TELEVISION

20p

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NOVEMBER 1973

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ALSO:
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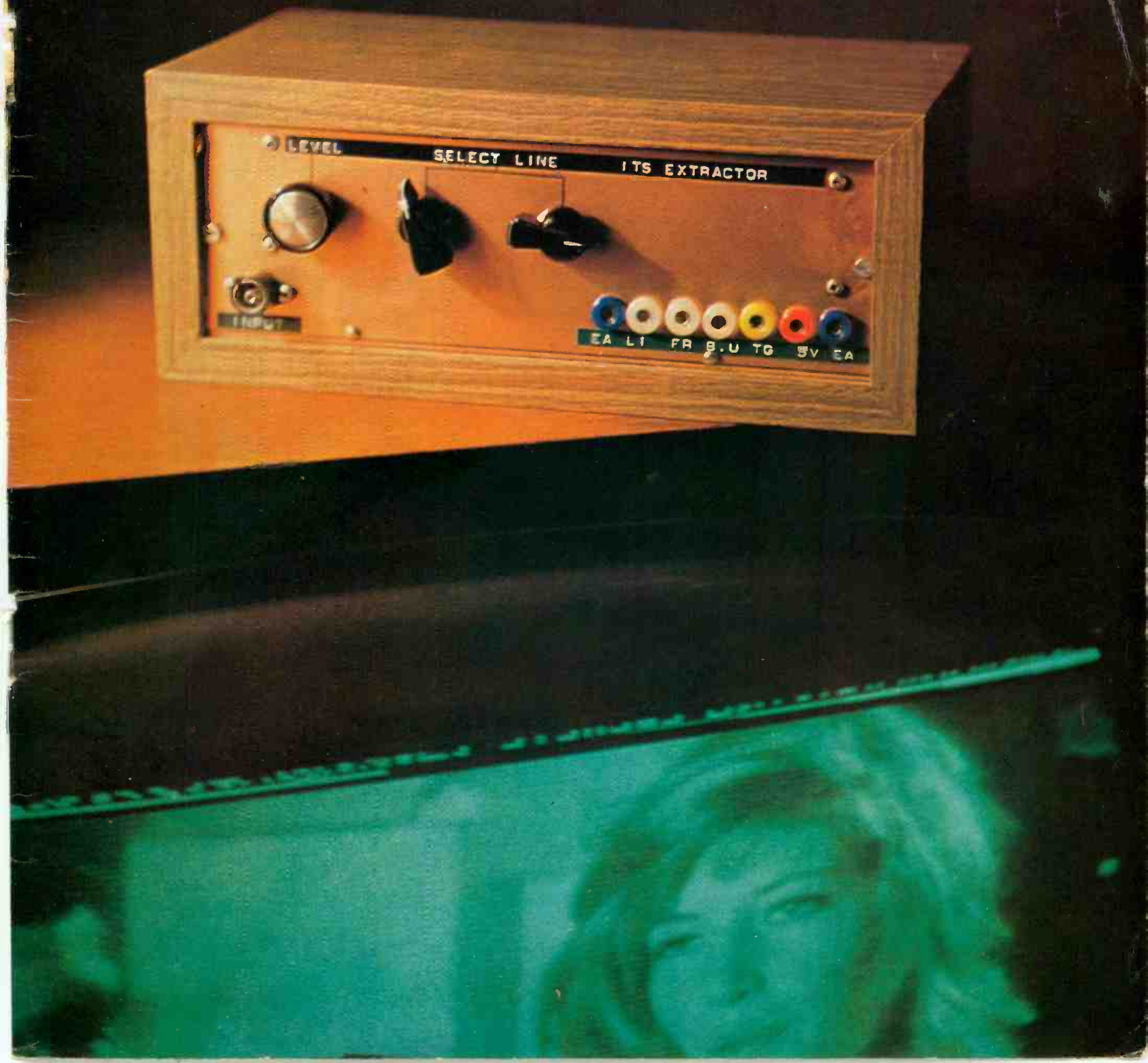

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1LN5	0·66
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1R5	0·28
1S4	0·33
1S5	0·22
1U4	0·44
1U5	0·80
2D21	0·44
2GK5	0·55
3A4	0·36
3B7	1·00
3D6	0·19
3Q4	0·49
3Q5GT	0·55
3S4	0·26
4CB6	0·55
5CG8	0·55
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6AN8	0·49
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6AR5	0·55
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6AW8A	0·65
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6B8G	0·25
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6BC8	0·60
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6BG6G	1·05
6BH6	0·70
6BJ6	0·39
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6BQ5	0·23
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6BR8	0·75
6BS7	1·40
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6BW7	0·50
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6C9	1·00
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6C17	1·00
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6SC7GT	·33
6SG7	0·39
6SH7	0·44
6SJ7	0·35
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6SQ7GT	·38
6U4GT	0·70
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6V6GT	0·27
6X4	0·27
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7F8	1·00
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9D7	0·40
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12AE6	0·60
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12AT7	0·20
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12AU7	0·21
12AV6	0·28
12AX7	0·22
12BA6	0·30
12BE6	0·30
12BH7	0·27
12J5GT	·33
12J7GT	·55
12K5	0·53
12K7GT	·38
12Q7GT	·45
12SA7GT	·55
12SC7	0·50
12SG7	0·38
12SH7	0·35
12SJ7	0·44
12SK7	0·55
12SN7	0·60
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19AQ5	0·42
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25Y5G	0·70
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25Z5	0·60
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30C15	0·58
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30C18	0·70
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30FL14	·66
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30L15	0·55
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30P4MR	·95
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30P19/30P4	0·65
30PL1	0·57
30PL12	·29
30PL13	·75
30PL14	·75
30PL15	·87
35/51	0·63
35A3	0·48
35A5	0·75
35D5	0·70
35L6GT	·42
35W4	0·23
35Z3	0·50
35Z4GT	·24
35Z5GT	·30
50B5	0·35
50C5	0·32
50CD6G	2·17
50EH5	0·55
50L6GT	·45
72	0·33
85A2	0·43
85A3	0·40
90AG	3·38
90AV	3·38
90CG	1·70
90CV	1·68
90C1	0·59
150B2	0·58
301	1·00
302	0·83
303	0·75
305	0·83
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AZ31	0·46
AZ41	0·53
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B319	0·29
CL33	0·90
CV6	0·53
CV63	0·53
CY1C	0·55
CY31	0·29
D63	0·25
DAC32	0·55
DAF91	0·22
DAF96	0·36
DC90	0·60
DD4	1·00
DF33	0·60
DF91	0·16
DF96	0·36
DH63	0·44
DH76	0·45
DH77	0·30
DH81	0·75
DK32	0·33
DK40	0·55
DK91	0·28
DK92	0·50
DK96	0·45
DL33	0·55
DL92	0·26
DL96	0·38
DM70	0·30
DM71	0·50
DW4/500	·38
DY87/6	0·22
DY802	0·30
E80CC	1·65
E80F	1·20
E83F	1·20
E88CC	0·60
E92CC	0·40
E180F	0·90
E182CC	1·00
E1148	0·53
EA50	0·27
EA76	0·88
EABC80	·30
EAC91	0·38
EAF42	0·48
EAF801	·50
EB34	0·25
EB91	0·12
EBC41	0·48
EBC81	0·29
EBC90	0·30
EBC91	0·33
EBF80	0·30
EBF83	0·38
EBF89	0·26
EBL21	0·60
EC54	0·50
EC86	0·59
EC88	0·59
EC92	0·34
ECC32	1·50
ECC33	1·50
ECC35	0·95
ECC40	0·68
ECC81	0·20
ECC82	0·21
ECC83	0·22
ECC84	0·30
ECC85	0·34
ECC86	0·40
ECC88	0·35
ECC189	·48
ECC804	·55
ECC807	1·00
ECF80	0·27
ECF82	0·25
ECF86	0·64
ECF804	2·10
ECH21	0·63
ECH35	0·50
ECH42	0·59
ECH81	0·28
ECH83	0·38
ECH84	0·34
ECL80	0·28
ECL82	0·28
ECL83	0·52
ECL84	0·54
ECL85	0·54
ECL86	0·33
EE80	0·60
EF22	0·63
EF40	0·49
EF41	0·58
EF42	0·33
EF73	0·75
EF80	0·23
EF83	0·54
EF85	0·28
EF86	0·30
EF89	0·23
EF91	0·17
EF92	0·30
EF97	0·55
EF98	0·65
EF183	0·25
EF184	0·27
EF804	1·20
EFP60	0·50
EH90	0·34
EL32	0·50
EL34	0·48
EL35	1·00
EL37	0·74
EL41	0·53
EL81	0·50
EL83	0·38
EL84	0·23
EL85	0·40
EL86	0·38
EL91	0·38
EL95	0·32
EL360	1·20
ELL80	0·75
EM80	0·37
EM81	0·37
EM83	0·75
EM84	0·31
EM85	1·00
EM87	0·49
EY51	0·35
EY81	0·35
EY83	0·54
EY84	0·50
EY87/6	·27
EY88	0·40
EY91	0·58
EZ35	0·28
EZ40	0·40
EZ41	0·42
EZ80	0·19
EZ81	0·20
FW4/500	0·75
FW4/800	0·75
GY501	0·75
GZ30	0·33
GZ32	0·39
GZ33	0·70
GZ34	0·57
GZ37	0·67
HABC80	·44
HL23DD	·40
HL41DD	·98
HL42DD	·50
HN309	1·40
HVR2	0·53
HVR2A	·53
IW3	0·38
IW4/350	·38
IW4/500	·38
KT2	0·25
KT8	1·75
KT41	0·98
KT44	1·00
KT63	0·35
KT66	0·80
KT74	0·63
KT76	0·63
KT81	2·00
KTW61	·63
KTW62	·63
KTW63	·50
LZ339	0·58
M8162	0·63
MHL4	0·75
MHLD6	·75
MX40	0·50
N308	0·95
N339	0·44
N359	0·43
P61	0·40
PABC80	·32
PC86	0·44
PC88	0·44
PC95	0·53
PC97	0·36
PC900	0·29
PCC84	0·29
PCC85	0·24
PCC88	0·39
PCC89	0·42
PCC189	0·46
PCC805	0·55
PCC806	0·65
PCF80	0·26
PCF82	0·30
PCF84	0·40
PCF86	0·44
PCF200	·67
PCF801	·40
PCF802	·37
PCF805	·75
PCF806	·55
PCF808	·66
PCH200	·62
PCL82	0·29
PCL83	0·54
PCL84	0·32
PCL805/85	0·55
PCL86	0·36
PCL88	0·75
PCL800	·75
PCL801	·57
PD500	1·44
PEN4DD	1·38
BEN45	0·80
PEN45DD	0·80
PEN46	0·20
PEN453DD	0·98
PENA4	0·98
PEN/DD/4020	0·88
PFL200	·50
PL33	0·38
PL36	0·46
PL81	0·43
PL81A	0·48
PL82	0·31
PL83	0·30
PL84	0·28
PL504/500	0·60
PL508	0·90
PL509	1·00
PL802	0·85
PM84	0·31
PY33/2	·50
PY80	0·33
PY81	0·25
PY82	0·25
PY83	0·26
PY88	0·31
PY301	0·65
PY500	0·80
PY500A	·80
PY800	0·31
PY801	0·31
PZ30	0·48
QQV03/10	1·20
Q875/20	·63
Q895/10	·49
Q8150/15	0·63
QVO4/7	·63
R11	0·98
R16	1·75
R17	0·88
R18	0·50
R19	0·28
R20	0·60
R52	0·33
RK34	0·38
SP61	0·75
TH4B	0·50
TH233	0·98
TP2620	·98
UABC80	·30
UAF42	0·49
UBC41	0·45
UBC81	0·40
UBF80	0·33
UBF89	0·33
UBL21	0·55
UC92	0·35
UCC84	0·33
UCC85	0·33
UCF80	0·31
UCH21	0·60
UCH42	0·57
UCH81	0·29
UCL82	0·30
UCL83	0·54
UF41	0·50
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UF89	0·27
UL41	0·54
UL84	0·28
UM80	0·33
UR1C	0·55
UU5	0·38
UU9	0·40
UU12	0·20
UY41	0·38
UY85	0·23
U10	0·45
U12/14	0·38
U16	0·75
U17	0·35
U18/20	0·75
U19	1·73
U22	0·39
U25	0·65
U26	0·60
U31	0·33
U33	1·50
U35	0·83
U37	1·75
U45	0·78
U47	0·65
U49	0·60
U50	0·30
U52	0·30
U76	0·24
U78	0·27
U191	0·65
U193	0·31
U251	0·62
U281	0·40
U282	0·40
U301	0·40
U403	0·33
U404	0·38
U801	0·76
U4020	0·55
VP13C	0·35
VP23	0·40
VP41	0·38
VT61A	0·35
VU111	0·44
VU120	0·60
VU120A	·60
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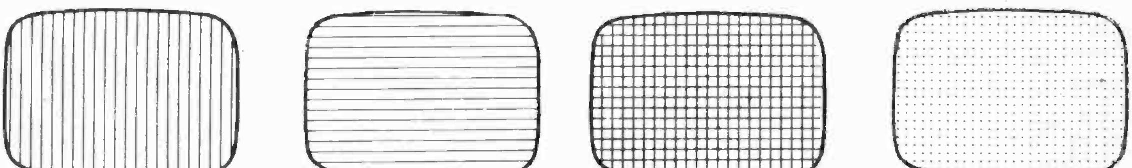

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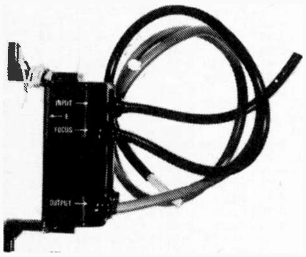

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TELEVISION

SERVICING · CONSTRUCTION · COLOUR · DEVELOPMENTS

VOL 24 No 1
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NOVEMBER 1973

POSITIVE POTENTIAL

Now that we have had time to reflect on the Berlin Radio and Television exhibition, it is with a considerable jolt that we realise the basic differences between British and German thinking on the future of television as a medium of communication. The determination of German industry to carry out what it believes to be the right course of action shows up the muddled thinking in much of the UK political/industrial scene. Our preoccupation with national and international crises seems to relegate industrial progress in entertainment electronics to a background position of mere polite acknowledgement. The situation is serious however.

