government has its way a similar arrangement might eventually apply to terrestrial TV, to replace the licence. So we might as well get to grips with this added complication. To make conditional access work you first have to scramble the signal.

Scrambling

It's the intention of the D-MAC broadcasters (and probably the D2-MAC camp as well) to scramble all broadcasts from the outset, the currently favoured method being the "double cut" – see Fig. 1. Parts of the picture, both luminance and chrominance, but not necessarily together, are cut out, reversed and reinserted in a pseudo-random manner determined by a key or control word. These keys or control words are included in line 625, together with the field sync pulse word and other codes that control access to countries and selected groups of viewers – see Fig. 2.

Every MAC decoder will have a unique code number implanted within it. This is rather like your credit card, and provision is made for interrogation of the individual code numbers at a rate of about a million subscribers an hour, via the incoming signal. Countries and groups get faster treatment, being up-dated at every programme start.

Panning

Line 625 was originally intended for field synchronisation. With MAC satellite TV transmissions it will, in addition to the field sync word, contain panning information and all the conditional access signals. Panning information? Well, provision is incorporated for future wide-screen (16:9 aspect ratio) transmissions, making it imperative that standard 5:4 receivers can be panned to follow the action, as is done at present when a Cinemascope film is being broadcast. The MAC panning code will indicate whether the transmission is wide-screen or not, and if so where 5:4 viewers' sets will look.

Conditional Access Codes

The conditional access codes are in two groups. The first gives service related messages, the second customer related messages. Service related messages include a descrambling code, programme identification and price details, the latter probably indicating one of four categories: clear (unscrambled); scrambled but free of charge; scrambled and charged to a monthly account; scrambled on a pay-as-you-view basis (including cost per hour). Customer related messages consist of country codes, group codes and the previously mentioned unique messages to individual subscribers. The block diagram of how this is all organised is too horrendous to include in an introductory article such as this one. Far better to look at a hypothetical example to see how it will be applied.

How it will work

Let's say that an evening's sport is followed by the news, a commercial break and a very adult late night movie.

The sport will contain a service related message making access conditional on the user inserting a pay-as-you-view "smart card". This is a credit card containing a microprocessor and a memory "charged up" with a number of pre-paid units. While the sport is being watched the units will be erased at say two an hour.

The news that follows is free but scrambled, so the smart card will have to stay in but no units will be erased. The sound might be multi-lingual, with the user preselecting his chosen language.

The commercial break is not only free but unscrambled, so presumably everyone can pick it up. Not so. Say that it contains a cigarette advertisement which is banned in the UK: the customer related message will include a code that prevents access by all UK receivers and decoders.

The saucy film that ends the day's programming presents another problem. Say that it contains scenes of explicit sexual behaviour which are banned in a number of European countries. The customer related message is changed to bar access to the film by people in those countries. Where it can be watched however it may cost a small fortune, since the price code could be upped to say five units an hour. Still, the whole of the UK could see it

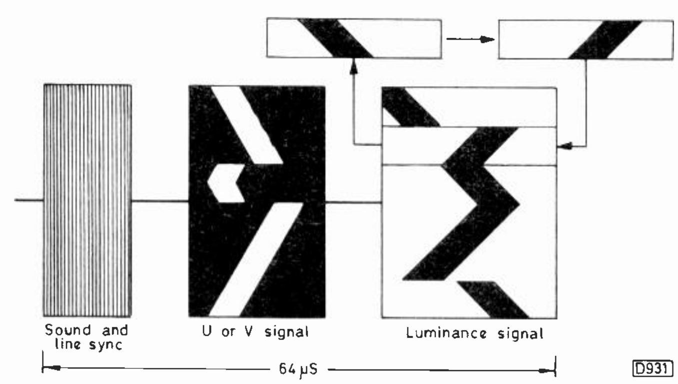

Fig. 1: Double-cut scrambling. For security, the code is changed every ten seconds.

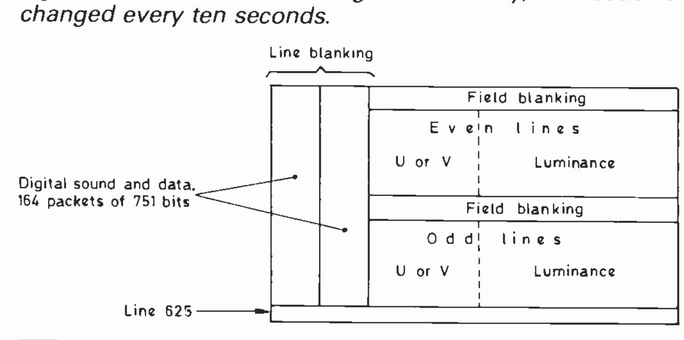

Fig. 2: Basic composition of a MAC frame.

except perhaps Harold Peters who failed to renew his subscription and has had his decoder turned off by a unique entitlement management message.

You mustn't take the example outlined as an exact description of how it will all come about. It's only what is being aimed at by the research people. Once the technology has been sorted out the politicians will have to agree – and they have a habit of voting against something simply because their country didn't think of it first. Anyway, it's question time . . .

What is there in it for the enthusiast and amateur?

Not a lot! It's a high-security system, and it's unlikely that DIY decoder kits will be available. The pseudo random binary sequence code is changed every ten seconds, so that's how long you have to crack it. But at least you know what you are up against and won't be taken in by anyone offering bogus equipment.

Could we listen to sound only, via a NICAM decoder?

This has also been though of. The sound will be scrambled on a pseudo random binary sequence basis different from the luminance and colour information.

What about servicing?

There's been a deathly hush on this one. It will presumably be a divided responsibility, similar to the arrangement when a rented set on a communal system fails.

Will one set of gear work on all transmissions?

Unlikely. Though the aim is for compatibility between D-MAC and D2-MAC the two are not at present compatible and they may be in use before dual-standard decoders have been developed. In addition, there's competition between two proposed and untried conditional access systems, while General Instruments is pushing its VideoCipher system as a third contender. The latter has the advantage of being fully developed and in use in the USA.

How can a faulty decoder as opposed to denied access be recognised?

How dare you talk of faulty decoders! It might be possible for the decoder to generate a "no access" caption.

For unique over-air addressing, a decoder must surely be run all the time?

Correct. While we are on about decoders, remember that decoded MAC translated back to PAL for your present set looses all the quality advantage of the MAC system.

What about video recording?

This is another grey area. MAC VCRs are not on the cards at present, so it's back to PAL through your existing machine. The more inventive amongst you might be tempted to develop a gadget that lowers and raises the smart card in its slot in synchronism with the VCR timer.

How much will it all cost?

I'm glad you asked me that! There's a natural reluctance on the part of the British to pay more for their TV than they did twenty years ago. Prices of sets have fallen by more than the licence fee has gone up during this time, while the van needed to deliver the thing has risen tenfold in price over the period.

The idea at present seems to be that the cost of the extra gear required will be roughly the current price of a TV set, to which you have to add the decoder rent and the pay-as-you-view charges.

To sum up, depending on how the authorities handle it, MAC could revolutionise TV as we know it while conditional access could kill it stone dead.

Test Report: Willow Vale Desoldering Tool

Alfred Damp

The electric desoldering tool available from Willow Vale Electronics Ltd. is basically a 30W soldering iron with a hollow tip. The element heats the tip in the conventional way, but surrounds a tube that connects the hollow tip to the solder sucker body, which is part of the handle.

The hollow tip is placed over the leg of the component to be unsoldered. This means that only the component leg and the surrounding solder pad are heated, not other parts of the print as with desoldering braid.

The great advantage is that the design gives you one-handed operation of the desoldering process. Your other hand is thus free to steady the board on which work is being done. For single-handed operation the tool is held as if it's a knife. This feels a little strange at first, but if you regard the tool as a solder sucker and hold it as such, with your thumb operating the plunger and the release button, you quickly get used to it.

With one-handed operation the board or panel can be held: you no longer have to balance or wedge the board only to have it move the first time you operate the sucker. Being able to hold the board and keep it stable while desoldering a component not only saves time, and thus money, but also saves frayed nerves.

Multiple-pin components such as integrated circuits, button units, switch banks, tuning banks and tuners are the most obvious candidates on which to use the tool. The only problem we've had to date has been with tuners, where the casing leg doesn't always desolder the first time, probably because of the heatsink effect of the case. It's also worth noting that if the iron is left plugged in continuously the handle gets quite hot. Remember that you have to wait for it to heat up – it's not an instant-heat iron.

The tool very quickly proved its worth in our workshops. Various chips, tuners and a couple of Sharp VC9300 button units were quickly and easily desoldered. I'm sure that field service engineers would find it useful for line output transformers, colour decoder chips and so on.

The desoldering iron is available from Willow Vale Electronics Ltd. for £14·49 trade plus VAT, a price that should be quickly recovered. The order code is 04-111. At the time of writing this report the iron had not been included in the Willow Vale catalogue. Willow Vale's headquarters address is 11 Arkwright Road, Reading, Berks, RG2 0LU (telephone 0734 876 444).

Letters

THE FLAT SQUARE TUBE

Until I bought one I believed that there were real advantages in having a TV set fitted with the comparatively recently introduced FS type of tube. The set I bought was a Toshiba model, but the point applies to others – that the convergence and focus set up are very critical with an FS tube. It seems that some manufacturers are not prepared to ensure that the setting up is carried out to an adequate standard. The performance of the new set was not up to that of the one-year old Decca/Tatung set it was supposed to replace, with a non-FS tube. A further check at the showroom revealed that all the sets with FS tubes had convergence/focus/grey scale errors. I decided to change the set for a Sony model that gives good if not outstanding results, and am beginning to think that this FST business is a bit of a gimmick.
Colin McCormick,
Plymouth, Devon.

Editorial comment: We've looked ourselves and asked around and can't find anyone who supports this view. FS tubes are self-converging and seem to be very good. Perhaps other readers might like to comment?

MAINTAINING THE TV22

In reply to David Tilley's request for help with valves for the Bush Model TV22, The Vintage Wireless Company Ltd., Tudor House, Cossham Street, Mangotsfield, Bristol BS17 3EN should be able to supply a PL38 and PZ30. Alternatively the PZ30 could be replaced with a couple of silicon diodes in series with surge limiters, suitably camouflaged. If the set is to be used, every paper and electrolytic capacitor should be replaced. This can easily be done whilst maintaining the internal appearance. My TV22 worked well until Holme Moss ceased 405-line transmissions a couple of years ago.
Mike Phelan,
Liversedge, W. Yorks.

THE ONDRA RC UNIT

A review of the Ondra programmable remote control unit appeared in the January issue. It seemed to be ideal for use in the workshop, so we ordered one. When it arrived we programmed it to control Philips TV sets and Panasonic and Ferguson VCRs. Unfortunately we soon found that it was not suitable for use with the Philips TV range, as the same digit couldn't be selected twice running, e.g. channel 11 or teletext page 888. This point seems to have been overlooked by your reviewer.
Gareth Foster,
Whitton, Middlesex.

Eugene Trundle comments: You are right of course. At the time when we tested the unit we didn't have any Philips products in the workshop – we don't see many of them, as our firm does not have Pye or Philips dealerships. Our apologies for missing this point.

The problem arises from the RC5 code used by Philips. The second bit in each transmitted command is a toggle bit which changes state each time a key is pressed, so that the receiver's decoder can discriminate between a "new identical command" and an "end of transmission interruption", e.g. someone passes between you and the receiver. It seems that the Ondra unit cannot be programmed to cope with this and retain its compatibility with other remote control codes.

In experimenting with the unit we've found that a partial solution is to key between identical digits some command that's irrelevant to the wanted function, i.e. to get page 111 key in 1 x 1 x 1 where x is channel up, mute, granny button or whatever. The alternate commands included in this way satisfy the toggle system in the RC5 decoder. The situation arises only where identical numbers are keyed in consecutively, typically with page selection.

SONY SPARES

Your TV/VCR Spares Guide (April) is very helpful but with regard to Sony one point should be made. If you don't have an account with Sony, spares orders, trade or otherwise, should be sent to:

Specialised Electronic Services (Dulwich) Ltd.,
Unit 4, Goose Green Trading Estate,
47 East Dulwich Road,
London SE22 9BS.
Telephone no. 01-693 9622.

I hope this information will be helpful to other readers.
M.K. Hayter,
Moseley, Birmingham.

BUZZING COIL

The r.f. suppression coil L1378 on the power supply panel in the Philips G8 chassis starts to buzz after a long life. The early, round type can be silenced by force fitting one or two Rawlplugs. To silence the later, square type, proceed as follows. Remove the inductor and cut from a piece of floor vinyl two thin strips approximately one millimetre thick. Fit these diagonally across between the inductor and chassis, with two self-tapping screws.
Paul Rowe,
Camborne, Cornwall.