UK overseas trade in electronics was £98 million in the red in the first half of 1973, and £52 million in the red during the whole of 1972. Of this business, imports of consumer electronics rose to £115 million in the first half of 1973, including £42.6 million worth of colour television receivers. Components that have had to be imported to meet UK production schedules have added substantially to the deficit.

The UK industry was not ready for the colour boom when credit restrictions were lifted by the Chancellor of the Exchequer. It can't solely be blamed for this in view of the previous history of government policy changes, blowing first hot and then cold. Even so some enterprising companies have shown the public what can be done. But there will be little or no real progress until genuine co-operation can be achieved between industry and government, with policies that encourage investment.

Take for example the television cassette recorder and disc player business which is being fully exploited on the continent; or the start with half-hearted encouragement of local cable TV services in various towns in the UK. Such operations need finance and reasonable industrial security and for this we look for a clear line of positive planning over the coming five to ten years. Neither industry nor government seem capable of achieving the dynamic approach shown by overseas competition.

We have Advisory Committees and National Councils that put in endless hours of work only to see it shelved until an improved financial climate prevails. Is this really the way that the UK intends to go on working, waiting for the miracle that never seems to come?

Entertainment electronics is big business. It must not be neglected but taken firmly by the scruff of the neck so that it can beat off the massive import burden.

M. A. COLWELL—*Editor*

THIS MONTH

THE NEXT ISSUE DATED DECEMBER WILL BE PUBLISHED NOVEMBER 19

Cover: Our cover photograph shows Alan Ainslie's Test Signal Extractor Unit on top of a receiver whose height control setting has been reduced to show test signals transmitted during the field flyback blanking interval—in this case an experimental Ceefax transmission. Only one gun of the receiver is switched on since changing the height control setting upsets the dynamic convergence.

TELETOPICS

NEW THORN PORTABLE CHASSIS

The fact that Thorn took advantage of the Berlin International Radio and TV Exhibition to show for the first time their new 1612 series of mains/battery monochrome portable TV sets augurs well for their intention, under the "Thorn-Ferguson" banner, to become established as a major force in the European market. Also on show was their new 110° colour chassis (4000) with touch tuning and remote control facilities. The design of both these new chassis is clearly aimed at an international market.

The new 1612 chassis will be used in 12in. portable models. Two models have been announced for release in the UK, the Ferguson 3830 and Ultra 6830. The chassis will operate on either 230-250V a.c. mains supplies or a 12V d.c. battery. When used with an external 12V battery supply the battery can be recharged through the receiver if access to a mains socket is available. A varicap tuner unit (type ELC1043) is used: the seven-button channel selector unit operates in conjunction with a concealed drawer which contains separate preset tuning controls and scales for each channel button.

The chassis employs six i.c.s and ten transistors (there are a further three transistors in the tuner unit). A notable first is the field timebase. This is the first we have come across that relies entirely on i.c.s. A line and field processor i.c. (SN76544N-07) incorporates the sync separator, flywheel line sync discriminator, line and field oscillators and a field driver stage. The field output stage consists of a TBA641-BX1 i.c. which is capacitively coupled to the field scan coils. The outputs from the line and field processor i.c. consist of pulses at line and field frequency. The field pulses initiate discharge of a conventional *RC* charging circuit. The line pulses are applied to a driver stage which is transformer coupled to the output transistor. An efficiency diode is connected in shunt with the line output transistor while a boost diode across a section of the output transformer provides a 24V boost rail from which most stages of the receiver are operated—only the field output i.c. and sound output i.c. (TAA611B12) are operated directly from the stabilised 11·2V rail.

On the signal side a three-stage transistor i.f. strip is followed by a TCA270Q synchronous demodulator, a.g.c. and video preamplifier i.c. The video channel is d.c. coupled throughout. The intercarrier sound channel consists of a TBA120AS (group III or IV) i.c. The other i.c. used is a TAA550 which stabilises the tuning voltage line to the varicap tuner.

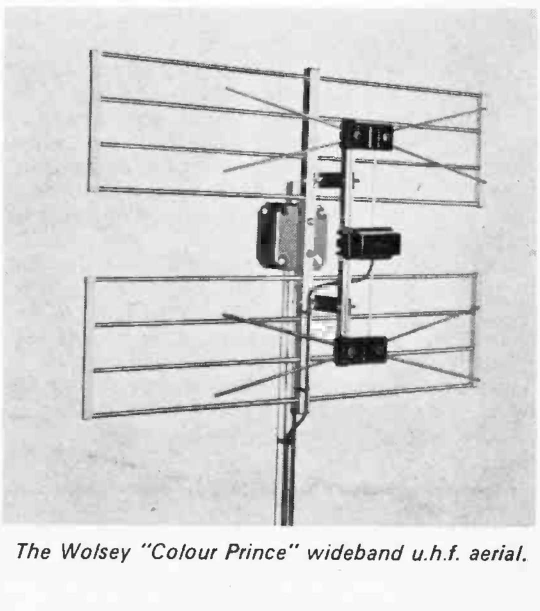
Altogether this is a thoroughly up to the minute design which should give excellent performance.

Thorn incidentally are at present producing some 15,000 colour and 16,000 monochrome receivers a week, representing 40 per cent of all colour and 50 per cent of all monochrome receivers made in the UK. Thorn say that their colour set production will overtake monochrome before the end of the year.

SEMICONDUCTORS OVERNIGHT

A new business that aims at providing an "overnight semiconductor service" for small quantity orders has been started. The new company, Mercury Semiconductor, is offering a 24-hour delivery service of all items in stock which they state include Mullard, Fairchild and Texas transistors. When we asked for more details of the despatch arrangements we were told that orders should be sent to the address of the operator, Bray Shop House, Callington, Cornwall (telephone 057 97 439). The order would then be transferred to NASCO Ltd. at 8 Cullen Way, London NW10.

Mr. Siddiqi of NASCO stated in an interview that they are obtaining quantities of Japanese semiconductor devices at favourable prices and arranging to mark them with NASCO code numbers and supply them through Mercury Semiconductor for use as replacement alternatives to other devices, in particular those not readily available. We were informed that Mercury Semiconductor is headed by



The Wolsey "Colour Prince" wideband u.h.f. aerial.

P. J. McGoldrick and based in Cornwall with a West of England sales force of "two or three". A technical back-up service for customers' problems is a feature of the business and when we enquired what the extent of this would be the Company's PR agents stated that it would be "quite considerable".

Readers will probably be aware that Mr. McGoldrick designed, and wrote the articles for, the *Television Colour Receiver Project* which has just come to an end. He is a senior lecturer at Plymouth Polytechnic. Mr. J. Marshall and Mr. Siddiqi are directors of NASCO: Mr. J. Marshall is also a director of Mercury Semiconductor.

TRANSMITTER OPENINGS

The main u.h.f. transmitters at **Presley,** Pembrokeshire are now in operation. BBC-2 is on channel 40, ITV on channel 43 (carrying HTV Wales programmes) and BBC-Wales on channel 46, with horizontal polarisation. Receiving aerial group B. The e.r.p. is 100kW (maximum). The following u.h.f. relay stations are now in operation:

Glossop (Derbyshire) BBC-1 channel 22, ITV channel 25 (carrying Granada programmes), BBC-2 channel 28. Receiving aerial group A.

Ventnor (Isle of Wight) ITV channel 49 carrying Southern Television programmes. Receiving aerial group B.

Weardale (Co. Durham) ITV channel 41 carrying Tyne Tees Television programmes. Receiving aerial group B.

These relay transmissions are all vertically polarised.

AERIAL NOTES

Wolsey Electronics have added to their range a new wideband u.h.f. aerial, the "Colour Prince", which is basically a smaller version of their "Colour King". We have heard reports that this latter aerial has proved to be very useful for getting good reception in difficult locations. The new smaller version consists of a couple of stacked skeleton bow-tie dipoles with reflectors and is intended for use where space is restricted. Its gain is said to be only 2-3dB less than that of multi-element aerials twice its size. Being a wideband design it is suitable for use in all areas. The overall dimensions are approximately 17 x 24in. Wolsey's address is Cymmer Road, Porth, Rhondda, Glamorgan.

Telecraft Ltd. (Quadrant Works, Wortley Road, Croydon) have introduced a wideband u.h.f. aerial for use with caravans. There are two versions, a standard one with 12 elements and an 18 element one for use where reception over greater distances is required. These aerials are basically Yagi types with dual director chains. They fold flat for easy storing and come complete with mast, feeder, etc.

RCA SHOW SELECTAVISION IN EUROPE

RCA demonstrated their Selectavision videotape cassette recorder/player system for the first time in Europe at the Berlin Radio and TV Exhibition. The videocassette machine will record off-air and playback through a standard colour receiver without receiver modification. In addition a black and white camera featuring a 3 to 1 zoom lens and look through the lens viewfinder will be available. This is said to

The main elements of the RCA Selectavision home TV player/recorder system.

require no auxiliary light when used under normal home lighting conditions. A built-in timer enables off-air recordings to be made even in the absence of the owner. It is also possible for the viewer to watch one programme on his set while at the same time recording another programme being transmitted on a different channel. Stereo TV sound capability is built in.

GERMAN SATELLITE TV SYSTEM

It is understood that West Germany is to start construction of a satellite TV system within the next two years and the prediction is that it will be in operation by 1980 to give the Federal Republic a further five TV channels. The transmissions would be in Band VI (12GHz) and it is expected that most reception would be via cable systems because of the cost of individual aerial/converter receiving installations. The move to Band VI is necessary if TV services are to be extended in the Republic, and after considerable research it seems that terrestial s.h.f. transmission has been ruled out in favour of satellite transmission. Ground stations will transmit to the satellite which will relay back directly. Uniform reception over very wide areas is given by satellite transmission—see for example the NASA Indian TV satellite coverage map in Roger Bunney's column later in this issue. The requirements of a satellite transmitter for TV purposes are far more stringent than those of satellites used for intercontinental telecommunications purposes. To give TV reception with the types of aerials envisaged calls for a power output of some 500W—ten times more—while it is necessary to keep the transmitting aerials accurately directed towards the receiving area with the solar cells constantly turned towards the sun. The surface area of the proposed German TV satellite is understood to be 100m.

Tackling Sticky Faults

VIVIAN CAPEL

ONE of the primary rules of servicing drummed into the head of every apprentice is the need for logical diagnosis and step-by-step fault-finding. Observe or listen to the symptoms, deduce the part of the circuit where the fault must lie and then by a series of tests and checks eliminate the various possibilities until the cause of the trouble is found. Simple isn't it? Well, perhaps it is in most cases, but as any engineer who has sweated over an obstinate fault will confirm you get some strange ones at times, faults that seem to disobey all the known rules. Like the reveller who meets his first pink elephant, his mind tells him that it shouldn't be but his senses and the symptoms say otherwise.

Strange Field Fault

Take for example the Philips 23TG132 I was asked to look at recently. The field scan was excessive and could not be turned down with the height control. It was so great in fact that only a portion of the picture was visible, the rest having disappeared at the top and bottom of the mask. After checking that the height control was reducing the voltage to the field generator it seemed an obvious case of an open-circuit component in the linearity feedback network. Lack of feedback is the only way (so I thought) that you can get too much scan. Half an hour later having checked every resistor and capacitor in the network as well as the print that connected it all together I was just as far off finding the cause of the trouble—in fact I was farther off now because I was left without a reasonable theory on which to base further action.

You see not only was there too much scan but during testing with the set running I had idly shorted the grid of the output valve to chassis and the scan was unaffected! Why didn't it collapse to the expected horizontal white line? Ah! theory again came to my aid: it must be a heater-cathode leak, a.c. from the heater modulating the cathode current and producing a scan. Full of confidence I then shorted the cathode to chassis expecting the unruly scan to be tamed into collapse. But no, there it was as large as ever, completely unperturbed and unaffected.

Pangs of disbelief not to say desperation began to arise: surely something can stop it! Just to reassure myself that it could in fact be killed I shorted out the primary of the output transformer. Nothing could get past that! But the full scan remained! I felt like the sorcerer's apprentice, involved with a power that couldn't be stopped by any means (I was almost afraid to switch off the mains). Then came the thought that perhaps I had stumbled on a new discovery, a wonderful means of obtaining scan without power, valves or transistors. I would become famous! After taking a deep breath however, getting a grip on myself and making a further careful examination the cause of the peculiar happening became clear.

Common Circuit Coupling

It serves to illustrate the principle of common circuit coupling, one which has proved to be at the bottom of many baffling faults: if any part of the wiring or print is common to two or more circuits and something goes wrong with that wiring (usually an open-circuit) we have a coupling that can give some extraordinary symptoms.

In this case it was merely an earth lead that had become disconnected. Fig. 1 shows what had happened. The heater chain earth connection (c.r.t. heater) was taken to the same tag as the earth side of the field scan coils. The field output transformer secondary winding earth connection was taken to a different earthing tag. The first tag had become disconnected with the result that the heater current was flowing through the field scan coils, the field output transformer and then to earth. There was no visible effect on the heaters since the extra series resistance of the windings was negligible, but the current provided a field scan. As the screen was well overscanned the non-linearity due to using a sinewave instead of a sawtooth was not observable.

As earth returns are often common to many circuits they are the most likely suspects in cases of difficult faults. Multiple electrolytics when robbed of their external earth connection can also cause strange circuit couplings. While the can is usually connected internally to the negative side so that the external earth tag, although fitted as an extra precaution, is in many cases superfluous it sometimes happens that a dry or broken earth tag joint coincides with a poor or non-existent internal can connection.

With radio receivers an open-circuit earth lead to the tuning gang can be baffling. This puts the two sections of the gang in series from the aerial tuning circuits to the oscillator and while it is not too difficult to establish that all is not right with the oscillator

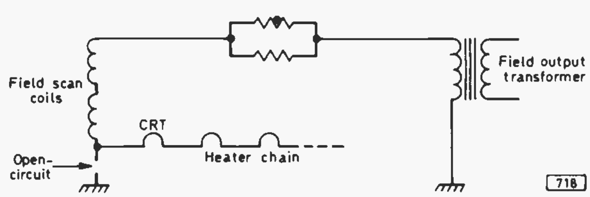
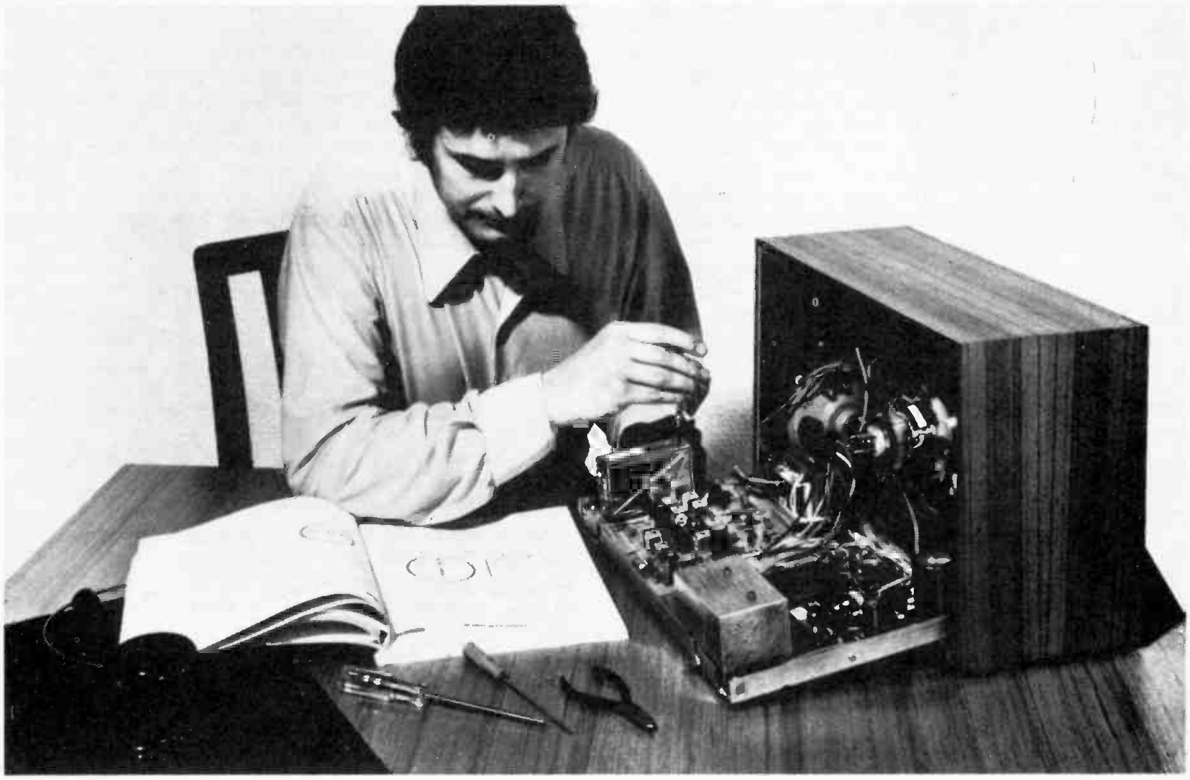


Fig. 1: Break in the lead providing a common earth for the field deflection coils and the heater chain resulted in the heater current passing through the scan coils and the secondary of the field output transformer, producing a spurious "scan".



LEARN about MODERN TV Design by building this Heathkit 12" B/W Portable

The new Heathkit GR-9900 portable 12" UHF Monochrome Television kit. A unique chance to double the pleasure available from any other television set — because you build this yourself.

We've used the latest modular construction and advanced design concepts to produce an outstandingly high performance TV worthy of the Heathkit name. All the main electronics are mounted on two easy-to-assemble printed circuit boards—this plus the use of no less than four integrated circuits perform the complex function of IF, video, sound, line frame and scan. Factory pre-aligned coils make alignment very easy and there are four presetable pushbutton controls for channel tuning—a luxury found in very few other models. The quality and fidelity is therefore excellent, and of a far higher standard than most ready-built televisions in the shops.

The GR-9900 is portable too—equally at home on the mains or off your 12 volt battery for car, boat or caravan use. Add to this Heath's world renowned experience in the design of equipment for first-time kit builders, and you will be impressed on all counts of engineering, styling, and performance.

The instruction manual is surprisingly simple with big, clear illustrations to map out your way. Would-be TV engineer? Here's your chance to learn—by actually building a television yourself. The manual not only shows you how to get 100% personalised quality control on your own; in the event of anything going wrong, a Trouble-Shooting section enables you to find the fault—and, in most cases, to put it right unaided.

The GR-9900 is a kit you'll be proud to build and own. You have a choice of fully finished cabinets in teak or modern white and the kit price, £62.70 (carriage extra), includes a FREE high performance indoor aerial.

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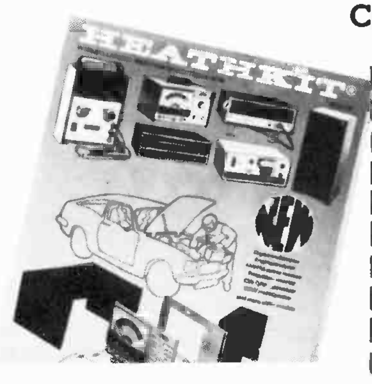

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it is not always easy to diagnose just what is wrong.

There was a stock poor earthing fault on a Philips transistor radio a few years ago. The connection between two sections of earthing print was made via the can of one of the i.f. coils. This was secured in the conventional manner by two lugs into the print, one into each section. Oxide on the lugs meant however that a batch got through with either one or other of the lugs dry-jointed. If without close attention to the layout and the way the print was run a quick check was made with a meter from earth to the can zero resistance would show and it would be assumed that the earthing was all right: the fact that other points in the circuit were relying on connection to the other side of the can would be unsuspected.

Check All Earths

There is a routine then which I always follow when faced with a fault that seems to defy normal testing procedures. This is to take a reading on the resistance range from chassis to all the earthing points in sight, including gangs and all coil cans. Doing this has saved many a long frustrating battle with difficult faults and is recommended as a rule of procedure when confronted with such problems. The time taken to make such checks is little while the time saved can be great.

HT Decoupling

An obvious common circuit is the h.t. supply, but here any open-circuit would be revealed by a lack of voltage at some particular point. Open-circuit decoupling capacitors can lead to strange and unexpected results at times. It is not rare for the main smoothing capacitor to be open-circuit without there being any trace of hum yet unwanted coupling is taking place between two circuits. The lack of hum tends to mislead one from the real cause of the problem. Here then is another procedure which can be followed when an unusual fault is encountered: bridge a high-value electrolytic across the supply line and chassis, trying both the main supply rail (i.e. across the main smoothing capacitor) and the branch supply to the suspected part of the circuit.

Multi-electrolytic Leaks

Coupling between circuits can take place as a result of leakage between the sections of a multiple electrolytic. A case that is sometimes encountered is leakage between the h.t. reservoir and smoothing sections. This virtually shorts out the smoothing resistor and can give rise to hum. Other decoupling capacitors, also cathode bypass units, are often included in a common can and leakages between these will produce couplings giving strange symptoms. A case of sound-on-vision was ultimately traced to the sound output cathode bypass capacitor—which incidentally was open-circuit—leaking to a decoupler in the video amplifier cathode circuit. Where such a possibility exists disconnect one section and wire into circuit a temporary external replacement.

Multiple Valves

Another possible cause of common circuit coupling is where a multiple valve is used for two totally different functions. Coupling between the sections can give rise to baffling effects because in the circuit diagram there is apparently no link between the two. Some valve combinations that have given rise to this sort of trouble are: sync separator and sound a.f., producing buzz on sound; and part field multivibrator and video output, leading to field non-linearity varying with picture content and picture shading due to sawtooth on the video output signal. It is common practice (and a sensible one) to try new valves as a first gambit in any fault condition and this should result in quick diagnosis of such troubles. There can be pitfalls however: in the latter case one half of the multivibrator was where one would expect to find it—sharing an envelope with the field output valve—but the other section with the video valve was over on another printed panel. Unless one had the manual and layout or was familiar with the receiver this situation would not have been suspected.

Plug and Socket Troubles

Some receivers have the interconnections between the various panels and sections terminated by paxolin plugs and sockets. From the servicing viewpoint this is a good idea since it enables panels to be changed without unsoldering a number of connections. There are snags however. Plugs can work loose or develop oxide on the pins, leading to intermittent or poor contact. Another snag is leakage between adjacent pins. This again provides an unwanted coupling between circuits which are quite separate on the circuit diagram with apparently nothing in common. Usually the leakage consists of tracking from a high-potential pin to a low-potential one. The result is a voltage in the low-potential circuit which shouldn't be there but can be detected by normal testing with a meter. It is not always obvious however where the voltage is coming from as the tracking, which is usually in the socket, is covered by the plug.

Tracking once started is difficult to eradicate completely. Any burnt or charred sections must be scraped away completely until one reaches the unburnt paxolin—any remaining charred parts will form a conductive path. It is often easier to transfer the connection to another unused pin. In the case of a printed panel this means severing the print to the affected pin socket and fitting a wire jumper to the unused one (see Fig. 2).

Other Leakage Mechanisms

Not all leakages are accompanied by visible tracking however: sometimes signal or sawtooth voltages reach adjacent pins by dust or dirt which is slightly conductive. A good clean up is the obvious answer in such cases.

While on the subject of pins and sockets another commonly used arrangement is a single lead terminated with a socket connector which fits on to a pin protruding from a printed panel. It is easy for these

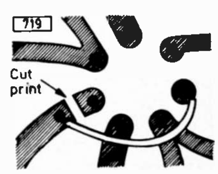


Fig. 2: A leaking printed socket connection can be isolated by cutting the print leading to it and bridging a wire across to an unused socket.

to come adrift when servicing, especially if panels are moved. This will of course produce symptoms but it is not always easy to spot the cause of the trouble in a forest of tightly packed wires, connectors and components. The trouble can be and often is compounded however by the loose wire becoming entangled with some other nearby wire-ended component with which it makes contact. In some cases this results in a flash and a puff of smoke, but in others just another strange fault with inexplicable symptoms arises.

Wire-ended components mounted vertically on a printed board sometimes lean over and touch an adjacent one.

Visual Inspection

In all these cases close visual inspection of the component panel will often reveal the source of the trouble. A further rule then in tackling awkward faults is to make such an examination. In doing so it is all too easy to overlook something that should be obvious: to avoid this it is good practice to scan the appropriate part of the panel with the eye rather as the spot scans the tube face. Be systematic in looking for anything amiss.

Disturbance Checking

If a visual check fails to reveal anything use an insulated tool to prod components and parts of the printed board: this may seem a haphazard and amateurish method of trouble-shooting but it is surprising how many faults are mechanically sensitive. By subjecting a component or section of print to a degree of stress a fault can often be made to come and go, thereby localising the source of the trouble. Although precise, systematic electrical tests should be made first if these fail to come up with the answer there is nothing to be lost and often something to be gained by having a prod around.