THE WYLEX MAINS OUTLET

While looking through some back issues I found several letters on mains plug safety. This got me thinking about the circular Wylex types that were at one time installed in the North Shields area. They were probably the first to have an internal fuse (see Fig. 1). There were two flat pins for neutral and live, a large circular pin sandwiched between them being used for earth. Five and 13A versions were available. The former had narrower pins, enabling them to fit into the 13A plug adaptors that were also available: both types were compatible with the socket outlets however, though the 5A plugs often made poor

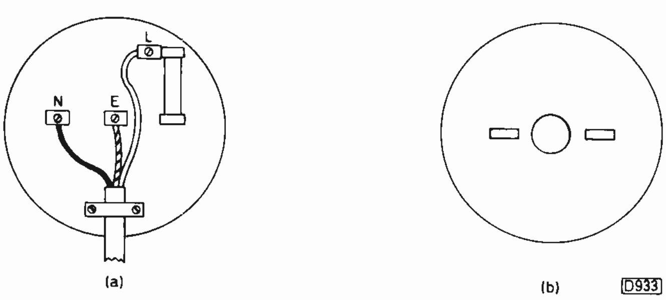

Fig. 1: The Wylex mains outlet, (a) plug, (b) socket.

contact – perfect for blowing G11 line output transistors!

In contrast with the present day 13A square-pin arrangement, these plugs were arranged so that the live lead was the longest of the three – and of course there were some who bypassed the cord grips . . .

The houses were rewired in 1978, much to the relief of the residents as the cost of the plugs had become prohibitive. The Electricity Board didn't supply replacement plugs, but it became cheaper in the long run. Does anyone else remember them, or still come across them? I can't say I miss them – I received my first electric shock from one of them some twenty years ago!
Brian Renforth,
Newcastle upon Tyne.

SHARP SPARES

A member of the public wrote to Sharp complaining about the treatment he'd received at local shops in the Stevenage area when he tried to order new drive belts and capstan wheels for his Sharp RG955 stereo car cassette player. He's a fully qualified electronics design engineer well able to undertake routine maintenance but was told by the first shop he tried that, after three weeks, they couldn't obtain the parts. Several other shops refused to help. He then wrote to Sharp direct, who forwarded his letter to us as official Sharp spares stockists. We were able to send off a pro forma invoice for the parts within a week of the original letter of complaint.

This sort of thing happens all the time. It seems that the so-called service trade just isn't interested unless it looks like a meaty job with a tasty profit. I'd like to see some replies from Stevenage "dealers" stating why they were unable to help. Ask yourself why we should spend thousands of pounds producing a Sharp Spares Catalogue if we've no wish to supply spare parts?!
Brian Tuckfield, Sales Manager,
Willow Vale Electronics Ltd., Reading.

FOR DISPOSAL

I have for disposal a Philips Model 21TG106U (BA5800) fitted with an AW53-88 tube. The set is in immaculate condition throughout, having been carefully looked after by its owner. It features a light-sensitive cell behind a small lens assembly at the front, beneath the tube screen. This produces picture bright-up when the room lighting is increased. To complete the ensemble, the original stand/magazine rack with two polished side wings is also available. I had acquired the set with a view to converting it into a more up-to-date one, but it occurs to me that this might be an act of sacrilege. If anyone who collects such things is interested, please contact me at the address below.
Brian Powell, 62 Ladysmith Road,
Ashton-under-Lyne, Lancs. OL6 9BZ.
Telephone 061 308 4639.

I have been given an old TV receiver without a cabinet – I believe it was once housed in a bookcase. It's not in very good condition, having been in a garden shed for the last twenty years. The tube looks to be about ten inches and appears to be still in good order: the valves all look to be in one piece, but the wiring etc. has deteriorated with age. Anyone who thinks it would be of some use to them can have it free of charge – buyer collects.
K. Wells, 21 Abottsfield Close,
Hastings, East Sussex. TN34 2DT.

next month in TELEVISION

● **DIGITAL VIDEO EFFECTS**
In developing his account of the use of memory chips to store TV pictures and the possibilities that this provides for various special effects in domestic TV/video equipment, Eugene Trundle looks at the digital video system used inthe Panasonic Model NV-D80 VCR. This uses eight-bit quantisation of the analogue video signal, two fast 1Mbit DRAMs and a purpose-designed 98-pin memory control chip to give strobe, graphic effects and noise reduction in addition to very high quality noise-free still pictures.

● **TRANSISTOR LOAD MATCHING**
A fundamental law of electronics states that maximum power is delivered to a load when the source and load resistances are equal. But electronics is full of surprises! This fundamental law apparently doesn't apply with power output transistors, where the normal load value is a small fraction of the device's output resistance. Stan Amos explains.

● **SERVICING WITH A VARIAC**
The trouble with many common faults in modern receivers is that the fuse blows at switch on or a trip operates almost instantaneously, leaving very little time for diagnosis. Attempts at repair can result in a pile of expensive dead transistors. In such a situation life is made much simpler by powering the saet via a variac, so that the input voltage can be increased gradually. Eugene Trundle describes the technique and also how to use lamps to gain additional clues.

● **LOW-POWER BAND I TRANSMITTERS**
Restoring and maintaining 405-line receivers has become quite a hobby. The problem is how to provide them with signals! A pattern generator can be used, but isn't really the answer. About six years ago Chas E. Miller acquired some equipment from the Radio Rentals factory at Bristol. It included vision and sound transmitters of relatively simple design but well able to serve as a source of 405-line signals for your sets. Full circuit details will be given.

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AC133	0.12
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AC127	0.27
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AC141	0.29
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AC151	0.28
AC176	0.30
AC179	0.28
AC183	0.72
AC187	0.39
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AC188	0.37
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AC188K	0.43
AC193K	0.65
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AD143	1.93
AD145	1.60
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AF279	0.88
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AN115	3.98
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AY106	1.09
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BC880	0.31
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BCY70	0.30
BCY71	0.21
BCY72	0.20
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BD116	0.70
BD124	1.31
BD124P+KIT	0.69
BD131	0.57
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BD190	0.72
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BD232	0.50
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BD679	0.57
BD680	0.76
BD681	1.48
BD696	2.47
BD699	3.49
BD700	3.70
BD707	0.98
BD709	1.05
BD710	0.80
BD809	0.80
BD810	0.69
BD879	0.74
BD880	0.79
BD895	2.31
BD899	2.48
BD901	0.99
BD902	0.84
BDW83C	1.45
BDW84C	1.56
BDX32	1.75
BDX53A	1.25
BDX53B	1.85
BDX54B	2.16
BDX62A	2.15

BDX63A	1.96
BDY20	1.21
BDY81	1.05
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BF117	0.66
BF118	0.67
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BF157	0.33
BF158	0.18
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BF160	0.31
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BF177	0.35
BF178	0.40
BF179	0.36
BF180	0.36
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BF184	0.43
BF185	0.39
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BF196	0.17
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BF199	0.17
BF200	0.37
BF218	0.36
BF224	0.17
BF237	0.65
BF240	0.17
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BF245B	0.49
BF246A	2.52
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BF256LB	0.42
BF256LC	0.82
BF257	0.34
BF258	0.36
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BF263	0.57
BF271	0.34
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BF324	0.35
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BF371	0.50
BF391	0.25
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BF870	0.30
BF959	0.42
BF960	0.49
BF970	0.50
BFR39	0.44
BFR61	0.92
BFR62	0.50
BFR79	0.29
BFR81	1.65
BFR86	1.08
BFR89	1.63
BFR90A	0.90
BFT42	0.43
BFT43	0.43
BFT84	0.40
BFW10	0.60
BFX29	0.34
BFX84	0.37
BFX85	0.41
BFX86	0.36
BFX87	0.55
BFX88	0.34
BFX89	0.44
BFY50	0.30
BFY51	0.25

BFY52	0.27
BFY79	0.49
BFY90	0.61
BLY49	2.20
BR100	0.29
BR101	0.65
BR103	0.55
BR303	1.15
BRC116	0.67
BRC300	2.01
BRC5296	0.77
BRC6109	0.83
BRC82	1.08
BRC83	2.19
BRC84	2.08
BRX44	0.60
BRX49	0.67
BRY39	0.69
BSS38	0.87
BSTBD140G	5.25
BSTC0246	6.99
BSTC0233	7.25
BSTCC0143	3.07
BSTD1043	2.85
BSV57B	3.49
BSW68	0.60
BSX19	1.29
BSX20	0.30
BSY52	0.50
BSY79	0.51
BT100A	1.61
BT108	1.45
BT119	1.76
BT120	2.17
BT121	2.48
BT123	1.98
BT151-800R	0.89
BTT6018	2.42
BTT8124	4.89
BU106	2.48
BU108	1.50
BU109	2.65
BU110	5.69
BU111Y	4.16
BU125	2.48
BU126	1.45
BU137	6.53
BU205	1.15
BU206	1.27
BU207	1.65
BU208	1.20
BU208/02	1.97
BU208A	1.12
BU208D	1.95
BU209	1.50
BU226	2.45
BU326	2.00
BU326A	2.20
BU326S	2.20
BU406	1.49
BU406D	1.79
BU407	0.82
BU407D	0.99
BU412	5.29
BU426A	1.13
BU500	1.45
BU508A	1.25
BU536	1.65
BU608	1.80
BU705	2.95
BU806	1.79
BU807	0.80
BU826A	1.95
BUW84	1.39
BUX84	1.00
BUX85	1.10
BUY69A	2.04
BY126	0.13
BY127	0.08
BY133	0.12
BY164	0.44
BY176	0.52
BY179	1.08
BY182	0.95
BY187	0.77
BY189	1.79
BY198	1.62
BY201/2	1.50
BY203/20	0.59
BY207	0.22
BY208	0.46
BY210-400	0.19
BY210-600	0.27
BY210-800	0.30
BY218	1.64
BY223	1.23
BY224-600	1.88
BY225-100	1.13
BY226	0.25
BY227	0.20
BY228	0.60
BY229-1000	1.12
BY229-600	0.92
BY255	0.66
BY295-600	1.03
BY298	0.36
BY299	0.45
BY407	0.90
BY409	1.49
BY448	1.35
BY713	0.65
BYW19/1000	0.69
BYW56	0.14
BYX10	0.29
BYX55-600	0.23
BYX71-600	0.85

BYX71-350	0.72
BYX94	0.16
BYY56	1.20
BZY93C30	1.86
BZY88 RANGE	0.10
BZX61 RANGE	0.18
BZX79 RANGE	0.10
C106D	0.46
C106M	0.76
C1129	0.58
CA3046	1.55
CA3089	0.83
CA3090AQ	3.25
CA3094	2.20
CA3131EM	2.95
CBF16848N-071	1.56
CD4001	0.34
CD4002	0.27
CD4008	1.35
CD4011	0.29
CD4012	0.24
CD4013	0.33
CD4016	0.46
CD4017	0.82
CD4020	1.23
CD4021	0.39
CD4023	0.28
CD4025	0.64
CD4028	0.84
CD4040B	0.85
CD4047	1.06
CD4049	0.24
CD4052	0.75
CD4066	0.20
CD4069	0.29
CD4070	0.66
CD4081	0.35
CD4093	0.72
CD4511	1.10
CD4528	2.04
CD4556	1.47
CR02AM-8	1.70
CV12E	4.09
CX095D	3.14
CX104	9.64
CX108	12.48
CX109	7.86
CX130	8.76
CX134	12.32
CX136	11.49
CX139	11.83
CX157	5.52
CX158	5.50
CX177	6.46
CX187	6.84
CX755	12.95
CX885A	6.85
DEC1	2.20
DEC2	2.20
DS3486N	4.33
DS3487N	4.95
E1222	0.40
E5024	0.28
E5386	0.25
E9003	0.46
E9005	0.50
FND500	5.78
GC374	1.65
GD243	4.34
GF758	0.84
GH3F	1.82
HA11215	1.75
HA11211	2.53
HA11225	1.50
HA11226	10.44
HA11229	1.96
HA11235	1.75
HA11124	5.25
HA11244	4.02
HA11251	4.47
HA1125	4.29
HA1137W	4.87
HA1138	5.03
HA11414	5.65
HA1144	7.87
HA1156	1.16
HA1160	4.78
HA1166	1.90
HA1166X	6.43
HA1167	6.45
HA11706	3.61
HA11705	8.00
HA11703	4.22
HA11701	4.56
HA11710	9.50
HA11713	9.75
HA11711	7.50
HA11715	3.25
HA11714	9.75
HA11716	13.10
HA11725	18.26
HA11725MP	16.00
HA117555P	6.23
HA11781	19.90
HA1180	5.15
HA1196	7.43
HA13001	1.73
HA1306	2.26
HA1338	7.50
HA1339	6.83
HA13402	7.87
HA13342	2.65
HA13365	4.02
HA1366WR	1.50
HA1367	2.75
HA1368R	2.45
HA1368	2.07
HA1370	3.30

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

Television Questionnaire

Our aim is that *Television* should be as useful and as interesting as possible to readers. In this connection it would greatly assist us if you would take a few minutes to complete the following questionnaire. It will tell us what you think about *Television* and whether there are any improvements you would like to see.

Every reply is important as it will help us to cater for the needs of all our readers. In appreciation of your help we are running a prize draw with four prizes of Adcola soldering equipment — for details see page 601. All answers received will be kept strictly confidential and will be analysed in statistical form only.

The questionnaire has been designed so that it can be removed from the magazine without damaging the other contents, then folded and returned post-paid.

1 Are you employed in the TV/video industry in any of the following jobs?

☐ TV service engineer only ☐ Video service engineer only ☐ TV/video service engineer
☐ Development engineer ☐ TV/video technical support engineer

Other — please specify ....

2 Are you employed by?

☐ A setmaker's service department ☐ A retail shop ☐ A rental branch
☐ A retail/rental outlet ☐ A spares distributor ☐ A servicing only company
☐ Self-employed ☐ Other — please specify ....

3 Does your job involve servicing equipment other than TV or video?

☐ Yes ☐ No If yes, please specify ....

4 Are you employed in any other branch of electronics?

☐ Yes ☐ No If yes, please specify ....

5 Do you have any of the following qualifications?

☐ City and Guilds ☐ Engineering technician ☐ Technician engineer
☐ Chartered engineer ☐ Degree ☐ Other — please specify

....

6 Do you regard electronics as

☐ Your job only? ☐ Your hobby only? ☐ Both your job and your hobby?

7 How interested are you in the following subjects covered in *Television*?

	Very interested	Interested	Not very interested	Not at all interested
Servicing TV sets	☐	☐	☐	☐
Servicing video equipment	☐	☐	☐	☐
TV/video circuitry/systems	☐	☐	☐	☐
Electronics theory	☐	☐	☐	☐
Constructional projects	☐	☐	☐	☐
Trade news	☐	☐	☐	☐

8 How interested are you in the following items that appear regularly in *Television*?

	Very interested	Interested	Not very interested	Not at all interested
The leader	☐	☐	☐	☐
Teletopics	☐	☐	☐	☐
Letters	☐	☐	☐	☐
TV Fault Finding	☐	☐	☐	☐
VCR Clinic	☐	☐	☐	☐
Micro Clinic	☐	☐	☐	☐
Long-distance TV	☐	☐	☐	☐
Service Bureau	☐	☐	☐	☐
Test Case	☐	☐	☐	☐
Advertisements	☐	☐	☐	☐

9 Would you like to see wider coverage of the following in *Television*?

☐ Microcomputer servicing
☐ Compact disc player servicing
☐ Satellite TV equipment
☐ Microcomputer applications
☐ Audio equipment servicing
☐ Constructional projects

Others—please specify ....

10 How interested would you be in seeing the scope of *Television* widened to include the following?

	Very interested	Interested	Not very interested	Not at all interested
TV programme production	☐	☐	☐	☐
Studio equipment	☐	☐	☐	☐
Cable TV	☐	☐	☐	☐
Information on new components	☐	☐	☐	☐
News on new TV/video equipment	☐	☐	☐	☐
Detailed information on circuit operation/design	☐	☐	☐	☐
User reports/reviews on video equipment	☐	☐	☐	☐
Servicing equipment/aids	☐	☐	☐	☐

11 Overall, how interesting do you find *Television*?

☐ Very interesting ☐ Interesting ☐ Not very interesting
☐ Not at all interesting

12 How useful do you find *Television* in your work?

☐ Very useful ☐ Useful ☐ Not very useful
☐ Not at all useful

13 Do you find the articles in *Television*

☐ Too technical? ☐ About right? ☐ Too basic?

14 What do you think of the overall layout and presentation of the contents of *Television*?

☐ Much too dull ☐ A little dull ☐ Appropriate

15 Is there anything you particularly like about *Television*? — please specify

....

16 Is there anything you particularly dislike about *Television*? – please specify

....

17 In general, are there any improvements you would like to see in *Television*? – please specify

....

18 How often do you use the following test equipment?

	Frequently	Occasionally	Rarely	Never
Multimeter	☐	☐	☐	☐
Digital multimeter	☐	☐	☐	☐
Oscilloscope	☐	☐	☐	☐
Frequency counter	☐	☐	☐	☐
Signal/pattern generator	☐	☐	☐	☐

19 How often do you buy the following?

	Frequently	Occasionally	Rarely	Never
Second-hand TV sets	☐	☐	☐	☐
Second-hand VCRs	☐	☐	☐	☐
Tubes	☐	☐	☐	☐
TV spares (LOPTs, triplers, etc.)	☐	☐	☐	☐
Video spares (heads, motors, etc.)	☐	☐	☐	☐
Electronic components (transistors, capacitors, etc.)	☐	☐	☐	☐
Servicing equipment	☐	☐	☐	☐
Servicing aids	☐	☐	☐	☐
Security systems	☐	☐	☐	☐

20 How often do you buy from the following sources?

	Frequently	Occasionally	Rarely	Never
Advertisers in *Television*	☐	☐	☐	☐
Manufacturer's service departments	☐	☐	☐	☐
Trade distributors	☐	☐	☐	☐
Mail order catalogue	☐	☐	☐	☐
Retail outlets	☐	☐	☐	☐

21 How often do you buy *Television*?

☐ Every issue ☐ Most issues ☐ Occasional issues

22 Are you more likely to buy *Television*:

	Yes, more likely to buy	No, does not influence my decision to buy
When something mentioned on the cover interests me	☐	☐
When there's a free gift	☐	☐

23 How do you usually acquire the copies of *Television* you read?

☐ Bought from a newsagent
☐ Read a copy taken by my firm/organisation
☐ By subscription
☐ Read someone else's copy

24 For how long have you been a reader of *Television*?

☐ Less than one year ☐ 1-4 years ☐ 5-10 years
☐ More than 10 years

25 Which if any of the following trade/radio/electronics magazines do you read?

	Frequently	Occasionally	Rarely	Never
Electronics and Wireless World	☐	☐	☐	☐
Electrical and Radio Trading	☐	☐	☐	☐
Electronics Weekly	☐	☐	☐	☐
Electronics Times	☐	☐	☐	☐
Elektor Electronics	☐	☐	☐	☐

Any other — please specify ....

26 Which if any video magazines do you regularly read? — please specify

....

27 Which if any national daily newspaper(s) do you read most often? — please specify

....

28 Please indicate your age group.

☐ Under 16 ☐ 16-24 ☐ 25-34 ☐ 35-44
☐ 45-54 ☐ 55-64 ☐ 65+

As an incentive to returning, completed, the *Television* questionnaire we're offering a prize draw for four Adcola soldering products as follows: first prize a U101 electronically-controlled 50W soldering station (trade price £99·19 plus VAT); second prize a U1456 24V 50W temperature-controlled iron with power supply (trade price £61·78 plus VAT); third prize a K4000 dual-temperature soldering iron with safety stand (trade price £25·57 plus VAT); fourth prize a K2000 standard 240V iron with safety stand (trade price £15·15 plus VAT). Questionnaires must be received in our offices by July 1st to qualify for the draw.

Please enter your name and address below in block capitals.

Name ....

Address ....

....

Thank you for your trouble. Please follow the instructions for folding the questionnaire then post it back to us — no need for a stamp, postage has been prepaid. All replies will be kept strictly confidential.

First fold

IPC Magazines Ltd.,
Television, Room 201 HH,
King's Reach Tower,
FREEPOST,
LONDON,
SE1 6BP.

Second fold — tuck in this flap

VCR Clinic

Reports from Philip Blundell, Eng. Tech., Phil. H. Ireland, Alfred Damp, Nick Beer and Eugene Trundle

GEC V4001/Hitachi VT9300

This machine worked fine in E-E but produced just a blank raster in the playback mode. The scope showed that there was no video coming out of pin 22 of IC202, though it was going in at pin 1. Voltage checks around the i.c. revealed that pin 23 (squelch) was at 3V. The manual specifies the voltage as 4·2V, but if you trace the line back it goes to the base of Q214 which is shown as being at 0·3V. They can't both be right! The feed to this comes from the audio-jack PCB, where Q640 should be conducting in playback but wasn't – it was open-circuit. Alter your circuit diagram to show 0·3V at pin 23 of IC202 in playback! **P.B.**

Sharp VC6300

Don't be surprised if you find that you have no rewind after fitting a non-genuine belt kit in one of these machines – the rewind belt is often too small, preventing the idler from moving over far enough. **P.B.**

Ferguson 3V31/JVC HR7650

For intermittent colour in the playback mode, check for dry-joints on crystal 401 on the chroma board. **P.B.**

Amstrad VCR4500

Crinkling of the lower edge of the tape as it re-enters the cassette has become a problem with these machines. The official modification involves reducing the take-up torque by replacing the clutch gear and fitting a smaller clutch spring. In one or two instances however some tapes continue to be damaged.

We've found that a more certain modification can be carried out by fitting, in addition to the previously mentioned items, the pinch-wheel tape support as used in the VCR4600. The only problem here is that the nylon nut doesn't have a part number and is thus presumably not available. A steel nut can be used provided the thread is varnished after setting up. Replacing the pinch-roller arm doesn't appear to be necessary since in all the machines we've come across the arm has been drilled ready to accommodate this part. The relevant part numbers are as follows: tape support 151482; tape shaft 151483; tape spring 152484; pinch-roller arm if required 150769. Fig. 1 shows these items. **P.H.I.**

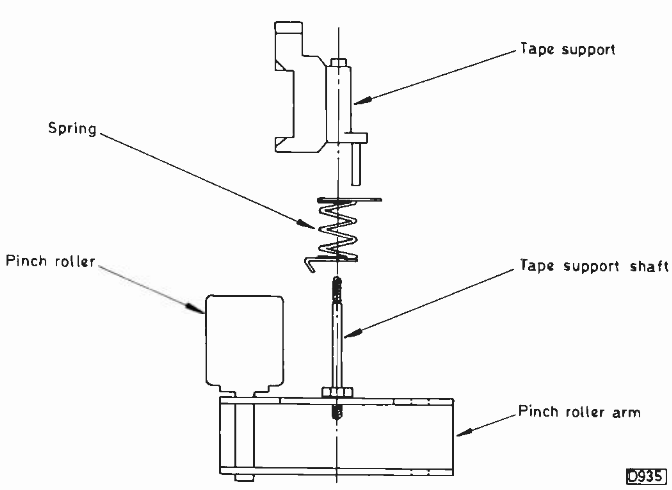

Fig. 1: The pinch wheel tape support assembly used in the Amstrad Model VCR4600.

Hitachi VT64

The complaint was noisy rewind, but after running two or three tapes through the machine nothing unusual could be heard. We decided to leave the machine on test on the soak bench, and after a few minutes the fault developed – but it was in playback, not rewind. Back on the work bench the machine worked normally when switched on. Time to leave it running in playback and make the tea. When I came back it was droning away nicely, but when the machine was tipped backwards to inspect its underside the noise went. Lowering it brought the noise back.

The help of a colleague was summoned: he held the machine while I looked up from beneath. Pushing the capstan flywheel up would clear the noise, and on inspection we saw that there were signs of rust deposits on the nylon plate in the middle of the flywheel support bracket. A smear of Vaseline on this plate cured the fault. **A.D.**

Fisher FVHP906

The clock worked but that was about all. The job ticket read "not playing" and the truth was that you couldn't switch the machine on. We found that the power control input to the main microcomputer chip was correct, but nothing happened at the power control output. Replacing the chip cured the fault. **A.D.**

Ferguson 3V42/JVC HRD455

The job card read "cassette jammed", but the customer had released it. On removing the top we found that the deck was in the half-loaded state. When we switched on, the loading motor tried to return the loading poles to the unloaded position but was prevented from doing so because the tension pole jammed the supply loading pole. When the loading/mode control motor bracket was removed so that we could inspect the nylon gear assembly on the underside of the deck we found that the cogs were badly worn, as was the loading gear. Replacing both these parts and setting up the loading timing cleared the trouble. **A.D.**

Amstrad VCR5200

A fully wound tape would be ejected as soon as it was inserted, but if a tape that was not fully wound was inserted it could at least be rewound, after which it would be ejected. A check on the inputs to the microcomputer chip revealed that there was a difference of 0·6V between the start and end sensor readings, the end sensor recording the lower voltage. Replacing the end sensor restored normal operation. **A.D.**

Panasonic NV430

This one was being serviced after coming back off rental. When I switched it on the capstan ran at high speed and the loading ring arms continually laced and unlaced.

When the bottom cover was removed the mode switch retaining screw was seen to be loose while the switch itself had moved. Refitting it correctly had no effect however, so a new one was fitted. This improved matters, but full order was not restored until the main cam gear and the brake actuating arms were realigned. All that was then required was a new VDV0152 loading belt. **N.B.**

Ferguson 3V45/JVC HRD140

We're now getting a lot of these machines with the "intermittent won't play or record" complaint, and of course the loading belt has stretched. Unlike the 3V29/3V30 series in which this was also a common complaint belt replacement in these models is very straightforward – just remove the top cover, hinge up the top PCB, remove the screening can and there it is right on top. No circlips etc. to remove! **N.B.**

Sony SL8000UB

After fitting new heads in this machine I noticed that two sections of the clock's minutes display were permanently partially illuminated. The cause of the trouble was leakage across the print leading to the digitron. Cutting out the offending areas and running leads across cured the fault. **N.B.**

Mitsubishi HS300

The complaint with this machine was that it wouldn't play until it had been switched on for over an hour. On dismantling it the cause of the trouble was soon seen – a lazy capstan motor. New motors are no longer available, but Mitsubishi rebuild them. This necessitates return of the old one. Unfortunately the first motor I received back was completely seized due to a distorted tacho ring. **N.B.**

Panasonic NV-G25B

The complaint with this new machine was of intermittent sound and picture dropouts. A field engineer had collected it and had noticed that the machine creased the bottom edge of the tape. On inspection we could see that the creasing occurred when the tape moved in the fully laced position (this machine has the half-lace facility so that the control head can read the tape and produce a real-time counter display). Closer inspection revealed that the pinch roller was barrel shaped and was thus distorting the tape as it passed over the capstan and the associated guide – this roller is the one that descends from above, driven by the loading motor.