Unconventional Arrangements

Unusual faults are sometimes associated with unconventional circuitry or components. I had an example of the latter recently on a set that had no brilliance. The e.h.t. was non-existent and it was observed that the e.h.t. rectifier was not alight. A boost voltage check revealed that this was a shade low but within the expected range while a healthy arc could be drawn from the line output valve anode. It seemed an obvious case of an open-circuit rectifier heater so another one was fitted. This also failed to light up. Having been caught out by dud new valves before I tried a further one but still without results.

As the line output stage seemed to be functioning the fault had to be in the heater supply to the rectifier. An ohmmeter reading across the heater sockets gave a low-resistance indication. This was either the heater winding or possibly a short across the pins under the valve base. A voltage reading was then taken with the set switched on. This would not be accurate of course because the voltage is a sawtooth, being derived from the line output stage operation, while the meter is calibrated for sinewave voltages. It should nevertheless provide a rough indication. The reading was about 0.1V instead of 6V. The valveholder was then removed from its insulated housing and the socket connections, series resistor and e.h.t. cap take-off lead visually examined. All seemed to be in order. The heater winding was not the usual loose wire wound on the transformer but was encased in a plastic block. Having come across cases before of shorted turns inside the block I cut it away and rewound the heater winding with e.h.t. cable, using the same number of turns as were in the block. But on connecting up and switching on there was still no heater illumination!

A recheck of the boost voltage and the line output valve anode arc showed that these were still in order. But this time a check was made (as it should have been previously) at the anode of the e.h.t. rectifier. The arc here was decidedly weak. It was then noticed that the heater winding was adjacent to the e.h.t. overwinding instead of being wound over the primary winding on the lower core limb as is the usual practice. A check on the overwinding with the Transtesta revealed short-circuited turns. So the trouble was in the e.h.t. overwinding! Such a fault usually either stops the line output stage working completely by damping the primary winding or if not too many turns are involved gives low e.h.t. and poor regulation. The heater voltage in such circumstances may be reduced but not removed almost completely because the heater winding is usually over or adjacent to the primary winding.

So an unusual component arrangement led to unexpected symptoms. The lesson here is to not take anything for granted. If puzzling symptoms present themselves check everything that might have a bearing on the matter, even apparently obvious things, and see if there are any unusual design features which could affect operation and mislead one.

Summary

To summarise these various points then: Check for common circuit couplings such as earth connections and h.t. points. Try h.t. decoupling and watch for possible leakage in multiple valves and electrolytics. Make sure that all plugs are in their proper places and pushed well home, whether multiples or single-lead types. Check for socket leaks or tracking and see that wire-ended components are not shorting to adjacent ones. Visually scan panels for such mechanical causes and prod around with an insulated probe. Watch out for unusual features and do not take anything for granted.

Many faults that due to all sorts of unusual factors do not respond to these methods will unfortunately be encountered. The procedures we have described will however run a goodly proportion of difficult problems to earth. ●

IBA'S DIGITAL TV BOOK

For the third in its series of Technical Reviews the IBA has published a fully-illustrated 64-page book on digital television. The publications in the series are intended for broadcasting engineers, technical and educational centres and libraries, and can be obtained from the IBA Engineering Information Service, 70 Brompton Road, London SW3 1EY. A study of this book will certainly put anyone in the picture so far as the present state of television signal handling in digital form is concerned.

TEST SIGNAL EXTRACTOR

THE first few lines of the television raster do not carry picture information and remain at black level. The main reason for "wasting" these lines is to ensure that the sync separator circuits in the receiver completely recover after receiving the field sync pulses before scanning of the picture proper begins. The internationally agreed television specifications call for more lines than are necessary for this purpose to be blanked however and as these lines are "above the top" of the viewer's screen the television broadcasting organisations are free to use some of them for their own purposes. Both the BBC and IBA regularly put out standard "pulse and bar", staircase and other signals (known as VITS—Video Insertion Test Signals) on these lines for use in monitoring the performance of their signal distribution equipment. The VITS can be seen on any receiver merely by reducing the height setting, see Fig. 1.

New interest has been focused on these blanked lines recently by the BBC and IBA plans ("Ceefax" and "Oracle" respectively) to transmit digitally coded printed news matter on two lines per field for reception by a special decoder on the receiver. Experimental Ceefax transmission on BBC-2 can be seen on the cover of this issue.

An oscilloscope can only be used to display these signals if it has a facility for strobing out the desired line only from the $312\frac{1}{2}$ lines scanned every 20 milliseconds (625-line system). While these VITS are not very useful for general receiver servicing, such a line strobing facility can be invaluable for colour TV servicing since it makes the standard colour bar pattern which appears on the top few lines of Test Card F usable for signal tracing in PAL decoders.

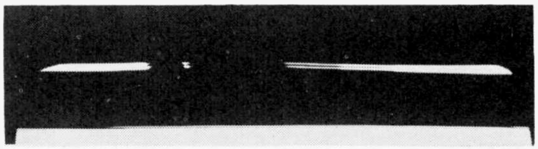
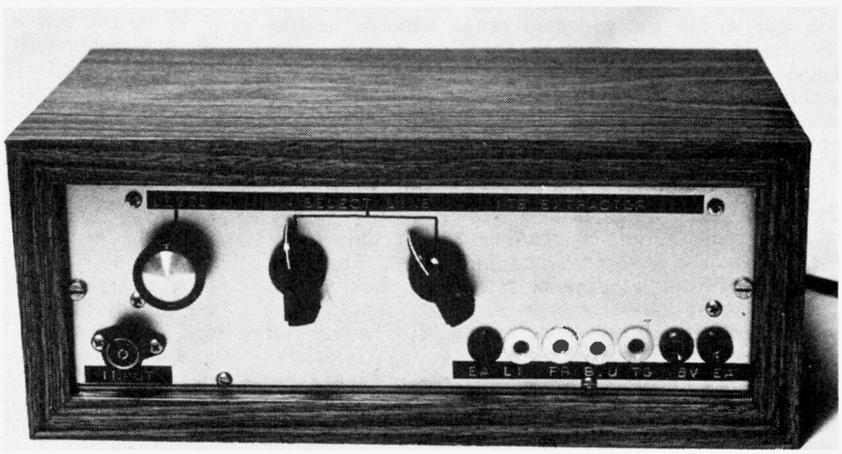


Fig. 1: The pulse and bar test signal—together with a grey scale signal—may be seen at the top of a transmitted picture when the height is reduced.

This article describes the construction of an economical add-on unit for oscilloscopes which do not have this strobing (delayed timebase) facility. It enables almost any line in the blanking or picture areas to be inspected. It can be used to inspect the new Ceefax or Oracle transmissions although of course a special unit is needed to decode them.

Delay Timebase Oscilloscope

The traditional method of strobing involves the use of an expensive type of oscilloscope with a delay timebase. The delay timebase is triggered by the field



Photograph shows the video test signal extractor unit.

pulses and then starts to "run down". At an adjustable point along the run down the main (display) timebase is triggered to display perhaps two or three lines. The principle is shown in Fig. 2. Applied to television there are a number of snags to this method however.

The first is that triggering from the complex field sync waveform can be difficult with scopes that do not have "TV line" and "TV field" trigger positions on the delay timebase trigger selector—and not many do.

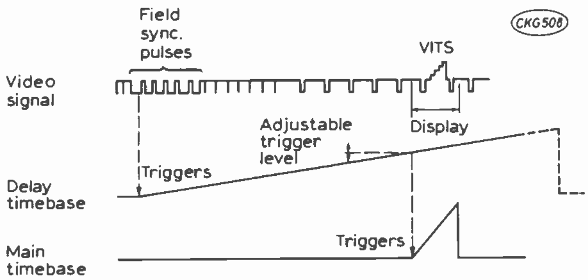


Fig. 2: Principle of using a delay-timebase oscilloscope to display single lines. This method has the disadvantages described in the text.

Another snag is that the delay timebase is running much slower than the main timebase so that jitter can result. This can be overcome in some scopes by using the line pulse preceding the lines required on the screen to trigger the main timebase. This can be difficult to arrange and is not possible on some scopes.

Another difficulty is that if the delay timebase triggers once per field (twice per picture) then due to the interlaced fields two overlapping displays are seen. See Fig. 3.

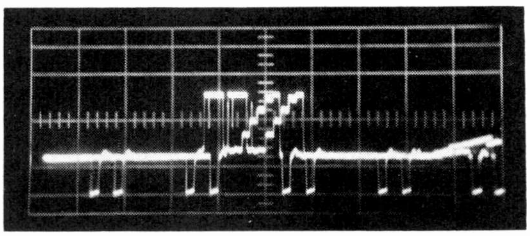


Fig. 3: The overlapping display obtained when two scans per picture are made from the delay timebase.

A further snag is that oscilloscopes with delay timebases cost an awful lot of money and are often more versatile and complex than required for television servicing, representing a waste of capital therefore.

A rather cunning trick that the author has employed several times is to use the field timebase of the receiver under test as the delay timebase. If the grid of the field output valve is connected to the "external trigger" socket of the scope then the trigger level control sets the point along the field at which the scope timebase triggers to display a few lines. Thus the lines displayed are selected by the trigger level control. Some receivers have rather jittery field circuits unfortunately and can present problems. Also there are two overlapping images due to the two field scans per picture. Despite these problems this method is well worth remembering for an emergency.

Sync Separator

In order to obviate the field triggering difficulty for oscilloscopes with a delay timebase the sync separator circuit shown in Fig. 4(a) was developed. It works as follows. Tr1 is fed with video at a level set by VR1. The video should be negative-going so that the sync is positive-going (e.g. direct from the c.r.t. cathode). Tr1 works as a conventional sync separator stage and the waveform at its collector consists of negative-going sync pulses. The negative-going pulses are fed to the NAND gate G1 which acts as an inverter giving at its output positive-going sync pulses of standard logic level (i.e. switching between levels of about 0·5V and 3·5V). These are fed to G2 and the line sync output socket. When field sync pulses arrive the combination R4/C2 charges to a level sufficient to switch G2. Thus with every field sync pulse the potential at the output of G2 falls. These negative-going pulses are inverted by Tr2 and are available as positive pulses at its collector.

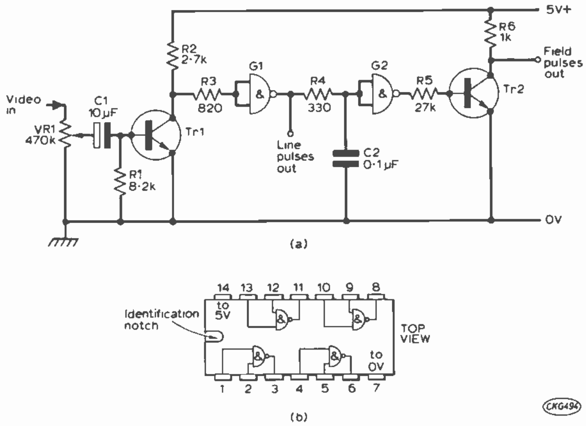


Fig. 4(a): Sync separator circuit using logic NAND gates. (b) Pin identification for the SN7400N quad 2-input NAND i.c.

A word might be useful here to those unfamiliar with the use of logic i.c.s. A NAND gate produces an output of logic 1 level (about 3·5V) when one or other of its inputs (or indeed all) are at logic 0 level (about 0·5V). To make the output fall to logic 0 all the inputs must be taken to logic 1.

G1 and G2 act as inverters since their inputs are connected together. There is also another use for G1. The gate switches over very rapidly when the inputs pass a certain level: the rate of change of the output can be much greater than the rate of change of the input therefore, giving a clean output pulse. G2 functions by switching over when the voltage on C2 exceeds the switching level. This occurs when the broad field sync pulses on lines 1, 2, 3 and 313, 314, 315 arrive. The output pulses are very clean and jitter free and the unit works on the 405- or 625-line standards.

The components are not critical except for R4 and C2. Tr1 and Tr2 are high-speed npn silicon transistors such as 2N706, BC107, BC108, BC109, etc. The choice of NAND gates is very wide and any TTL or DTL gates should work. The SN7400N is an economical and readily available i.c. which contains four separate NAND gates, one of which could replace Tr2.

The author used some DTL NAND gates from a surplus Marconi panel (Fig. 5). The surplus shops seem to have rather a lot of these particular panels and they represent an even cheaper way of building this circuit or the full extractor unit.

The surplus boards contain small subpanels labelled "R50—3877—01" on which there are two dual three-input NAND gate i.c.s type "D.A.T.11 R.C./6806", made by Marconi-Elliot. They are in small ten-lead packages and as they are very difficult to unsolder it is recommended that the the whole subpanel is used. Also on the panel are a 4V zener and pulse shaping diodes. The connections are taken to 24 pins along one side of the panel.

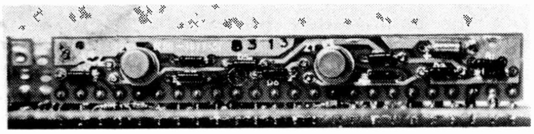


Fig. 5: The Marconi surplus i.c. panel mentioned in this article.