A point worth making about this and other machines that use the G mechanism is that there is nothing in the manual on replacing the mode switch. It's of the rotary type, and there will be no problems provided you carefully note the position of the old one before removing it. If you do get caught, Fig. 2 shows the position in the tape ejected mode. **N.B.**

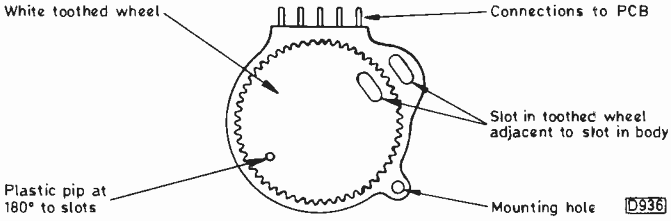

Fig. 2: Mode switch in the tape ejected mode.

Mitsubishi HS337

We've had two or three cases of "no go" with these models – sometimes intermittent. The symptoms have been as follows. On pressing the "power" button the channel indicator has come up momentarily on 1, but the "on" LED has not lit at all. The problem is caused by failure of the SW5V line as a result of dry-joints between Q9A2 and the control PCB. Note that the circuit diagram in the manual is correct but on the board itself and the board layout diagram in the manual Q9A2's base and emitter connections are transposed. Other joints in the area are worth checking. The "on" command from the syscon microcomputer chip establishes the TU-12V line which in turn brings on the SW5V supply. **E.T.**

Philips VR6462/Finlux 1010 etc.

The usual cause of insufficient reel torque in the record, playback and search modes in these machines is slippage (insufficient friction) in the "flying-shuttle" reel idler. We've had one or two cases where the trouble has been due to too much friction however.

The idler is retained by an elliptical spring and a circular baseplate, upon which it revolves. Excessive friction can sometimes develop between the underside of the idler and the top of the plate – the friction can be sufficient to bring the reel motor to almost a standstill in any but the fast forward and rewind modes. Once it has been confirmed that the reel brakes are not binding, i.e. the brake solenoid is not sticky, the point can be proved by pulling the idler clear of the motor drive boss, when the speed of the reel motor should zoom up for a second. Cleaning and polishing both face surfaces will cure the binding, but it's best to replace both the idler and the plate. **E.T.**

Sanyo VHR3300

This was a difficult puzzle to solve. The machine stood accused of intermittently chewing tapes and failing to eject the cassette. It took some time to discover, while the machine was going through bouts of working and not working, that fuse 5001 on the power supply panel (PW1) was going open-circuit intermittently. When it opened and closed the sequence was that the loading arms retracted but the tape was not wound into the cassette. Eject was then permitted, with some 20cm of tape at large in the machine. Messy! **E.T.**

Hitachi VT410

There was no colour at all during playback, though the machine recorded good colour. The chroma signal path was present and correct throughout the up-conversion circuitry, but the signal was lost at R307 which was dry-jointed to the PCB. This resistor provides matching for the 2H delay line. **E.T.**

Baird 8940/JVC HR7350

"One channel down" said the job card. These guessing games are part of workshop life. The TV channels were all o.k., so we turned our attention to the audio channels – this machine has stereo capability on longitudinal tracks. The front-mounted audio monitor switch gave us good sound when pushed to the left, reasonable sound at its centre setting and no sound at all when pushed to the right-most position. During playback there was no output from pin 3 of the audio DIN socket unless the monitor switch was pushed to the left: the E-E sound here was o.k. however. Plainly the LH (channel 1) playback channel was in trouble.

With two identical circuits, fault-finding in one of them is easy. IC2 on the audio/video panel looks after the LH sound, and we found a big oscillation at some supersonic frequency at pin 1. There was a bigger dose of the same at pin 4. Playback equalisation is applied here and C9 ($22\mu F$, 16V), which is part of the feedback network, turned out to be open-circuit. **E.T.**

A Guide to Microwave Techniques

Part 3: Aerials

Andrew J. Heron

In the previous two instalments we have seen how a TEM wave can be propagated along a waveguide and have looked at various components that can be used in a transmission system. With any transmission system the aerial is of prime importance, since the overall performance of a transmitting or receiving system depends on its efficiency.

In general an aerial's gain is proportional to, and its beamwidth is inversely proportional to, the aerial's physical size, which is defined in terms of wavelengths. At v.h.f. and u.h.f. the dimensions of a practical aerial cannot be much greater than a few wavelengths. This is not the case at s.h.f.: for example, at 10GHz an aerial whose dimensions are equivalent to ten wavelengths is only about 30cm. It will be apparent therefore that at s.h.f. we can have physically small aerials with a high gain and narrow beamwidth.

Waveguide Horns

A length of waveguide that's open at one end will radiate from the aperture. This could be considered to be the most basic form of aerial. As we have seen the dimensions of a waveguide supporting the dominant mode are close to one wavelength. Thus in terms of wavelengths the aperture is small, resulting in a broad distribution of radiation. If the waveguide's a and b dimensions are extended to form a flare we obtain a horn-shaped aperture – see Fig. 21(a). This is referred to as a pyramidal waveguide horn. The net effect of the flaring is to increase the aperture size and thus achieve greater directivity, i.e. a narrower beamwidth.

It can be seen from Fig. 21(b) that by flaring the aperture the path length from a point within the aperture of the main guide to the end of the flared section varies across the horn aperture. This varying path length produces phase variations across the aperture of the horn, an undesirable feature since it results in large sidelobes. Sidelobes constitute radiation in a direction other than that of the main beam and represent a waste of power.

Such path length variations can be minimised by using a very long yet shallow flare, but this is obviously impractical. A compromise length is usually adopted. The general rule is to limit the phase variations to 90°. Since the maximum phase variation occurs at the extreme of the aperture, this means that the value of dL is $\lambda/4$. The optimum horn length is then defined as follows:

$$L = (D^2/2\lambda) - (\lambda/8),$$

while the approximate gain relative to a half-wave dipole is given by:

$$G = 4{\cdot}5\ (ab/\lambda 2).$$

The pyramidal horn produces a relatively broad beamwidth and in consequence has few applications as a transmitting source in communications systems. The horn's properties make it suitable for use as a transmitting source in measuring systems however, an application where the

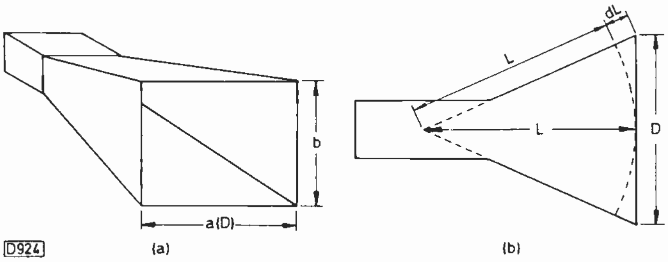

Fig. 21: The pyramidal waveguide horn.

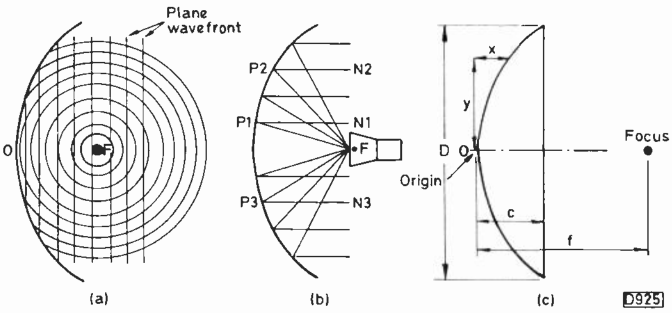

Fig. 22: Principles of the parabolic dish aerial. The distances F-P1-N1, F-P2-N2 and F-P3-N3 in (b) are all the same.

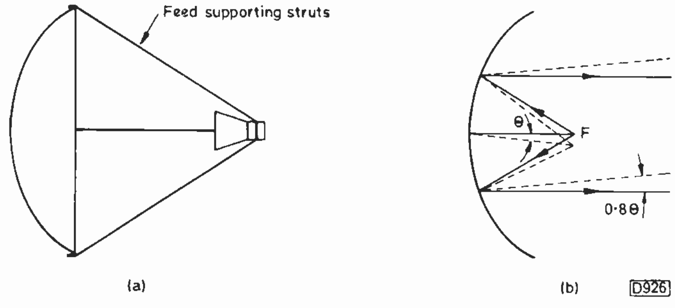

Fig. 23: Direct-feed system.

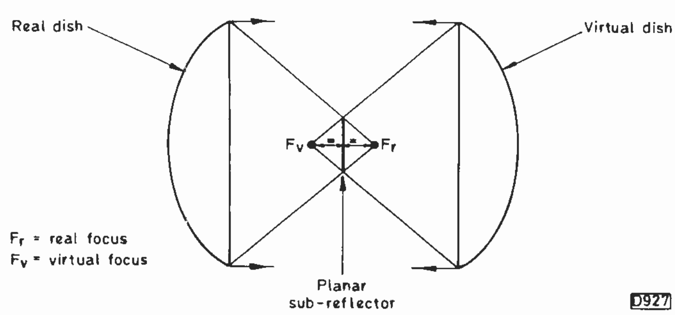

Fig. 24: Use of a planar sub-reflector.

transmitting aerial is required to produce a fairly broad beam.

The typical gain of a horn is up to about 25dB – the actual gain varies with frequency and also the waveguide size. Horns which have been accurately calibrated for gain against frequency are referred to as standard gain horns. They are frequently used in measurements to determine the gain of a test aerial.

The Parabolic Reflector

The requirements of an aerial used for a terrestrial point-to-point link are: (1) High gain, to increase the level of the extremely low received signals. A high-gain aerial will reduce the gain requirements of the receiving equipment. (2) Narrow beamwidth in both the horizontal and the vertical planes, typically less than 2°, to minimise interference between neighbouring links.

Metal plate reflectors are extensively used at microwave frequencies to form the radiation into a narrow beam. Many shapes can be used, but the narrowest beamwidth for a given reflector size is obtained with a parabolic profile – see Fig. 22(a). The profile shown here is a two-dimensional curve called a parabola: a three-dimensional reflector is called a paraboloid and can be considered as the three-dimensional profile that would be produced by rotating Fig. 22(a) about its axis OF.

The major properties of the paraboloid reflector are that a spherical wavefront from a point source F – see Fig. 22(a) – will be reflected from the surface and converted to a plane wavefront. Similarly, radiation entering the aperture of the paraboloid reflector will be reflected from the surface and will from every point on the surface be directed towards point F – see Fig. 22(b). Point F is referred to as the focus and is the point at which the reflected energy converges. The distance FO is the focal length, i.e. the distance between the focal point and the centre of the paraboloid. The focal length depends on the profile of the paraboloid.

It will be noticed that a point source F, Fig. 22(a), will also radiate energy directly. This energy does not reach the reflector and is a waste of power. The problem is avoided by mounting a feed at point F so that the radiation is propagated only in the direction of the reflector. Notice that the path length between the focus, the reflector and the plane of the feed is at all points equal.

Fig. 22(c) shows the various paraboloid dimensions. D is the aperture diameter, f is the focal length, c is the depth of the paraboloid at its centre, y is any vertical distance from the origin and x the distance between the parabola and a line perpendicular to the origin at a vertical distance y. The following relationships are used for paraboloid calculations:

$$y^2 = 4fx,\ y^2 = 4Dx(f/D) \text{ and } f = D^2/16c,$$

where f/D is the ratio of the focal length to the dish diameter.

For a given diameter the f/D ratio determines the depth of the dish. A low f/D ratio means a deep dish. If the focus is inside the aperture the radiated signal will not illuminate the entire dish uniformly. Efficiency is therefore reduced, but a deep dish provides a high degree of sidelobe suppression. A large f/D ratio means a shallow dish with the focus some distance from its surface. The radiated signal will illuminate a greater area than that of the dish, again reducing the efficiency. With an f/D ratio of 0·25 the focus will lie in the plane of the paraboloid's rim. This gives maximum gain and efficiency since the source illuminates the entire dish area uniformly.

Dish Size

Dish size determines the maximum theoretical gain that can be achieved at a given frequency. The maximum theoretical gain is given by:

$$G = \eta(\pi^2 D^2/\lambda^2)$$

where η is the dish efficiency.

At a given frequency, if the dish diameter is doubled the maximum gain will be quadrupled. Gain will also be quadrupled by doubling the frequency, for a given dish diameter. In practice maximum gain is determined by efficiency, which is generally assumed to be 50 per cent.

If the diameter of the dish is halved the f/D ratio is doubled. It's possible however to simulate reduced diameter electrically by under illuminating the dish.

Dish Illumination

The term illumination means the direction of radiation towards a reflective dish. The ideal case is with the feed situated at the focus so that its radiation illuminates the entire area of the reflector and no more. In practice this is never achieved and all dish aerials are to some degree inefficient. The area actually illuminated, relative to the total area, is a measure of the illumination efficiency K. It's defined by:

K = (Area illuminated by feed/total reflector area) × 100%, or

K = (Actual gain/maximum theoretical gain) × 100%.

Illumination is ultimately governed by the feed however. It must be designed to suit the diameter and focal length of the dish. Although the illumination efficiency contributes to the overall aerial efficiency, factors such as phase errors across the aperture and blocking loss due to the obstruction caused by the feed also have a significant effect.

Direct Feed

The simplest feed system consists of a single horn mounted with its phase centre at the focal point, supported by three struts attached to the rim of the dish – the phase centre of a horn is the point from which radiation appears to emanate. This arrangement, called a front-feed or direct feed aerial, is shown in Fig. 23(a). The main disadvantage is the obstruction caused by the feed and its mounting struts, but by careful mounting these effects can be minimised. Poor positioning of the feed, i.e. deviation from the focal point, will shift the direction of the beam relative to the dish. This is shown in Fig. 23(b). Minor errors will not result in a significant gain reduction however. For a given degree of shift, the feed displacement will increase with increased focal length.

From a practical point of view, the front-feed arrangement is convenient as it leaves the back of the dish unobstructed for ease of mounting. It's the easiest arrangement to set up.

Indirect Feed

If a second reflector is placed between the dish and its focal point the aerial can be fed from the back of the dish.

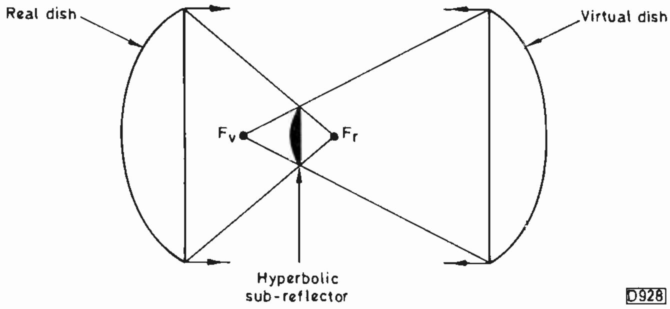

Fig. 25: Use of a hyperbolic sub-reflector – the Cassegrain-feed system.

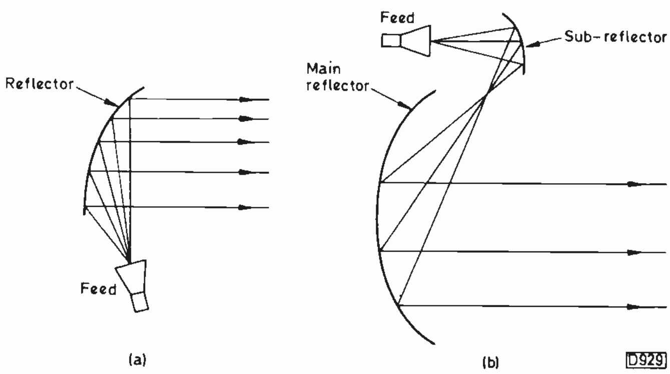

Fig. 26: Offset-fed systems.

In the arrangement shown in Fig. 24 the sub-reflector is planar: it should be a few wavelengths in diameter but as a general rule, to avoid significant gain reduction, should not be greater than 0·3 times the diameter of the dish. As the sub-reflector is planar the feed system can be of the same type as with a front-fed aerial.

The sub-reflector's position can be found by projecting lines from the focal point to both extremes of the dish: the sub-reflector is then positioned so that it fits between these two lines. The feed should be mounted at the same distance from the sub-reflector as the sub-reflector from the focal point – at point Fv in Fig. 24. This is best envisaged, as shown, by imagining a reflection of the main dish in the plane of the sub-reflector. The reflection is called the virtual dish and its focal point the virtual focus. It can be seen that this geometric construction serves to determine the position of the feed – at the virtual focal point Fv.

Although this arrangement complicates the mounting system slightly, it has the advantage that the feed enters at the rear of the main dish while the support required for the sub-reflector is of a lighter type than that required for a front-feed horn. The major disadvantage is that aerials employing sub-reflectors are generally more difficult to set up.

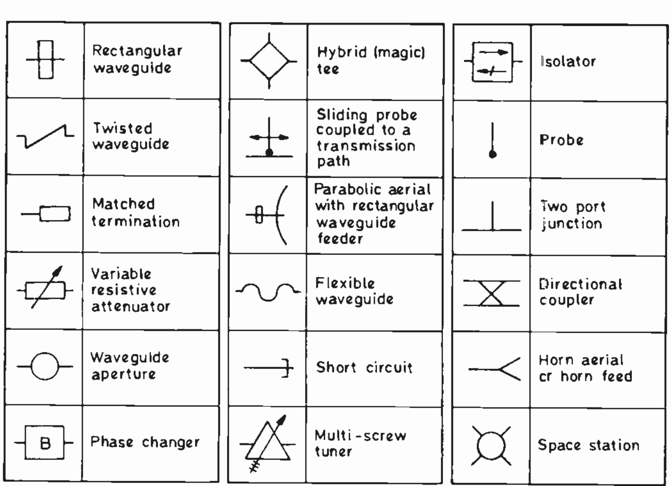

Fig. 27: Graphical symbols used in waveguide diagrams.

Cassegrain Feed

A variation on this theme is the Cassegrain-feed system which employs a sub-reflector with a hyperbolic profile – see Fig. 25. With a hyperbolic sub-reflector the focal length of the virtual dish is greater than that of the real dish. Thus a dish with a short focal length can be efficiently illuminated.

The main advantage of the Cassegrain-feed system is that the position of the feed relative to the sub-reflector is far less critical. It's common practice to mount the feed behind the dish, firing the radiation through a suitably sized hole at the centre of the dish.

Offset Feed

Offset-feed systems may also be of the front-fed or indirect type. The front-fed arrangement is shown in Fig. 26(a). It employs a main reflector and a horn feed, the principle being that the dish is illuminated from the bottom, at an angle. The dish is neither symmetrical nor a paraboloid, so both design and manufacture are more difficult. A variation is the offset–Gregorian aerial shown in Fig. 26(b), employing a shaped sub-reflector to form an indirect feed.

The major attraction of offset–fed aerials is that the dish is unobstructed, which results in increased efficiency and thus gain. The problem with all offset feeds however is that setting up is difficult and critical. With the offset-Gregorian system the sub-reflector is usually mounted on an arm that extends from the dish and includes a means of adjustment. This structure is very critical and must be free from vibration, since the slightest movement of the sub-reflector will cause severe degradation of both the gain and the radiation pattern.

Micro Strip

Although waveguides and waveguide components are expensive and often difficult to produce, they remain the most efficient method of high-power transmission at microwave frequencies.

In recent years however considerable progress has been made in the field of microwave circuitry. Microstrip transmission lines – miniature transmission lines on printed circuit board – are frequently used. Conventional PCB technology is generally employed for this purpose. Matching components, i.e. capacitors and inductors, can be readily produced in microstrip form and are much cheaper than their waveguide equivalents. Microstrip aerials can be produced, though these are not widely used at present. Further development is likely to produce aerials that are smaller and of lower cost than the present generation of dish aerials. The Matsushita flat-panel aerial, at present still in the development stage, was illustrated in the June 1987 issue of *Television*.

In Conclusion

In conclusion, Fig. 27 shows some of the graphical symbols used in waveguide diagrams. The aim of this series has been to outline the fundamental features of the subject without going into detail.

Service Bureau

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

FERGUSON TX100 CHASSIS

The fault with a Model 51A3 is unstable tuning and control (sound, brightness, etc.). Sometimes the vision and sound will disappear, leaving only a raster, and the channel number will change, with the mute light coming into operation. At other times the sound only will go off, while sometimes it suddently rises to full volume. Even the brightness has been affected. The faults are intermittent, occurring maybe two-three times a day or perhaps only once or twice a week.

First ensure that the 5V supply is present and correct at R1905 on the remote preamplifier panel PC1543-003. If so, check the board for poor connections and dry-joints before suspecting IC1902 (TDA3047) and IC1901 (SAA3004P) in that order.

VCR HEAD CLEANING

I used a cleaning tape and although it cleaned the heads the results are not good enough. It would seem to be better to wet clean the heads. Can you suggest a suitable fluid to use?

Though proprietary head-cleaning fluids are available we use surgical spirit with complete success, on a single layer of felt-free cloth held taught over the index finger. Hold the finger still, pressing moderately hard, and rotate the head drum anticlockwise against it. Also do the stationary heads, guides and capstan. Leave to dry fully before using the machine with a tape.

AMSTRAD VCR7000

Apart from failure to eject, this machine works perfectly. The solenoid moves slightly when the eject button is pressed and works when powered by an external 12V supply. We've tried using a digital meter to take voltage readings at the solenoid when the eject button is pressed and find that the voltage seems to vary slightly.

A meter, whether of the digital or analogue variety, is too slow to indicate the "depth" of the eject solenoid drive pulse. First confirm that the "unreg 18V" supply is present at both ends of the solenoid. Then press eject and confirm that "EJ. SOL-" (P1007/2) momentarily drops below 2V. If it does, replace the solenoid. If not, IC1004 is suspect so long as pin 4 of IC1001 is going fully high.

GEC 20AX Mk II CHASSIS

The power supply panel will provide the specified 1·2A h.t. current with a dummy load, but when connected to the set it keeps tripping. Adjusting the set over-current trip control to a slightly higher value sometimes enables the set to run, provided it quickly locks to incoming line sync pulses. When it does run however there are two vertical white lines, caused by interference generated by the chopper driver transistor TR501 as it switches off and on. The hash interferes with other sets several yards away. The power supply will also work in the set if the h.t. is kept below about 125V instead of the specified 133V. Replacing the chopper control chip and the driver and chopper transistors has made no difference.

We suggest you replace the h.t. rectifier diode D510 and the associated reservoir/smoothing electrolytic block C527 which, in our experience, can fail giving peculiar results. We have also found that the two zener diodes D503 and D504 can sometimes "hiccup", upsetting the operation of the TDA2640 chopper control chip.

AKAI VS2

The fault with this machine occurred after the customer had replaced the cassette bulb with one obtained from a local shop. Everything would work all right for a couple of seconds, then the machine would shut down. I decided that the bulb was the wrong one and fitted a Thorn replacement. The timer and play functions then worked but two days later the machine was back again. Now in one out of six tries the machine shuts down as before.

The cassette lamp circuit in this model is unusual, and all sorts of strange symptoms occur when the incorrect type of lamp is fitted. Fit the correct type, part no. EL-330446, which will have to be obtained from Akai or through an agent.

DECCA/TATUNG 120 CHASSIS

This set required a new tripler. It subsequently started to change channel from 3 to 4 or 1 to 2.

The most likely cause of this problem is intermittent flashover in the focus sparkgap on the tube base panel. An improved type, part no. 25-1990-9, is available. Also check that the h.t. is not excessive.

HITACHI VT64

There's a cassette eject fault with this machine. When eject is selected the cassette motor continues to run in the eject direction then reverses and stops when SW1 (load cassette position) next closes. When the machine is switched on the cassette is instantly loaded. SW1 and SW2 are initially open. The switch states are: cassette loaded SW1 open, SW2 closed; cassette ejected SW1 and SW2 open; load cassette SW2 closed then SW1 closed. The syscon and motor drive chips are in order.

Operation of the cassette cradle is largely controlled by the tape-end sensor phototransistors Q141 and Q142 which are particularly troublesome in this model. We suggest you replace them – part nos. 5381681 and 5381682.

QUERY COUPON

Available until 15th June 1988. One coupon, plus a £1·50 (inc. VAT) cheque or postal order, must accompany EACH PROBLEM sent in accordance with the notice printed above.

TELEVISION JUNE 1988

FERGUSON TX10 CHASSIS WITH TELETEXT

There had been a flashover in the focus control which was replaced along with the SAA5012 remote control chip – the latter had been killed by the flashover. The set now works correctly except that when teletext is selected all that appears is random lines of the same digit, with no page number or date and day.

We have often experienced this sequence of events. Almost invariably the SAA5030 chip in the teletext decoder has proved to be faulty. It seems to be more vulnerable than the other i.c.s on the teletext panel.

TEST CASE

306

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 summer time and there's been a slight decline in the numer of TV sets and videos coming in for repair. This is just as well, with staff thin on the ground as a result of holidays. The respite has enabled us to wade into a big pile of stock sets and VCRs. One of them, a Sanyo Model VHR3300 VCR, gave us a bit of practice at logical fault-finding. Not all faults have such logical causes and cures as this one!