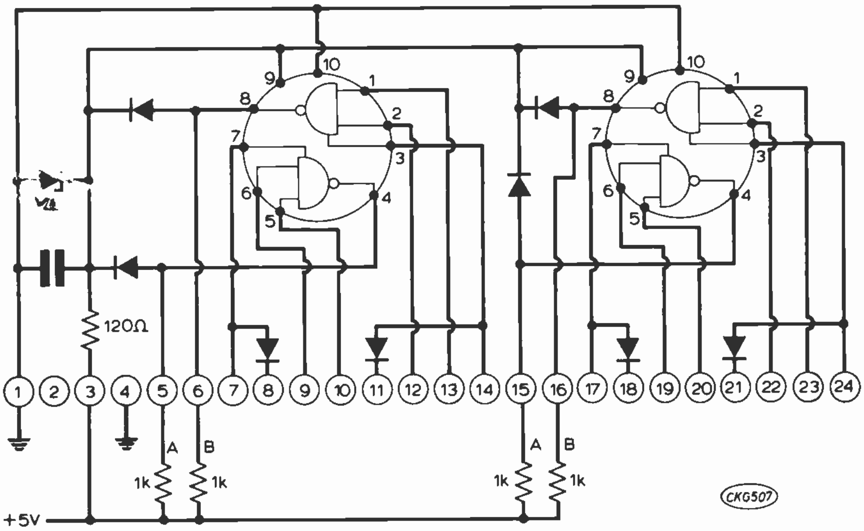
Fig. 6 shows the circuit of one of these panels. It should be noted that the i.c. outputs are open-collector type which require "pull up" resistors to the h.t. line. The diagram shows 1kΩ resistors to the supply line but on all the boards purchased by the author the resistors have been 1·8kΩ. There is an option of coupling the third input to each gate through a diode—from pins 8, 11, 18 and 21. However this third input is left open-circuited and the gates used as two-input types. The constructor should find little difficulty in locating or using these panels, but in case of difficulty the SN7400N i.c. can be used. See Fig. 4(b).

Before use the i.c. panels are removed from the main board and the 24 pins cleaned. These pins are spaced 0·2in. apart. The 1·8kΩ resistors can also be salvaged from the main board if necessary.

Video Test Signal Extractor

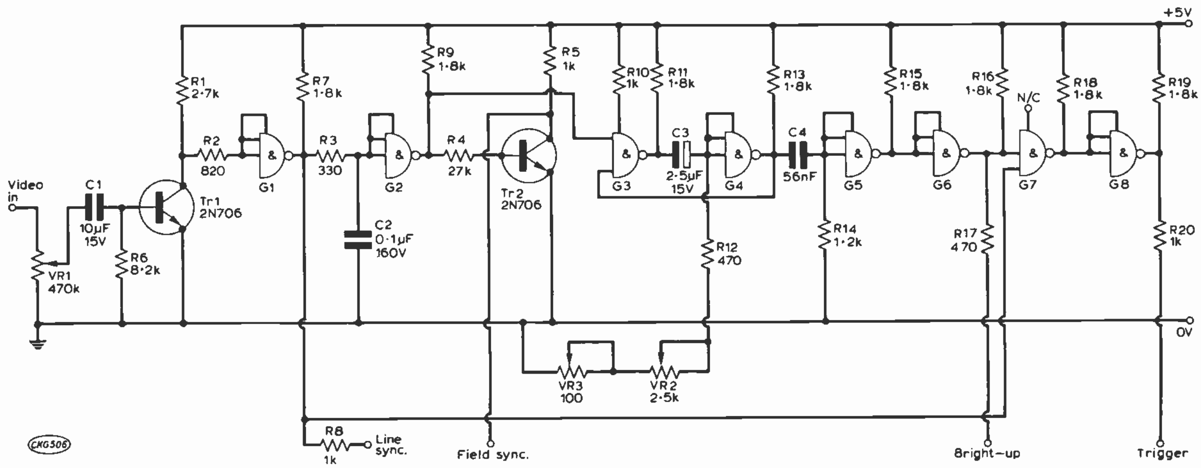
The circuit shown in Fig. 4(a) is in fact the first stage of the complete extractor unit which is shown in Figs. 7 and 9.

The circuit description that follows refers to Fig. 9.



◀ *Fig. 6: Circuit of the Marconi surplus i.c. panel.*

Fig. 7: Circuit of the video test signal extractor unit utilising the Marconi i.c.s. C1 should be shown as an electrolytic capacitor, polarity as in Figs. 4 and 9. ▼



Although the operation of Figs. 7 and 9 is identical, their circuit annotation differs.

Gates G3 and G4 form a monostable—this being the delay element. In the rest state the inputs to G4 are both at logic 0 and so the output is logic 1. G4 holds one input of G3 at logic 1, and the input driven by G2 is also at logic 1 until a field pulse arrives. The logic 0 field pulse from G2 applied to one input of G3 changes its output from logic 0 to logic 1, charging C3 through R9/VR2/VR3.

The voltage produced across R9/VR2/VR3 charging C3 makes the output of G4 go to logic 0, thus maintaining one input of G3 at logic 0. The situation stays like this until C3 is nearly charged when the voltage across R9/VR2/VR3 will not hold the output of G4 at logic 0 and the two gates switch over to await the next field pulse.

The period of the monostable is governed by the total value of R9/VR2/VR3—the last two being variable to change the delay.

When the output of G4 goes to logic 1 at the end of the timing period C4 charges through R10 switching the output of G5 to logic 0 as C4 charges. G5 reverts to normal after a period of a few lines when C4 is charged.

G6 inverts the negative-going pulse produced at G5 output at the end of the delay period and applies the inverted pulse to one input of G7. Line pulses from G1 are fed to the other input.

When both the positive pulse from G6 (at the end of the timing period) and the positive sync pulse are present G7 output will go to logic 0 producing a negative pulse. This negative pulse is inverted by G8 and is the pulse used to trigger the oscilloscope.

As this pulse output is generated from a line sync pulse there is no jitter and no overlapping of images so two displays per picture can be made.

VR2 and VR3 are adjusted to create the required delay, the trigger pulse being fed to the external trigger socket on the scope. As VR2 and VR3 are varied one can view any line singly down to about two thirds of the way down the picture after which the timing gets erratic. If the user requires to trigger right down to the bottom then C3 should be 4.7μF and R9 decreased to 270Ω.

Fig. 8 (right): A few scopes may give an improved line display if a bright-up transistor is added, as shown here.

The values of C4 and R10 determine the length of the line gating pulse. If the time period is too short erratic operation will result and if the period is too long too many trigger pulses will be produced, limiting the maximum sweep speed usable due to the scope triggering off each individual pulse.

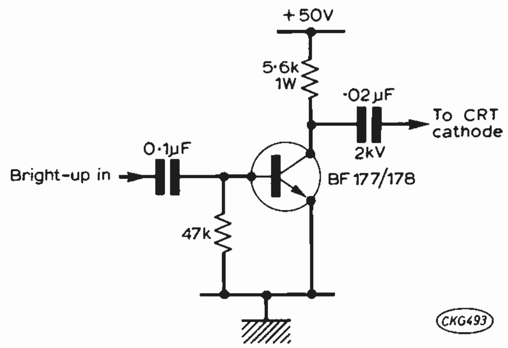
The values shown give two reliable pulses on 405 and three on 625. A switch may be incorporated to switch a 2.7kΩ resistor in parallel with R10 for fewer pulses on 625, but this has not been found to be really necessary.

When using the unit to display the colour bars at the top of the test card a number of trigger pulses are an advantage as more scans can be made per picture giving a brighter display. Placing a 0.15μF capacitor across C4 will ensure this and this could be switched at the front panel if thought necessary.

Bright-up

The gating pulse from G6 can be used to bright-up the trace on scopes with an inadequate bright-up bistable. The pulse is positive going and can be used to cathode modulate the c.r.t. via a suitable single valve or single transistor stage mounted inside the scope.

Fig. 8 shows a suitable transistor unit that can be built on a small tagstrip inside the scope. Finding a 50V line might prove difficult in some scopes but the current taken is only 10mA and so a simple potential divider can be used to supply the unit from a higher voltage rail. Obviously the method of connection depends on the user's circumstances and in



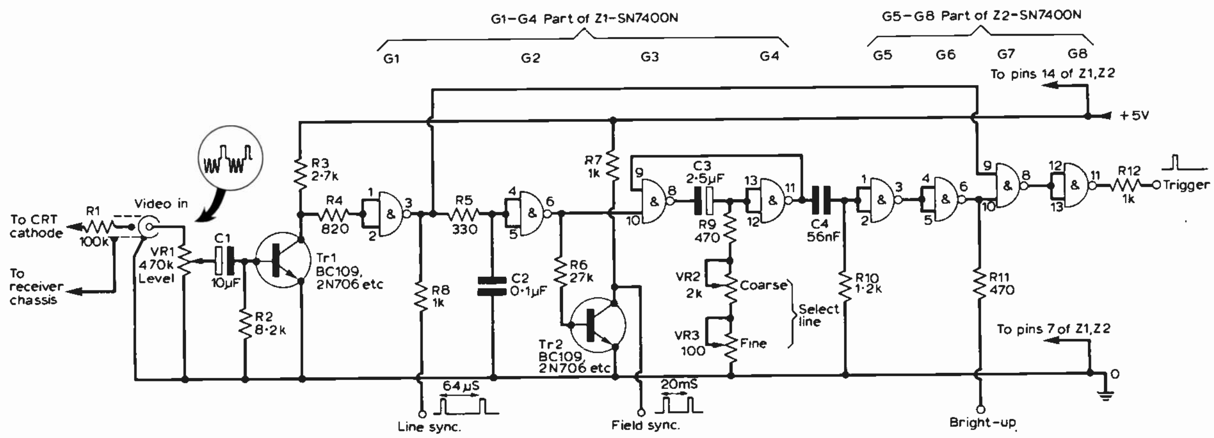


Fig. 9: Circuit of the video test signal extractor unit using two SN7400N i.c.s.

most cases the bright-up unit will not be required. The 0·02μF capacitor can usually be omitted as the necessary coupling components are normally incorporated in the scope.

The extractor unit can be powered from a 4·5V dry battery, e.g. Ever Ready B126, or from the simple mains supply shown in Fig. 11. The 5V zener D1 stabilises the output supply. Generous smoothing is provided as ripple tends to upset the delay monostable causing it to jitter between lines. The 8V a.c. is supplied by a small bell transformer.

Construction

Construction is fairly simple and a layout is given in Fig. 10. This layout is for the SN7400N i.c.s.

The board carries most of the components and only the power supply and variable resistors are mounted off the board.

The whole unit can be built into a case 3 x 9 x 6in. with ease. If the use of a printed circuit is contemplated the unit can be made far more compact but if the print is made too small it can be very awkward to etch especially around the base of the i.c.s.

Once constructed there is no reason why the unit should not work immediately but if there is any trouble a quick check with an oscilloscope should enable any faults to be pinpointed.

Use

The input signal needed is only a volt or so of video, sync positive-going, and a probe with 100kΩ in the tip will be sensitive enough for most receivers. The level control VR1 is turned up until the unit just produces pulses. The timing of the bright-up and trigger pulses is set by the two controls VR2 and VR3.

The trigger output of about 4V is ample for most scopes. All the outputs of the unit are of this level and positive-going. Any output can be shorted to earth without ill effect but should not be allowed to attain greater than 5V otherwise the i.c.s will be damaged.

In use the signal to trigger the unit can best be obtained from the cathode of the c.r.t. in the receiver via a 100kΩ resistive probe. This connection ensures that the video is negative-going and the sync pulses positive-going. The trigger output can be inspected on the scope and VR1 turned up until trigger pulses appear. These pulses are then fed to the external trigger socket of the scope—the trigger circuits being set to accept external positive pulses.

The delay potentiometers VR2 and VR3 are adjusted to make the output pulse such that the required lines are displayed, e.g. Fig. 13.

If the bright-up output is used note that it lasts for the duration of the trigger pulses.

When this unit is used with simple scopes with low-voltage tubes there will be an obvious lack of brightness due to the low periodicity of the quick

Test Signal Extractor—Figs. 9/11—Components

Resistors

R1 100kΩ	R6 27kΩ	R10 1·2kΩ
R2 8·2kΩ	R7 1kΩ	R11 470Ω
R3 2·7kΩ	R8 1kΩ	R12 1kΩ
R4 820Ω	R9 470Ω	R13 33Ω 1 Watt
R5 330Ω	all ¼W 5% unless stated otherwise.	

Potentiometers

VR1 470kΩ VR2 2 or 2·5kΩ VR3 100Ω

Capacitors

C1 10μF 15V electrolytic	C2 0·1μF
C3 2·5μF 6V electrolytic	C4 0·056μF
C5 1,000μF 6V electrolytic	
C6 2,000μF 12V electrolytic	

Working voltages given for electrolytic capacitors are minimum values.