A customer had returned the machine which was labelled "please exchange – poor colour". So we fed in a test tape with a colour-bar recording. Perfect colour came up on the monitor. The E-E picture was good too, so we made a recording from Channel 4. If the replay was all right the machine would go back to the shop! The colours were terrible however – there were lines and streaks of incorrect colour, reds turned to greens and vice versa in horizontal bands, and sometimes there was no colour at all. Ugh!

The tape was rewound and removed from the machine so that it could be tried on another machine whose signal circuits were known to be in good order. The results were virtually the same. So we had a chroma fault that was confined to the record mode. When in doubt in a case like this, it's as well to go through the manufacturer's alignment instructions. Realignment will not necessarily solve the problem, but can provide some concrete evidence as to where the source of the trouble lies. If something won't set up, finding out why will usually provide the key to the diagnosis.

Compared to the twiddler's delights of five to ten years ago, very little setting up is required with modern machines. In this case only two adjustments on the chroma side of things are detailed in the service manual – the single voltage-controlled crystal oscillator (VXO), to provide a 4·433619MHz signal on playback of a blank tape, and the chrominance writing current. This latter adjustment is somewhat confusing due to an error of some sort in the service manual. Both factory settings were found to be correct, and an examination of the 627kHz colour-under signal going on to the tape showed that there was nothing wrong with the "envelope" pattern of the chroma component of a colour-bar signal.

The man on the job's first impulse would perhaps have been to change the colour processing chip – in this machine a single TA8632N carries out all the chroma signal processing in the record and playback modes. Wiser councils prevailed however. The problem could have been within the i.c., but most of its circuitry works during playback as well as during record. In fact had the chip been changed the results would have been just as before. The signal and pulse input and output routes are also similar in both modes, but come from and go to different sources.

Here lay the essential clue – and it's not necessary to have the service manual or a detailed knowledge of the circuitry involved to be able to make a reasoned guess as to the cause of the problem. Indeed the advice a colleage shouted across the busy workshop was given without any reference to the service manual and was well on target.

Use of an oscilloscope together with a reasonable knowledge of the VHS colour-under system and a careful analysis of the clues enabled the source of the problem to be found. Where would you have connected the scope's probe and what would you have expected to see? What are the characteristics of the colour-under signal recorded on the tape, and on what do they depend? Next month's issue will reveal all . . .

ANSWER TO TEST CASE 305
– page 528 last month –

The kerfuffle described last month culminated in an accusation that Super Tuner Repairs Ltd. was not up to the job. Despite fitting two new chips and a service-exchange tuner, the grainy picture displayed by a Fidelity CTV14R colour portable obstinately remained. As a final check on the aerial link, the off-air signal in the workshop was applied directly to the input point inside the tuner, a fair enough procedure so long as the TV chassis is fully isolated from the mains supply by one means or another. In this case the bench power supply was provided by an isolating transformer. But direct aerial connection in his way did nothing for the poor picture display.

There remained only one real possibility – the SAW filter, which provides the i.f. bandpass shaping. It was in fact the culprit, and also accounted for the slight ringing effect that had been noticed on the test card. Whatever had happened inside this one had increased its loss and caused an impedance mismatch.

Failure of one of these devices – this one was an SW153 – is very rare. Indeed it's the first time we've had this fault, which is why we'd left the SAWF out of the reckoning during our attempts at diagnosis.

When a glass delay line fails our curiosity usually leads us to break it open and have a look inside to see what's gone wrong. The solid casing of this little wonder precludes such action however, so we'll never know. The piezo element is probably too small for easy inspection anyway.

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VP294	1	2732D 32K Eprom	£3.00
VP295	1	6821P Peripheral Interface Adaptor (PIA)	£1.50
VP296	6	LM324 14 pin DIL Quad Op-Amp	£2.00
VP297	5	CA3130E MOS-FET I/P, CMOS O/P, Op-Amp	£2.00
VP298	3	MC1310P Stereo Decoder, 14 pin DIL	£2.00
VP299	3	CA3085 Pos. Volt Regulator, 1.7v-46v, 8 pin TO5	£2.00
VP400	1	27128 128K Eprom	£2.50
VP401	2	LM317T Adjst. Voltage Regulator, 1.5A	£1.00
VP402	1	2114 4K Static Ram	£2.00
VP403	1	TA7204 Audio Amp I.C. 4.2w, 13v, 2-4 ohms	£1.00
VP404	1	TBA461 Audio Power Amp, 4.5w	£1.50
VP432	8	CD4016B	£2.00
VP433	6	CD4017B	£2.00
VP434	10	CD4024B	£2.00
VP435	10	CD4028B	£2.00
VP7413	4	7413 Dual Nand Schmitt Trigger, 4-input	£1.00
VP7440	4	7440 Dual 4-input, Positive-Nand Buffer	£1.00
VP7470	4	And gated Positive-edge-triggered Flip-Flop with preset	£1.00
VP7480	4	7480 Gated full Adder	£1.00
VP7481	4	7481 16-bit Random Access memories	£1.00
VP7490	4	7490 Decade Counter	£1.00
VP7491	4	7491 8-Bit Shift Register	£1.00

MISC.

Pak No	Qty	Description	Price
VP177	1	Pack assorted Hardware, nuts, bolts, etc	£1.00
VP178	5	Assorted Battery Holders and Clips, PP3/9, AA/D, etc	£1.00
VP223A	6	Tag Boards, 18 way paxaline	£1.00
VP225	20	DIN Plugs, plastic 2-8 pin, 180°/240°/360° mixed	£2.50
VP226	20	DIN Chassis Skts, metal 2-8 pin 180°/240°/360° mixed	£2.50
VP227	18	DIN In-line Skts, plastic, 2-8 pin 180°/240°/360° mixed	£2.50
VP228	10	C15 Computer Cassette Tapes, leadless	£3.00
VP232	1	Cassette Head Cleaner/Demagnetizer, in case	£2.00
VP233	1	Revolving Cassette Rack, holds 32, smokey perspex	£2.50
VP244	1	High Power Piezo Electric Siren. Emits earpiercing warbling sound. Ideal alarm. White plastic body with mounting bracket. Power 12vDC 150mA. Output 100dB (A) at 1m typ. freq. 2.5KHz. Size: 57 x 42 x 37mm	£6.00
VP260	1	9" x 6" Elliptical 8 ohms 10W RMS Speaker. Freq. Res. 60-10000 Hz. Gauss 10000. Centre HF cone	£4.50
VP260A	1	2 1/4" Transducer Waterproof Speaker. Polyester film diaphragm. Moisture res. 8 ohms 300mW Freq. Res. 20-20000 Hz	£1.00
VP273	10	10K Lin Rotary Potentiometers, slim spindle	£1.00
VP281	4	Plug-in Relays. Mixed volts, etc	£1.00

TOOLS.

Pak No	Qty	Description	Price
VP95	1	Plastic Vice, small, with suction base	£1.75
VP97	1	Logic Probe/Tester, supply 4.5v-18v, DTL, TTL, CMOS	£8.50
VP99	1	Universal Tester, with ceramic buzzer	£5.00
VP103	1	6 Pc STANLEY Screwdriver Set. Flat and crosspoint	£3.50
VP139	1	Pick-up Tool, spring loaded	£1.75
VP217	1	Helping Hand	£4.00
VP218	1	Watchmakers Screwdriver Set, 6 pieces	£1.75
VP219	1	Miniature Side Cutters	£1.55
VP220	1	Miniature Bent-nose Pliers	£1.55
VP221	1	Miniature Long-nose Pliers	£1.55
VP237	1	Universal Ni-Cad Battery Charger. AA-HP11-HP2-PHP3	£6.00
VP238	4	AA Ni-Cad Batteries. 1.25v 500mAH C/R mA	£4.00
VP239	2	C-HP11 Ni-Cad Batteries. Rechargeable	£3.50
VP240	2	D-HP2 Ni-Cad Batteries. Rechargeable	£4.00
VP246	1	25w Quality Low Cost Soldering Iron. 240vAC	£3.50
VP247	1	15w "Lightweight" Quality Low Cost Soldering Iron. 240vAC	£3.50
VP248	1	High Suction Desoldering Pump. Teflon nozzle. Auto eject heavy duty return spring	£4.00
VP250	1	Long Finger Grip. Soldering aid. Heavy metal base. Serrated jaws with rev. tweezer action. Ideal for holding small components. Fully adjustable	£3.00
VP254	1	250 grams Etchant Granules (Ferric Chloride) makes 1/2 pint	£1.00
VP255	1	Etching Pen. Etch resistant. Spare tip. Blue	£1.00
VP258	1	Multicore Solder. 5m total. 10 and 22 SWG	£1.00
VP259	1	PCB Holder. Fully adjustable from 0-320mm wide and to any angle. Complete with iron stand and sponge. Strong metal construction with rubber feet. Very high quality	£15.00
VP286	2	Etch Resist PCB Transfer Sheets. Asst. symbols/lines	£1.00
VP405	2	Steel Rules 1 x 4", 1 x 10", measuring ins and mm	£1.00
VP406	1	Junior Hacksaw & 3 blades + hobby knife & 2 blades	£1.00
VP407	1	10 Piece Needle File Set	£3.00
VP408	1	4 Piece Stainless Steel Tweezer Set	£4.00
VP409	1	Set of 4 min. low cost Side & End Cutters, snipe & combination Pliers 5" insul. handles	£4.50

DIODES & SCRS.

Pak No	Qty	Description	Price
VP29	30	Assorted volt Zeners 50mw-2w	£1.00
VP30	10	Assorted volt Zeners 10w, coded	£1.00
VP31	10	5A SCR's TO66, 50-400v, coded	£1.00
VP32	20	3A SCR's TO66, up to 400v, uncoded	£1.00
VP33	100	Sil. Diodes like 1N4148	£1.00
VP34	200	Sil. Diodes like OA200/BAX13-16, 40v 200mA	£1.00
VP35	50	1A IN4000 Diodes, all good, uncoded, 50v min	£1.00
VP49	30	Assorted Sil. Rectifiers 1A-10A, mixed volt	£1.00
VP141	40	IN4002 Sil. Rectifiers, 1A 100v, preformed pitch	£1.00
VP142	4	40A Power Rectifiers, silicon, TO48 300 PIV	£1.00
VP143	5	BY187 12KV Sil. Diodes, In carriers, 2.5MA	£1.00
VP184	3	4A 400v Triacs, plastic	£1.00
VP187	10	SCR's 800MA. 200v, 2N5064, plastic, TO92	£1.00
VP194	50	OA91 point contact germanium Diodes, uncoded	£1.00
VP195	50	OA47 gold bonded germanium Diodes, uncoded	£1.00
VP196	50	OA70-79 detector germanium Diodes	£1.00
VP197	50	OA90 type germanium Diodes, uncoded	£1.00
VP198	40	BA248 Sil. Diodes, 350v 2A, fast recovery	£1.00
VP222	20	3A Stud Rectifiers, 50-400v, assorted	£1.00
VP274	12	SCR's (Thyristors) 1A 100-400v, TO-39	£1.00
VP275	3	5A 400v SCR's, TO220, TIC106D	£1.00
VP276	5	SCR's standard type, 5-16Amp to 400v	£1.00
VP277	4	Triacs 2Amp 400v TO-39	£1.00
VP278	4	6Amp 1000v plastic Silicon Rectifiers	£1.00
VP283	5	Diac BR100, triac trigger	£1.00

TRANSISTORS

Pak No	Qty	Description	Price
VP38	100	Sil. Transistors, NPN plastic, coded, with data	£3.00
VP39	100	Sil. Transistors, PNP plastic, coded, with data	£3.00
VP47	10	Sil. Power Transistors, similar 2N3055, uncoded	£1.00
VP48	5	Pairs NPN/PNP plastic Power Transistors, 4A, data	£1.00
VP50	60	NPN Sil. Switching Transistors, TO-18 and TO-92	£1.00
VP51	60	PNP Sil. Switching Transistors, TO-18 and TO-92	£1.00
VP60	100	All sorts Transistors, NPN/PNP	£1.00
VP150	20	BC183B Sil. Transistors, NPN 30v 200mA Hfe240+ TO92	£1.00
VP151	25	BC171B Sil. Transistors, NPN 45v 100mA Hfe240+ TO92	£1.00
VP152	15	TIS90 Sil. Transistors, NPN 40v 400mA Hfe100+ TO92	£1.00
VP153	15	TIS91 Sil. Transistors, PNP 40v 400mA Hfe100+ TO92	£1.00
VP154	15	MPSA56 Sil. Transistors, PNP 80v 800mA Hfe50+ TO92	£1.00
VP155	20	BF595 Sil. Transistors, NPN eqvt BF184 H.F. TO92	£1.00
VP156	20	BF495 Sil. Transistors, NPN eqvt BF173 H.F. TO92	£1.00
VP157	15	ZTX500 series Sil. Transistors, PNP plastic	£1.00
VP158	15	ZTX107 Sil. Transistors, NPN eqvt BC107 plastic	£1.00
VP159	15	ZTX108 Sil. Transistors, NPN eqvt BC108 plastic	£1.00
VP161	25	BC183L Sil. Transistors, NPN 30v 200mA TO92	£1.00
VP162	5	SJE5451 Sil. Power Transistors, NPN 80v 4A Hfe20+	£1.00
VP163	2	NPN/PNP pairs, Sil. Power Transistors, like SJE5451	£1.00
VP164	4	2N6289 Sil. Power Transistors, NPN 40v 40w 7A Hfe30+	£1.00
VP165	6	BFT33 NPN Sil. Transistors, 80v 5A Hfe50-200 TO39	£1.00
VP166	5	BFT34 NPN Sil. Transistors, 100v 5A Hfe50-200 TO39	£1.00
VP167	1	BUY69C NPN Transistors, TO3 VCB 500, 10A, 100w, Hfe15+	£1.00
VP168	10	BC478 eqvt BCY71 PNP Sil. Transistors. TO18	£1.00
VP169	10	BXS21 eqvt BC394 NPN Sil. Transistors. 80v 50mA TO18	£1.00
VP170	10	Assorted Power Transistors, NPN/PNP coded and data	£1.00
VP171	10	BF355 NPN TO-39 Sil. Transistors, eqvt BF258 225v 100mA	£1.00

I.C.S.