Semiconductors

Tr1, Tr2 2N706, BC109, BC108, BC107, etc.
D1, 4·7V or 5V 2W zener diode
D2, D3, D4, D5 1N4002
G1-4, G5-8 Two off SN7400N (Texas, etc.) see text

Miscellaneous

T1 8V bell transformer; co-ax input socket; output sockets; wiring board, case, etc.

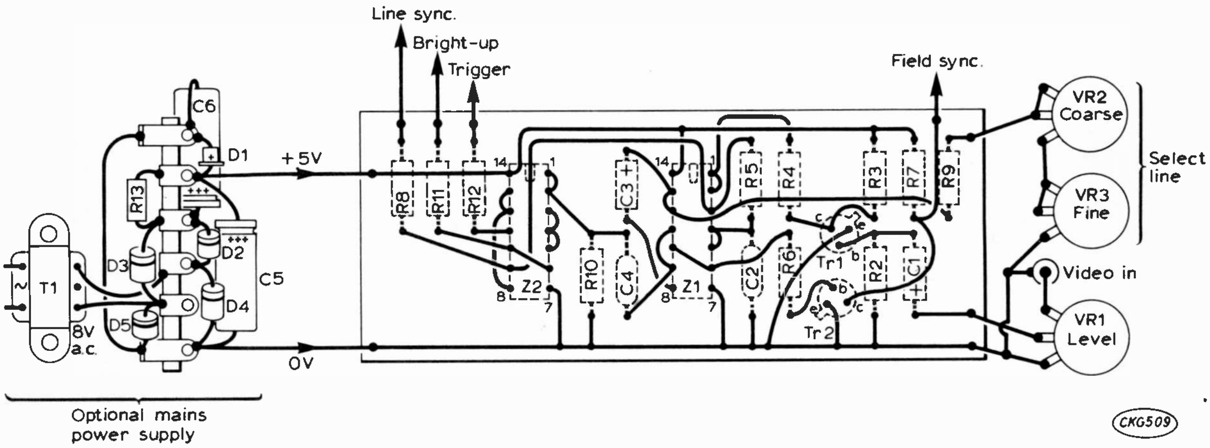


Fig. 10: Layout for the circuit shown in Fig. 9, viewed from the conductor side.

Components list—Marconi CCT—Fig 7

Resistors

R1 2·7k Ω	R8 1k Ω	R15 1·8k Ω
R2 820 Ω	R9 1·8k Ω	R16 1·8k Ω
R3 330 Ω	R10 1k Ω	R17 470 Ω
R4 27k Ω	R11 1·8k Ω	R18 1·8k Ω
R5 1k	R12 470 Ω	R19 1·8k Ω
R6 8·2k Ω	R13 1·8k	R20 1k Ω
R7 1·8k Ω	R14 1·2k Ω	

Capacitors

C1 10µF 15V	C3 2·5µF 15V
C2 0·1µF 160V	C4 0·056µF 160V

Potentiometers

VR1 470k Ω VR2 2 or 2·5k Ω VR3 100 Ω

Semiconductors

Tr1 2N706, BC109, etc. Tr2 2N706, BC109, etc.
G1 . . . G8 D.A.T.11 R.C./6806 (four)

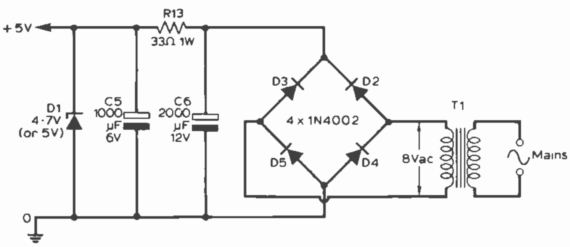


Fig. 11: 5V d.c. mains power supply suitable for the video test signal extractor unit.

scans. Turning the brightness up too far just causes the spot to defocus.

The line and field sync outputs have many uses

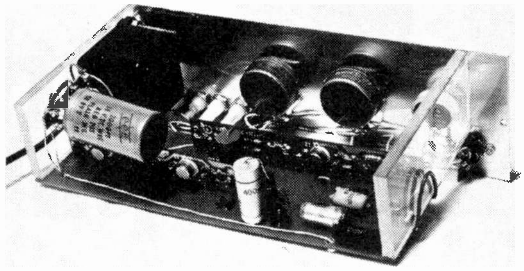


Fig. 12: Internal view of the assembled extractor unit.

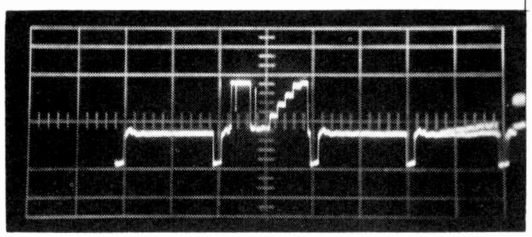


Fig. 13: The clean display obtained by use of the video test signal extractor unit.

and both are positive-going. It is useful to trigger the scope externally from these pulses in general servicing if the scope jitters when triggered internally.

The line and field pulses can also be used for triggering an oscilloscope to display complete TV pictures (using the delay timebase as a field generator).

The unit is certainly of great use in TV work and for many applications can save the expense of an expensive delay scope. Construction is relatively simple and in operation there have been no difficulties at all. ■

BOOK REVIEW

THE MAZDA BOOK OF PAL RECEIVER SERVICING

By D. J. Seal (Foulsham). Available from Mazda valve outlets and bookstores. 276 pages, 9x6 in., price £3.50.

No book can give the full "feel" of colour television servicing, obtainable only by practice, but this volume comes close to doing so. It is intended for the serviceman who already knows his way around a monochrome set, providing a straightforward introduction to the new techniques to be mastered for colour. The treatment is practical and circuits used in commerical sets are used throughout to illustrate operating principles and fault diagnosis, helping to keep the reader's feet on the ground rather than over-exposing him to heady theory. The circuits are taken from two early colour chassis, the Decca CTV25 and the BRC 2000 chassis. These two are useful examples of alternative techniques, e.g. hybrid or all-transistor circuitry, colour-difference or primary-colour tube drive, etc. The fact that these two dual-standard chassis are now several years out of production does not reduce the book's relevance to modern servicing since little space is spent on the redundant 405-line side of their circuits, or in fact on faults peculiar to these models only. Virtually the whole text is still relevant to currently made sets, at least those produced in this country. Anyway one can hardly fail to encounter these two grand old chassis in general servicing whereupon this book will be, despite a disclaimer, as good or better than a service manual. Another proof that the book is not outdated is the information given on some novel features of later chassis, as recent as the BRC 8000.

The book is lavishly endowed with off-screen colour pictures, including a truly excellent series showing the effects of dynamic convergence adjustments (your reviewer is still wondering whether the almost *too* perfect photograph of "A well converged crosshatch" on page 34 can be real—dare one suggest that the otherwise unimpeachable photographer was persuaded to load up with monochrome film for that one?). There is a cross-referenced guide to all basic faults and in addition such useful information as the addresses of manufacturers' trade service departments, suppliers of equipment for colour servicing and transmitter service areas—the latter inevitably now slightly out of date.

Highly recommended, especially to those who have hesitated to leap into colour servicing. C.R.B.

Coping with ICs

PART 3

HAROLD PETERS

If your fears about i.c.s take the form of a recurrent nightmare in which you discover a panel with an i.c. at each corner, all d.c. interconnected and with no apparent means of finding your way into, through or out of the whole arrangement, don't despair: it isn't a nightmare but reality! The four i.c. colour decoder is at present in production by GEC and Pye, also in part by Philips: others are bound to follow.

The Four IC Decoder

The basic circuit is of Mullard origin and is shown in its original form in Fig. 1. The four i.c.s—TBA530, TBA540, TBA560 and TBA990—were all dealt with as individuals in the "habits" section last month: their prime purpose however is to be used as a package. We will first outline the working principle and then look at alignment and trouble shooting.

For easy understanding most decoders can be split into the burst and chrominance paths. This one isn't so clear-cut, so start with an open mind.

Signal Path

The input i.c. (TBA560) is split roughly along the middle, pins 2-8 being concerned mostly with the luminance signal whilst the bottom row of pins is associated with the chrominance channel. Taking the easy bit first, the luminance signal from the luminance delay line and subcarrier trap L1 goes into the TBA560 at pin 3. It leaves at pin 5, amplified and blanked of syncs and burst. From there it is d.c. coupled to pin 5 of the TBA530. There it ends. The chrominance signal enters the TBA560 balanced about pins 1 and 15, emerging amplified and blanked at pin 9 from which it goes to the DL50 glass delay line/matrix for the usual PAL-D separation of the U and V components of the signal across R48. The V signal, alternating in phase line by line, then goes to pin 13 and the U signal to pin 10 of the TBA990 demodulator i.c.

Demodulation is by synchronous detection within this i.c. which has an integral bistable to switch the V signal on alternate lines. U and V thus become B−Y and R−Y and from these two is derived (still within the TBA990) the G−Y signal. These three colour-difference signals are then d.c. coupled through identical subcarrier filters to pins 2, 3 and 4 of the TBA530. The matrixing which is carried out within this i.c. is a simple matter of adding Y (in at pin 5) to the colour-difference signals to produce R, G and B. The RGB drive outputs for the output transistors Tr2, Tr3 and Tr4 are at pins 10, 13 and 16 respectively. Heavy feedback—both a.c. and d.c.—from the output transistors is applied to pins 9, 12 and 15 of the TBA530 to give good linearity and matching to the video amplifiers. As the gain needed is so high the TBA530 has three external high-wattage collector loads—R80, R93 and R106—which are taken to h.t. (Easy bit over.)

Burst Path

The burst path begins with the gated burst leaving pin 7 of the TBA560 at 1Vp-p, heading for the reference oscillator i.c. TBA540 which, sadly, needs 1·5V of burst. L2 in between gives the lift required and also acts as burst phase adjustment in alignment.

The reference oscillator (regenerated subcarrier) signal starts at pins 1, 2 and 15 of the TBA540 and is locked to the bursts by a synchronous detector in this i.c. The filter for this detector hangs on pins 13 and 14. Output in U phase leaves pin 4* and is a.c. coupled by C48 to the B−Y demodulator in the TBA990. C27 and R24 phase shift the pin 4 output by 90° to provide the V phase reference signal for pin 2 of the TBA990, coupled by C37. Ident, a.c.c. and colour killer voltages are produced by a second synchronous detector circuit in the TBA540. This detector is gated by the half line frequency (7·8kHz) squarewave signal generated in the TBA990, entering at 3V p-p at pin 8 of the TBA540. It compares this squarewave with the 7·8kHz burst ripple and if all is well an output of approximately 1V appears at pin 9 for a.c.c. and ident purposes. Further, by making the impedance of killer pin 7 look like an open-circuit to pin 13 of the TBA560 the colour killer there is disabled. If the burst ripple and the 7·8kHz squarewave are out of step however the detector lifts the a.c.c. line to 8V which is sufficient to hold up the bistable in the TBA990 (to which it is connected directly at pin 1) for one line so that the two signals are in step again. The a.c.c. line is then restored to its normal 1V. On monochrome there is no burst signal and thus no burst ripple: the a.c.c. line voltage is then arranged (by adjusting R50) to sit halfway at 4V. This causes the colour-killer pin 7 to become low in impedance, grounding R23 and shutting down the chrominance path through the TBA560.

Pulses

Without line and field pulses the synchronous detectors in the TBA540 and TBA990 would shut these devices down, as would the absence of gating and blanking pulses to the TBA560. Pulses then are a must. They come from the timebases and are

**In Fig. 2 last month the output from pin 4 was shown in V phase: this applied with early prototype versions of the circuit.*

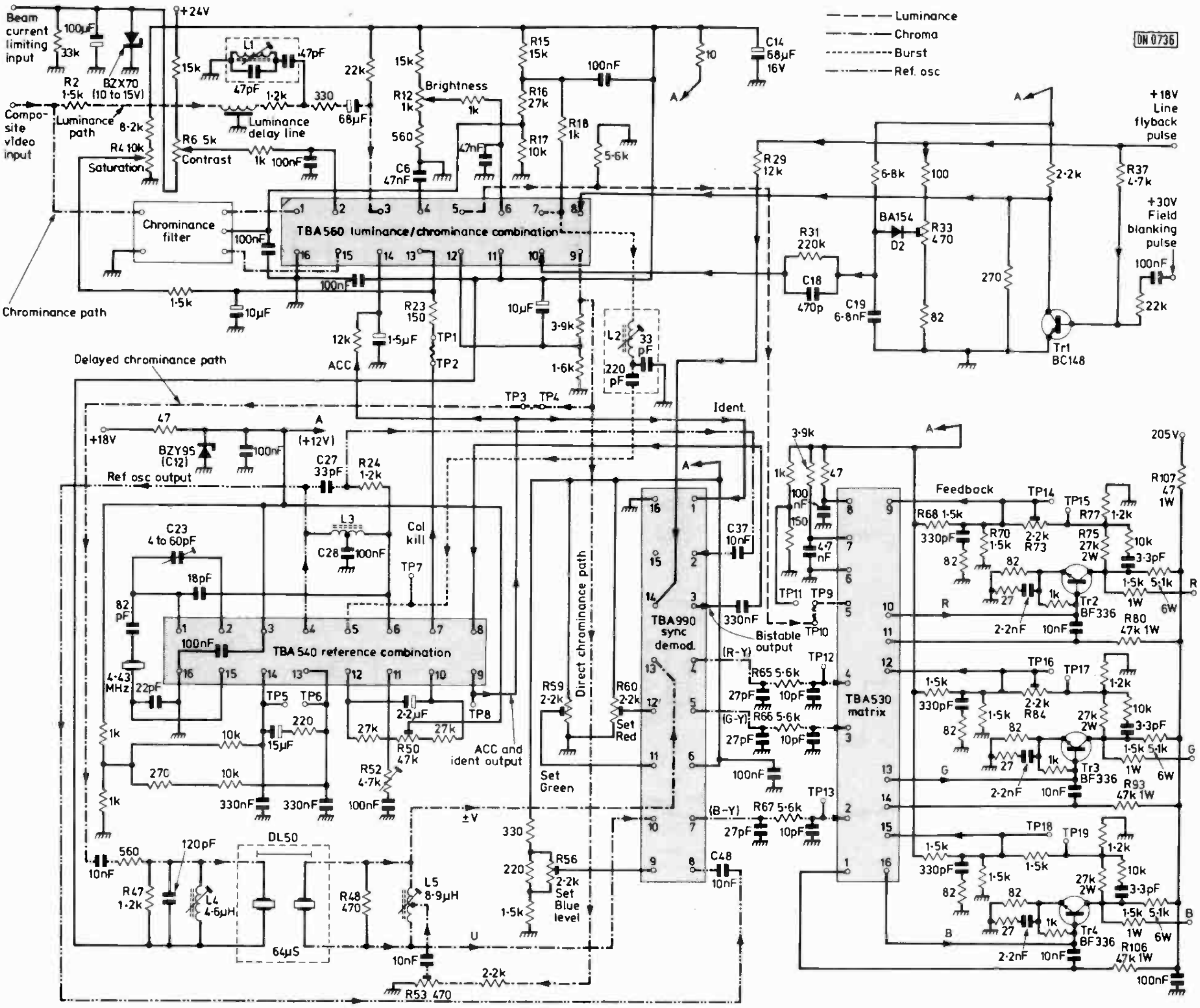


Fig. 1: Circuit of the four i.c. decoder. The gating/clamping pulses applied to pin 10 of the TBA560 are generated across C19 when the flyback pulses briefly cut off D2.

mixed in Tr1 to give a composite blanking pulse for TBA560 pin 8. At the same time R29 feeds line pulses to the TBA990 to trigger the bistable in this i.c. and a cone shaped pulse is taken to pin 10 of the TBA560 for burst gating and black-level clamping. This pulse is shaped by R31 and C18 and its amplitude governed by R33 which thus determines the burst gate position. With no pulses the signal paths close and an uncontrollably bright raster results.

Alignment

Aligning the decoder is a piece of Madeira. You start at the back end by setting the *black level* of the whole video amplifier chain. Methods vary from model to model but the general principle is to clamp the luminance input pin 5 of the TBA530 to 1·5V (a U2 battery will suffice), turn the user controls down and with a meter connected to the collector of the blue output transistor Tr4 adjust R56 "set blue level" control for the stated collector voltage, say 125V. Then similarly adjust the "set red level" control R60 for the same voltage at Tr2 collector and the "set green level" control R59 for the same voltage at Tr3 collector. Ideally R73 and R84 should be preset halfway for this adjustment as they set the white point in grey-scale tracking, but this setting may already have been carried out on your set. The set blue level control R56 changes all three levels together so if the raster is white (tint free) this may be the only one needing adjustment. The only remaining luminance adjustment is the subcarrier trap L1. Remove the U2 and put a scope probe in its place. Display colour bars. Tune L1 for minimum chrominance "fuzz".

The first colour adjustment is for correct burst gating. Transfer the scope to TBA560 pin 7 (R18 bottom end), check that the line timebase is in phase by centring the picture in the raster and adjust R33 until the burst sits in the middle of the gating pulse.

Then lock in the subcarrier oscillator. Disable the killer by opening TP1 and 2 or biasing TBA560 pin 13 on with a +4·5V battery. Short across TBA540 pins 13 and 14 and carefully trim C23 until colour just "runs through" on the screen. Remove the short and reinstate the killer.

Switch to a monochrome signal and set the a.c.c.

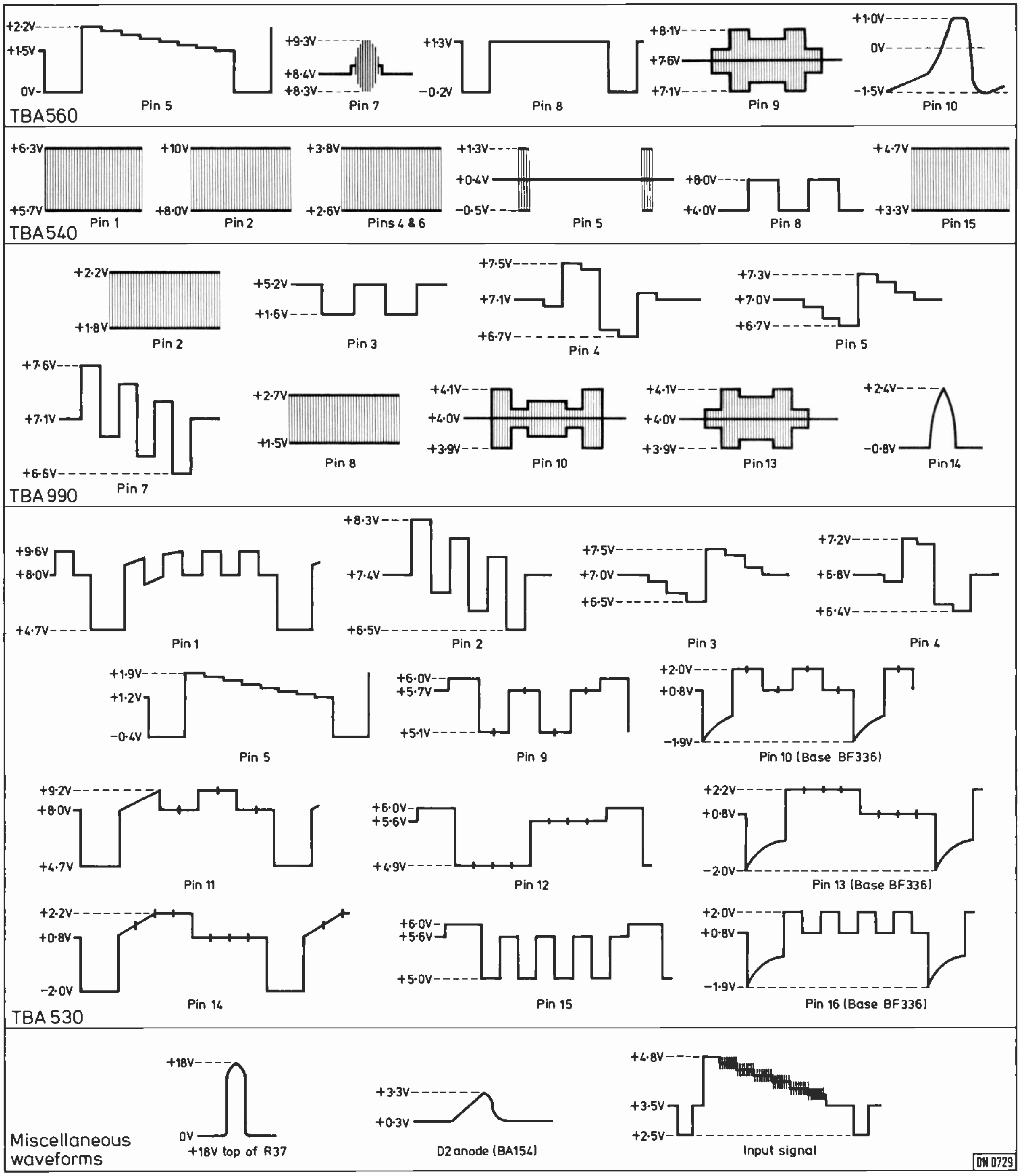


Fig. 2: Four i.c. decoder waveforms.

starting point by adjusting R50 for a meter reading of 4V at TBA540 pin 9 (TP8). Check that this drops to 1V with the return of the colour bars.

Now set the burst amplitude by means of R52, making the burst height 1·5V p-p seen on a scope at pin 5 of the TBA540 (TP7). This usually occurs when R52 is almost short-circuit.

With bars still displayed transfer the scope to R65 and R67 (TP12 and TP13) or if it has only a single beam apply the probe to either as required. (If you have a Philips type PM5508 bar generator the scope may be discarded altogether and the final four adjustments done with the "phase and delay" patterns.) Now adjust the burst phase. Make the set "simple PAL" by shorting out the delay line across R47, and by adjusting the scope to display (TP13)

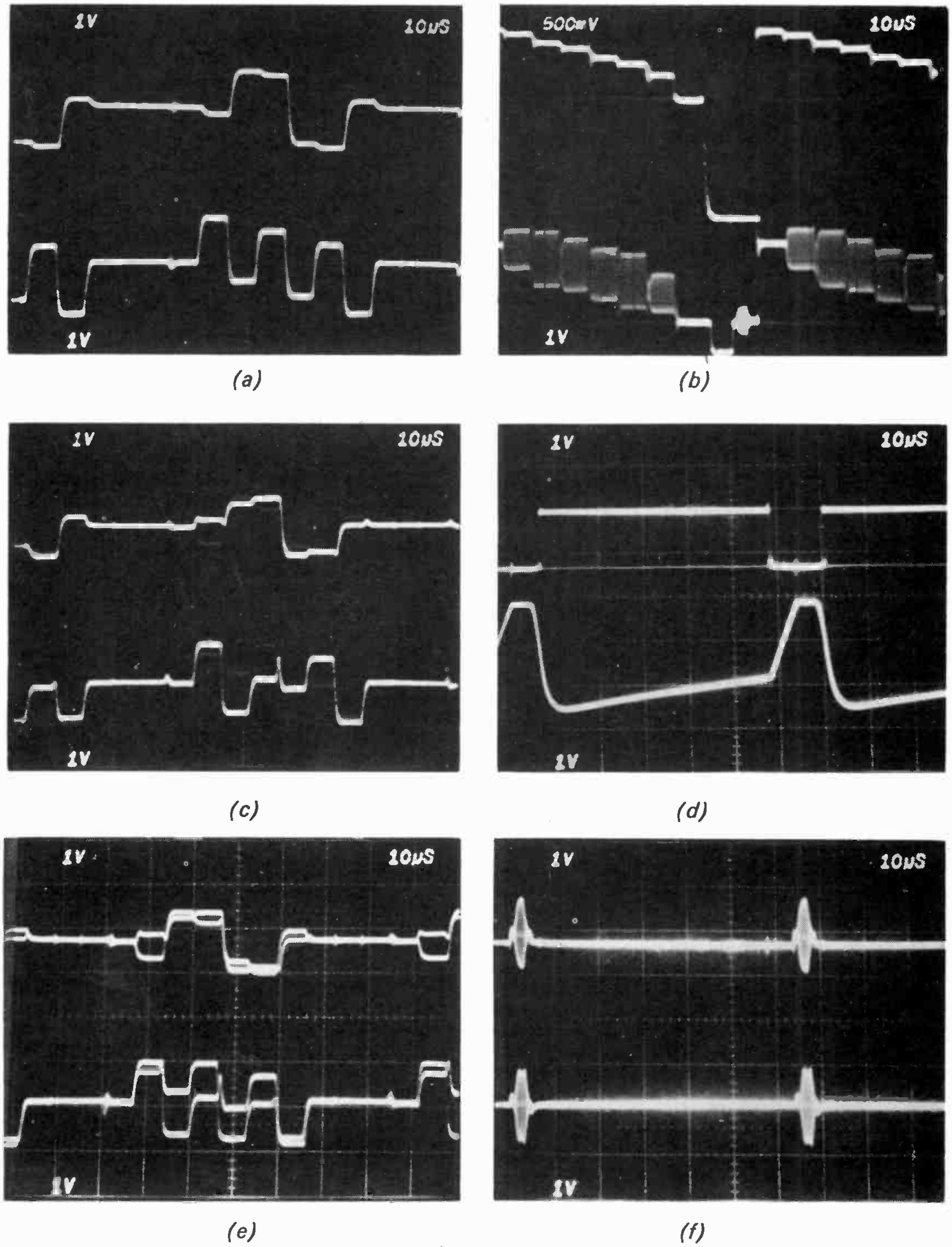


Fig. 3: Actual oscillograms taken with the four i.c. decoder. (a) R—Y signal at TBA530 pin 4 (TP12) top, B—Y signal at TBA530 pin 2 (TP13) bottom. (b) Luminance signal at TBA530 pin 5 (TP9) top, input colour bar signal at R2 bottom. (c) As (a) but with L2 maladjusted; pairs of lines shown. (d) Blanking pulse at TBA560 pin 8 top, gating pulse at TBA560 pin 10 bottom. (e) As (c), L2 maladjusted, but with alternate lines superimposed on the scope. It is a simple matter to adjust L2 until the double traces coincide as shown in (a).