Pak No	Qty	Description	Price
VP7492	4	7492 Divide by 12 Counter	£1.00
VP7493	4	7493 4-bit Binary Counter	£1.00
VP7494	4	7494 4-bit Shift Register	£1.00
VP7495	4	7495 4-bit Shift Register	£1.00
VP74111	4	74111 Dual J-K Master Slave, Flip Flop	£1.00
VP74141	4	74141 BCD-Decimal Decoder/Driver	£1.00
VP74151	4	74151 1 of 8 Data Selectors/Multiplexers	£1.00
VP74153	4	74153 Dual 4 line to 1 line Data Selectors/Multiplexers	£1.00
VP74164	4	74164 8-bit Parallel Output Serial Shift Registers	£1.00
VP74167	4	74167 Synchronous Decade Rate Multipliers	£1.00
VP74174	4	74174 Hex D type Flip-Flops	£1.00
VP74181	4	74181 Arithmetic Logic Units/Function Generators	£1.00
VP74193	4	74193 Synchronous Up/Down Dual Clock Counters. Binary clear	£1.00
VP74279	4	74279 Quad S-R Latches	£1.00
BPX6	1	TTL Data Book 74 series, including "LS". Complete with Pin out diagrams. 7400-74670 TTl interchangeability guide. Function selection guide and explanation of function tables. "NO VAT"	£1.00
BPX5	1	IC555 PROJECTS BOOK (TIMER). 167 pages. Over 50 project circuits to build and other information on IC555 Timers. Plus FREE with our compliments, 3 x IC 555 Timer, worth 80p. **Special offer price just £2.95.** **"NO VAT"**	
BPX4	1	INTERNATIONAL TRANSISTOR EQUIVALENTS GUIDE. Babani Publishing's latest edition BP85, plus FREE with our compliments, 10 popular Silicon Transistors, worth £1.00. **Special offer price just £3.50. "NO VAT"**	

MISC.

Pak No	Qty	Description	Price
VP17	50	Metres PVC single strand Wire, mixed colours	£1.00
VP18	30	Metres PVC multi strand Wire, mixed colours	£1.00
VP19	40	Metres PVC single/Multi strand Wire, mixed colours	£1.00
VP22	200	Sq. Inches total Copper Clad Board	£1.00
VP23	10	40mm Track Slider Pots. 100K Lin	£1.00
VP42	10	Black Heatsinks, fit TO3 and TO220, drilled	£1.00
VP43	4	Power-fin Heatsinks, 2 x TO3, 2 x TO66	£1.00
VP44	15	Assorted Heatsinks, TO1/3/5/18/220	£1.00
VP56	100	Semiconductors from around the world, mixed	£4.00
VP82	1	Electronic Buzzer, 3v, 25MA	£0.95
VP83	1	Electronic Buzzer, 6v, 25MA	£0.95
VP84	1	Electronic Buzzer, 9v, 25MA	£0.95
VP85	1	Electronic Buzer, 12v, 25MA	£0.95
VP86	1	TECASBOTY Components Pack, semiconductors, caps, wire, etc	£8.00
VP87	1	Telephone Pick-up Coil with 3.5mm jack plug	£1.25
VP88	1	Pillow Speaker with 3.5mm jack plug	£1.45
VP107	1	Piezo Buzzer, miniature, 12v	£1.25
VP108	1	Piezo Buzzer, miniature, 240v	£1.25
VP113	1	Coax Antenna Switch, 2 way	£4.50
VP114	1	Coax Antenna Switch, 3 way	£4.75
VP115	1	High Pass Filter/Suppressor, CB/TV	£0.50
VP116	1	Low Pass Filter, VHS/TV bsnd	£3.00
VP122	1	Precision Morse Key, fully adjustable	£1.85
VP144	4	100K Lin multi turn Pots, ideal vari. cap. tuning	£1.00
VP145	10	Assorted Pots, inc dual and switched types	£1.00
VP148	30	Presets, horizontal and vertical, mixed values	£1.00
VP174	5	DIL Switches, 1 and 2 way slide, 6 way SPST, assorted	£1.00
VP176	30	Fuses, 20mm and 1 1/4" glass, assorted values	£1.00

TOOLS.

Pak No	Qty	Description	Price
VP410	1	18 Pc Hex Wrench Keys. AF sizes in wallet	£1.50
VP411	1	16 Pc Hex Key Wrench Set. SAE and Metric	£2.00
VP412	1	Crimping Pliers, Wire Strippers & Bolt Cutters	£1.00
VP413	2	IC Extraction Tools, jaw width 18 and 29mm	£2.00
VP414	1	End Action Stripping Pliers. Adjustable jaws	£1.00
VP415	1	5" Grip Locking Pliers	£3.00
VP416	1	6" Long Nose Grip Locking Pliers	£3.00
VP417	1	6" Adjustable Wrench. Forged alloy steel	£2.50
VP418	1	8" Tin Snips. Hardened steel, spring joint	£2.00
VP419	2	"Chubby" Screwdrivers. Crosspoint No 1 and 2	£1.50
VP420	2	"Chubby" Screwdrivers. Flat blade 4.5 and 6mm	£1.50
VP421	1	Screwdriver 400mm long, 6mm flat blade	£3.00
VP422	1	Screwdriver 400mm long, No 2 crosspoint	£3.00
VP423	1	Vernier Caliper-Crosshorns. Depth gauge. Vernier Cap. 4 1/2"/110mm reading 1/128", 1/10mm	£2.50
VP424	1	Helping Hand with Magnifier	£4.50
VP425	1	7 Pc high quality Screwdriver Set	£8.50
VP426	1	7 Pc high quality Screwdriver Set 1000v	£12.50
VP427	1	6 Pc Cushion Grip Screwdriver Set	£4.00

LEADS.

Pak No	Qty	Description	Price
VP300	1	10m Speaker Lead 2 pin DIN Plug to 2 pin DIN Skt	£1.00
VP301	1	2m Video Lead Coaxial Skt to Coaxial Skt + 2 adaptors	£1.20
VP302	1	3m 4 core cable indv. screned 5 pin DIN Plug 5 pin DIN Plug	£1.80
VP303	1	TV Ext. Lead. Coax plug to Coax Plug. White	£1.00
VP304	1	1.5m 4 core indv. screen. 5 pin DIN Plug-tinned open end	£1.00
VP305	1	1.5m cable 5 pin DIN Plug-3.5mm Jack Plug. Pin 1 & 4 connect	£1.00
VP306	1	2m Typewriter/Calculator Lead. 3 pin Plug, angled European IEC configuration. 6A 250vAC	£2.00
VP307	1	60cm Patch Lead. PL259 Plug to PL259 Plug	£1.00
VP308	1	1.2m Patch Lead. PL259 Plug to PL259 Plug	£1.50
VP309	1	1.2m Lead 4 Phono Plugs to 4 Phono Plugs	£1.50
VP310	1	20cm Lead 2 x 2 pin DIN Plug to Stereo Inline Jack Skt	£1.00
VP311	1	2m Lead Scart Plug to 5 pin DIN Plug & 2 BNC Plugs	£6.00
VP312	1	1.2m Video Lead. BNC Plug to Phono Plug	£1.50
VP313	1	3m Headphone Lead. 3.5mm Jack Plug to 3.5mm Jack Skt	£1.00
VP314	1	2m Coax Lead BNC Plug to BNC Plug. 75 ohms	£3.00
VP315	1	2m Coax Lead BNC Plug to UHF Plug. 75 ohms	£3.00

TELEPHONE ACCESSORIES.

Pak No	Qty	Description	Price
VP316	1	5m Telephone Ext. Lead. Plug to Socket	£4.50
VP317	1	10m Telephone Ext. Lead. Plug to Socket	£6.00
VP318	1	3m Line Jack Cord. BT 4 way Plug to 4 Spade Terminals	£1.75
VP319	1	Double Adaptor. One IDC plug, 2 socket	£3.50
VP320	1	IDC Telephone Plug 4 way	£0.50
VP321	1	Telephone Master Socket Surface Box. Screw terminals	£3.50
VP322	1	Telephone Slave Socket Surface Box. Screw terminals	£2.25

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Neg 100mA 79L05-12-15-18-24	30p each

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3HSS4VB £54.60
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Sharp
3HSS(SP) £29.90
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Toshiba
PS3B(T) £31.95
Fits model numbers: V9600, V31B, V33B.

Hitachi
3HSS(H) £26.50
Fits model numbers: VT8000, VT9300 etc.

Sony
PS3B(S) £24.95
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P84B(2S) £34.50
Fits model numbers: SLC20, SLC30, SLC40, SLF1.
PS5B(3S) £44.25
Fits model numbers: SLC9, SLT50, SLC8, SLF60.

Amstrad/Saisho
3HSS(R) £29.50
Fits model numbers: VCR7000 and all models using Orion chassis.
3HSS(FI) £34.50
Fits model numbers: VCR4500, VCR5200, VCR9000 etc.

Fisher/Fidelity
3HSS(SF) £29.95
Fits model numbers: FVHP615, FVHP710, V1000.

GENUINE HEADS

Panasonic	
NV2000, NV2010	£44.00
NV7000, NV7200	£44.00
NV333, NV370	£44.00
NV366	£64.50
NV688, NV777, NV788	£64.50
NV730	£67.50
All others available P.O.A.	
Ferguson	
3V00, 3V16, 3V22	£59.90
3V29, 3V30	£59.90
3V32	£66.95
3V35, 3V36, 3V38, 3V39	£59.90
Sharp	
VC7300, VC7700, VC7750	£69.90
VC8300	£69.90
VC9300, VC9500, VC9700	£62.00
VC381, VC383, VC386	£62.00
VC483, VC483	£62.00
All others available P.O.A.	
Sanyo	
VTC5000, VTC5150	£39.90
VTC5300, VTC5400	£39.90
VTC9300	£39.90
Sony	
SLC5, SLC6, SLC7	£49.50
SL8000, SL8080	£49.50
SLC20, SLC30	£54.50
SLC9	£54.50
Toshiba	
V9600	£59.90
V8600	£69.90
V31, V33	£59.90
V55, V56	£59.90
Hitachi	
VT5000, VT5500	£34.50
VT6500, VT8000, VT8300	£34.50
VT8500, VT8700	£34.50
VT9300, VT9500, VT9700	£34.50
VT11E, VT14E	£34.50
VT17E, VT19E	£54.60
VT33E	£34.50
Philips	
VR6460	£44.00
VR6462	£44.50

Please call if your model is not listed.

BELT KITS

GENUINE

Panasonic	
NV2000, NV2010	£6.50
NV7000, NV7200	£6.50
NV333, NV366	£6.50
NV370, NV830, NV850	£2.80
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NV777, NV788	£4.70
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3V29, 3V30	£4.90
3V35, 3V36, 3V38, 3V39	£2.90
Sanyo	
VTC5000, VTC5150	£1.99
VTC5300, VTC5400	£4.50
VTC9300	£6.50
Sony	
SLC5, SLC7	£6.50
SLC6	£7.50
SL8000, SL8080	£6.50
Sharp	
VC7300, VC7700, VC7750	£6.50
VC8300	£6.50
VC9100, VC9300, VC9500	£6.50
VC381, VC383, VC386	£6.50
Hitachi	
VT5000, VT5500	£6.50
VT8000, VT8300, VT8500	£2.90
VT9300, VT9500, VT9700	£3.30
VT11E, VT14E, VT17E, VT19	£6.50
VT33E	£6.50
Akai	
VS9700	£6.50
VS2, VS3, VS4, VS5	£4.90
VS9300, VS9500, VS9700	£6.50

Many others available

REPLACEMENTS

Panasonic	
NV2000, NV2010	£3.50
NV7000, NV7200	£3.00
NV333, NV366	£3.00
NV8600, NV8610	£3.95
Ferguson	
3V00, 3V16, 3V22	£3.50
3V23	£2.90
3V29, 3V30	£3.50
3V35, 3V36, 3V38, 3V39	£2.90
Sanyo	
VTC5000, VTC5150	£1.00
VTC5300, VTC5400	£2.50
VTC9300	£4.25
Sony	
SLC5, SLC7	£3.60
SLC6	£4.95
SL8000, SL8080	£4.25
Sharp	
VC7300, VC7700, VC7780	£3.50
VC8300	£3.90
VC9100, VC9300, VC9500	£3.90
VC381, VC383, VC386	£3.90
Hitachi	
VT5000, VT5500	£4.50
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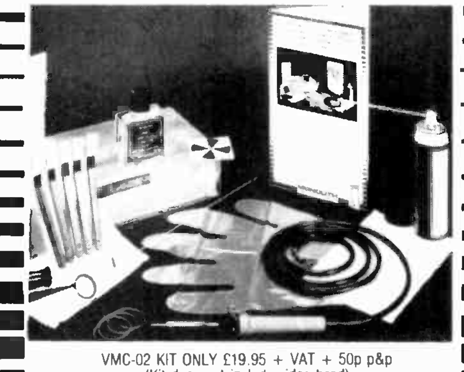

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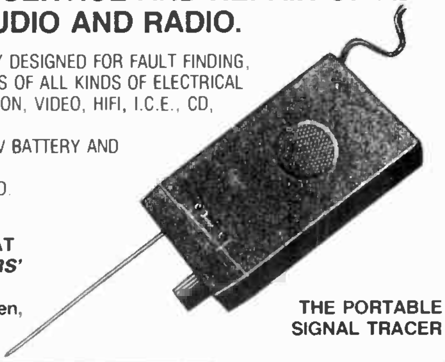

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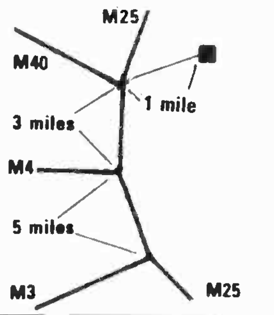

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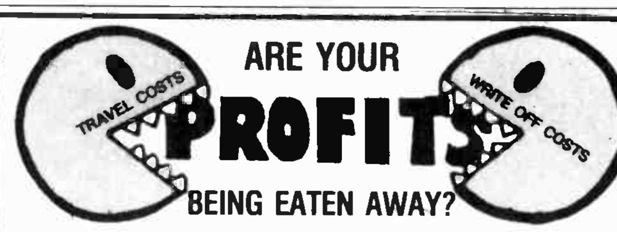

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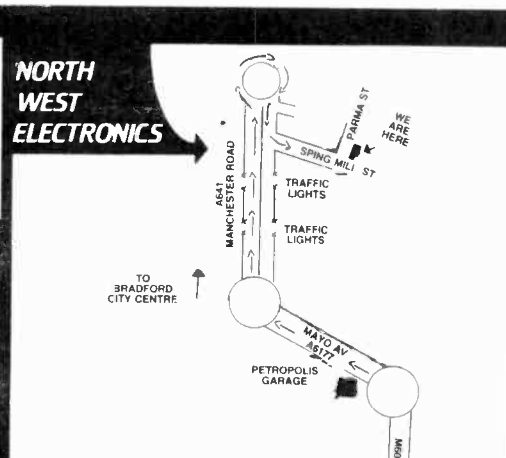

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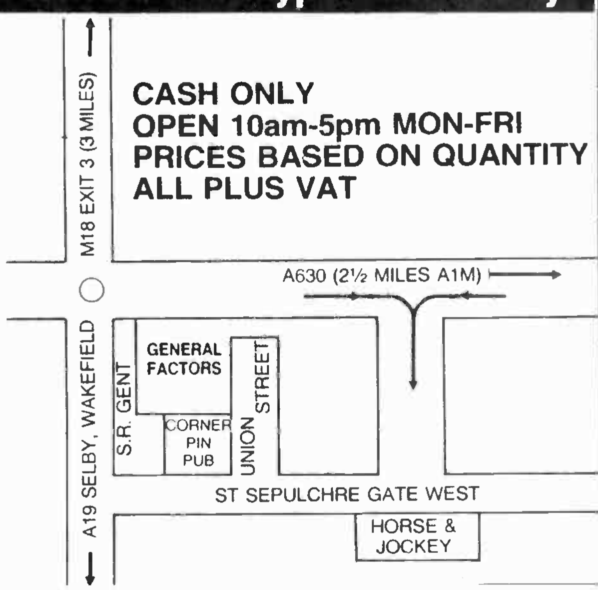

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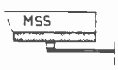

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SENDZ COMPONENTS

TO ORDER SEE BACK PAGE

Matsushita PY3422() Tuner £7
C Cam Decoder with TDA3591 £5
Toshiba VHF/UHF FG522F £6
Mitsumi MEC1-F51 £5

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 IvNPN 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 AI Diode 20p
Export 3500 IF panel £2
IC board with set of SN74LS £1
4000 Tube base £4
3500 AI 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 MFCH £4
7 Button Unit GEC with Lamps £7
697 Push Button Unit £6.00
Z916B panel £5.00
T513AP panel £5.00

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
Ac Socket & Lead
GEC, ITT, Philips, Pye 25p
7×3¾ Thorn £1
Thorn 1600-1700 £1.50
Rank Toshiba Tube Bases 30p

Speakers

6×4 GEI 25 ohm £1.00
3½×2½ 3 ohm £1.00
5×3 80 ohm 70p
5×3 50 ohm 50p
5×3 35 ohm 70p
6×4 15 ohm £1.00
6×4 speaker 16 ohm
7×3 70 ohm £1.00
8×5 8 ohm 15 watt £2
8×5 8 ohm £1
5×3 8 ohm 70p
7×3 16 ohm £1.00
5" dia 16 ohm £1.00
5" dia 8 ohm £1.50
6½" dia 4 ohm £1.50
6½" dia 3 ohm £1.50
2¾" dia 8 ohm 75p
3" dia 8 ohm 75p
4½" sq 15 ohm 75p
KT3 speaker K30 75p
3" dia 15 ohm 60p
1690 5×3 12 ohm £1
K45 Philip 15 ohm 75p
K30 15 watt £1

KT3-K30

OF-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 164 50p
BY 176 25p
BY 179 40p
BY 184 25p
BY 187 10p
BY 190 40p
BY 196 30p
BY 198 10p
BY 204/4 8p
BY 206 8p
BY 208/800 8p
BY 210/400 5p
BY 210/800 10p
BY 223 60p
BY 224/600 4 8A-600v bridge 50p
BY 226 15p
BY 227 15p
BY 228 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 527 10p
BY 602 10p
F 247 10p
GP20G 5p
GRP80G (TX10) 60p
XK 3102 50p
BYV 28/200 20p
Bridge TX10 800/3 amps 30p
KBPC35-02 Bridge £1.50

K35 Decoder £8.00
K35 Sound OP £4.00
K35 Split Diode 3122-138-35930 £10.00
Thick Film Daughter KT3 3122-127-43891 £3
12 CH K30 Tex Rec Front Panel with IC £5
K35 IF £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 J/Pots 3,500 I off each type £3.00
G8 Trans Philips £7.00
GII Split Diode £12.00
CVC820 Split Diode ITT £10.00
Thorn B/W AD5308F + 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 T O P T Z970 £3.00
CVC32 £6.00
AT2080/15 £5.00
CVC30 ITT £5.00
CVC 32 Line Tran £7.00
CVC800 Line Trans £6.00
CVC 40 Slip/Diode £12.00
CVC 45 £5.00
GEC Portable G1OT2041 £3.00
GEC Portable G1OT2046 £3.00
FIT 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

Universal Tripler

with small focus pot Green type £7.00

Black Triplers

KT3 Triplers £6.00
S T C Universal Tripler £6.00
11 TJ1 £2.50
11 TGA £2.00
ITT CVC 5-8-9 £3.50
Rank T25LE Tripler £2.00
Rank IT1CP A823 £3.50
TU 25 30K Rank £3.00
11 TE-Z 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
1118Q Pye 731 £3.00
1111Y £4.00
D22 for Pye 18" colour portable £4.00
LP 1193/63 £4.00
BG 100/41 £3.25
ERO Tripler print type with leads 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
GII F W Transformer 50p
GII E.W. coils £1.00
GII Transient Suppressors 245V 20p
GII Scan Coils £5.00
GII 100K tuner pots 12 for £1
KT3 II 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 TO66 O P Trans pair 25p
5 button touch tuner BBC1/2 ITV1/2 video with ic SAS 560T/570T £7.00
Control panel 5 sliders + mains lead £1.50
GII 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
6A/600V Stud Diodes 20p
6A/1000V Stud Diodes 20p
BTW 92/800R £3
25A473 PNP C/P 10p

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 GII IF Panel £10.00

25% OFF ALL PANELS

G8 Tuner Unit + Panel £4.00
G8 IF & Chroma £6.00
G8 Chroma £3.00

GII IF Detector £3.00
GII Selector gain module £3
Complete CVC 825 Chassis (both panels) £40.00
AFC V/Cap Resistor Unit UHF with IC SAS660 SAS670 £3.00
Z714 RANK IF Panels 6MHz I.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 GII 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

GII 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

Line O/P panel GEC 2217/2218/2213/ 2214/2226/2227/2228 £10

PHILIPS BATTERIES (Small Types) HAND SETS

SR41 40p
SR43 40p
SR44 40p
SR54 40p
LR43 40p
LR44 40p
LR54 40p
CR2032 40p
10 500PF 2KV 20p
.22/1000 20p
.1/250AC 20p
1/100 5p
1MFD-250AC 25p

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
3e3/250 A.C. 10p
.33/250V 20p
.39/250V 15p
4n7/250 tested 5KV 25p
22/250 15p
47/250 10p
100/250 20p
GII 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 820ITT 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
2n0/1500 10p
2n2/1500 15p
.01/1600 15p
GII.8200/2KV 15p
0 1/2KV 20p
3n9/2KV 15p
0.0015/2KV 10p
6n2/2KV 15p
2n0/2KV 15p
2n2/2KV 15p
470pf 4KV 10p
7500pf/2KV 10p
3000PF/3000V 10p
4n7/2KV 15p
5n2/2KV 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 GII £2.00
Philips K4 CAP 150M/385V 50p

CVC 20-25-30 Mains Switches 60p
Infra Red and Ultrasonic GII Teletext Decoder Panel £30
RANK & ITT Mains Remote On-Off Switch (720R) £1.50
RANK & ITT Remote Switch 2800 ohm £1.50
GII Mains Switch 50p
4 amp Mains Switch 25p
GEC Mains Switch 4 amp 30p
KT3 Mainswitch £1.00
G8 Mains Switch 75p
GII Preh Red LED P/Button for C.H. Change 20p
RANK TOSHIBA Transductors TPC-2011 50p
Mains Switch ITT Long Type Print 75p
Mains Switch Philip Long Type TAG 75p
Mains Switch GEC Long Type TAG 75p
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

220 MFD Sprague 3
350V 300M + 300M
400V 400M
350V 400M
Thorn 3500
175/100/100/350v
KT3/200/25/25/385v
KT3-K30 220+40+40 75p
200+200+75+25M 325V £1.00
300+300+150+100+50MFD
350V £2.00
GII 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 £8.00
CMC 303 front panel £8.00

CMC 302 Panel with TC mains switch etc £8.00

CMD 800 Decoder £8.00

GII £1.50
I.I.C. Receiver Panel

3 I.C. Power Supply GII Full Remote Receiver Panel £3.00

PHILIPS SBC 469 Stereo Microphone £23.00
Meters Hills 520 £17.00
Meters Hills 420 £15.00
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
HD1000 Digital £20.00
HD3000 Digital £25.00
HD5000 Digital £25.00
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 £8.00
Fits in top pocket.

Handset Tester with LED £4.50

Repaired Handsets

Philips K4-K35, RC5350-RC5380, RC5370, RC5375, repaired same day £10.00

RC4001 Full Remote KT3 K30 Teletext Handsets exchanged £15.00

NEW Type RC4001 9 buttons not 12 £7.00

GEC Full Remote Infra-red, 1983 models £15.00

Timers, 60 mins, small £1.00

TOSHIBA HAND SETS

24 Button CT938 Fullremote £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 £15.00

GII Full Remote Ultrasonic £32.00
GII Ultrasonic Teletext Handset £20.00
8CH Ultrasonic GEC Full Remote C2014H/C2219H £15.00
New Replacement for GII Ultrasonic Full Remote £12.00
Thorn 4000 insert with 7 buttons £5.00
Decca RC 11 £14.00
Decca RC 12 £14.00
GII Infra-red full teletext £24.00
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
GII, Full remote top button assy £12.00
GII, Full remote repair service (exchange unit) £18.00
GII, Full remote new ultrasonic £32.00
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 £19.00
TX9 with Text £19.00
TX9 & TX10 button print £3.50

ITT

T/V & Video Processor 1200 Type £10.00

PHILIPS UNIVERSAL HAND SET £15.00 KT3 - K45

We have all parts for Philips Handsets

RC5353 £15.00
RC5300 £12.00
Philips RC5 £15.00

TEX-TYPE

Replace Hand Set for Philips KT3-K30, K4 etc £12.30