DECODER ALIGNMENT SUMMARY

(1) *Set black level:* Clamp TBA530 pin 5 to 1·5V and trim R56, R59 and R60 for the correct RGB output transistor collector voltages.
(2) *Subcarrier trap:* Tune L1 for minimum chrominance on the luminance signal.
(3) *Set burst:* Adjust R33 to gate the burst signal correctly.
(4) *Reference oscillator:* Disable the colour killer, short-circuit TBA540 pins 13 and 14 and trim C23.
(5) *Set a.c.c.:* Adjust R50 for 4V at TBA540 pin 9 on a monochrome transmission.
(6) *Burst amplitude:* Adjust R52 for 1·5V p-p burst at TBA540 pin 5.
(7) *Burst phase:* Short-circuit the DL50, scope B – Y (TP13) and trim L2.
(8) *Delay phase:* Remove DL50 short-circuit and trim L4.
(9) *Delay amplitude:* Displace phase of L2 and trim R53.

alternate lines superimposed upon each other—as in Fig. 3(e)—tune the burst phase coil L2 for coincident traces.

If your set has R24 as a preset control first set L2 for correct B—Y then adjust R24 for correct R—Y (TP12).

Remove the delay line short and adjust the delay phase. Look at B—Y (TP13) and trim L4 for coincidence.

The last adjustment, delay amplitude, is now remarkably easy thanks to a novel method suggested by the Mullard designers. All you have to do is displace the burst phase by more than 45° by linking a capacitor of 120-270pF from the junction of L2 and R18 to chassis. The B—Y trace is then made to coincide by setting R53. If stuck you could always detune L2 but you would then have to repeat the burst phase adjustment afterwards.

That then is the decoder aligned.

Trouble Shooting

Where do you begin trouble shooting on a board like this? Admittedly it is not as straightforward as with discrete component circuits but nevertheless if a set method is followed and certain key points recognised you will be lead to the troubled section.

A good scope and a multimeter of the Avo 8 grade are essential. A colour bar generator is also an asset but a good transmission will suffice. In our text we will assume however that bars are applied to the input.

The first checks should be on the h.t. and l.t. supplies; then take a quick look at the waveforms. The most important one is the 18V line pulse at R37. Without it only the TBA530 stays open for business.

Fault-Finding Procedure

The fault-finding procedure is simply to work through the alignment drill until you come to a stage that doesn't function properly. Then localise the faulty component using the i.c. voltages as a guide.

The output stages are all d.c. linked to the set blue level potentiometer R56. If you clamp the luminance input (TBA530 pin 5) to 1·5V and swing R56 through its range each BF336 collector should swing from about 60V to 130V. The voltages at R65, R66 and R67 should all swing as equally from about 6·5V to 8·0V. If this happens but one colour predominates suspect a feedback fault in the network R68, R70, R77, R75 for the red channel or the corresponding components for the other two colours. These circuits can be misleading as there is sufficient feedback to the TBA530 to pull the nominal "balanced condition" voltage of 6V back to something nearly right despite a mammoth value change in any one component.

Check that the TBA990 has five waveforms going in and four coming out. The inputs are 3V p-p line pulses at pin 14, the 4·43MHz reference subcarrier of 1V p-p at pins 2 and 8 and U and V inputs from the DL50 delay line at pins 10 and 13. The outputs are a 3V p-p 7·8kHz squarewave at pin 3 and the three colour-difference signals at pins 4, 5 and 7.

The TBA540 should have a 4·43 MHz signal at pins 1, 2, 4, 6 and 15. There should be 1·5V p-p burst at pin 5 while the 3V 7·8kHz squarewave that left pin 3 of the TBA990 should turn up at pin 8. To observe the conditions in more detail disable the killer by disconnecting TP1 and TP2 or biasing pin 13 of the TBA560 with +4·5V. If there is only a thin trace of unlocked colour check around the L3, C28 area. If the colour is strong but unlocked suspect the filter circuit on pins 13 and 14. If the colour is delayed after a channel change the cause could be a faulty TBA540 i.c. or noise on the a.c.c. line. The latter can be reduced by fitting a 10kΩ resistor between pin 9 of the TBA540 and pin 1 of the TBA990 with the latter pin decoupled by an 0·01μF capacitor.

The chrominance input to pins 1 and 15 of the TBA560 and the luminance input to pin 3 are so small that they can only be seen with a sensitive scope and with the supplies removed to take out earth currents. Fault find around here by bypassing sections of the circuit. An open-circuit C6 can lose you luminance as can loss of input pulses at pins 8 or 10. To find chrominance faults disable the killer as above and check the bias on pins 1 and 15. A fault in the network R15/R16/R17 can cause no chrominance, confirmed by a large pedestal on the burst at pin 7. Check the range of the controls which should typically be: contrast (pin 2) 1·5V-5V; colour (pin 13) 2V-5V; brightness (pin 6) 0·6V-1·0V. These readings should be 0·5V higher all round for the TBA560A or C.

Conclusion

We hope that this short excursion into i.c.s has helped restore your faith in TV. But what next? I.c.s are already getting into timebases and those flatly tuned i.f. strips are beginning to be replaced by i.c.s. I would also wager that the decoder just described will be down to two i.c.s before too long. As for that little bit of space that nobody loves behind the control panel, where better to stick a Ceefax or Oracle memory? Anyway, having introduced this family of domestic i.c.s I will retire hurt. Nothing to do with fear for the future. Quite the reverse. I've just burned my wrist on an EF50! (There is no more stable oscillator!). ■

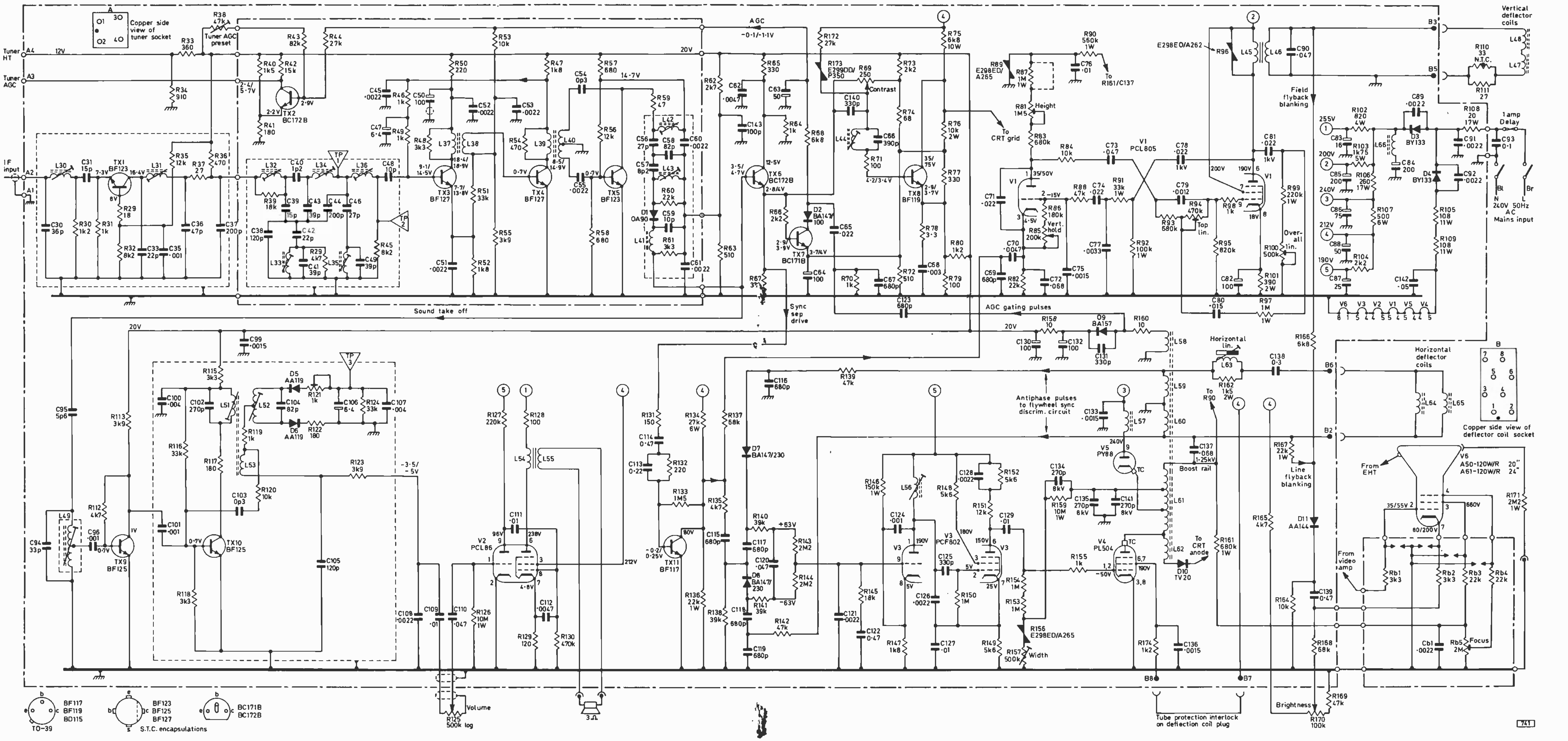


Fig. 3: Circuit of the ITT VC200 chassis. Voltages measured with a 20kΩ/V meter (Avo Model 8), TX6, TX7 and TX8 voltages with the contrast control set midway.

in overall brightness could well be due to the focus control (Rb5) changing value. In this event the loss of brightness will be more severe than the loss of height, due to the presence of R161 in series with the focus control. Gradual loss of height with no loss of brightness is more likely to be due to R83 (680kΩ) going high-resistance. Replace it with a 1W type.

Sudden cramping at the bottom with some loss at the top will be due to C82 becoming open-circuit. This is easily proved by shunting a similar value electrolytic across it. The linearity controls are not above suspicion and should be checked for good contact and correct value.

The PCL805 can be responsible for a number of different fault conditions ranging from any of those already described to variation of hold and total loss of height as evidenced by a single white line across the screen with the voltages present. If voltages are not present at pins 6 and 7 check back to the smoothing resistor R103 which can go open-circuit with no contributory cause.

Intercarrier Sound Channel

The 6MHz sound i.f. stages TX9 and TX10 seem quite reliable. C102 and/or C104 can however cause distorted and/or intermittent sound and the alignment of L51/L52 may require adjustment. The sudden appearance of a buzz should direct attention to the 6.4μF electrolytic C106 which is likely to become open-circuit. The drill here is to check the back-to-front ratio of the detector diodes D5 and D6, ensure that the balance control (R121) is working and then replace the capacitor.

Audio Circuits

The audio output stage is simplicity itself but there are a few points to watch. The valve often runs into grid current or suffers an interelectrode short which either distorts the sound or knocks it off completely. In either event a new valve will restore sound but the cathode resistor will have received a rough passage and should be checked. If it is at all discoloured it should be replaced to save almost certain trouble later (R129, 120Ω). R102 can also suffer as noted earlier.

The PCL86 has three electrodes that require h.t. These are the triode anode (pin 9) which is fed via R127, the pentode anode (pin 6) which is fed via the output transformer and R128 and the pentode screen grid (pin 3). Each of these supplies is derived from a different source: R127 from HT5 which also supplies the line oscillator; the screen from HT4 which also feeds the brightness control; and the pen-

—continued on page 33

THE SONY TRINITRON tube

DEWI JAMES

ALTHOUGH the Sony Trinitron colour tube is based on the same fundamental principle as the conventional shadowmask tube—that of employing a "shadowing" device to ensure that the three individually modulated electron beams strike only the appropriate colour phosphors on the tube screen—there are considerable differences in the internal arrangements. The two main differences are first that instead of three separate electron guns there is a single gun system which emits three electron beams from three cathodes arranged in line horizontally; and secondly that the phosphors are deposited on the tube face in vertical stripes instead of dots, with the beam shadowing device consisting of a metal grill with vertical apertures. Since this latter arrangement intercepts less beam current than a conventional shadowmask the picture brightness for a given beam current is increased—in fact the "beam transparency" of the aperture grill is some 30 per cent greater than that of a standard shadowmask.

With the single gun arrangement the three beams share a common electron lens system. This means that the beam current can be greater than with a shadowmask tube, giving a further increase in picture brightness.

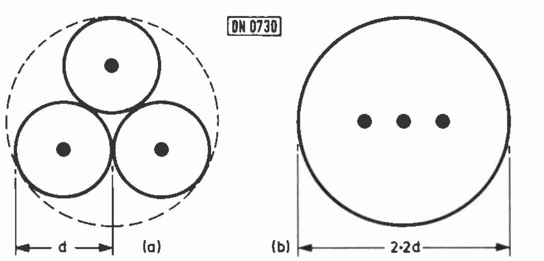


Fig. 1: Comparison between the effective electron lens diameter of the delta gun arrangement used in the shadowmask tube (a) and the single-gun system used in the Trinitron tube (b).

Electron Lens System

In the shadowmask tube the three separate electron gun assemblies are mounted in the tube neck in delta formation as shown in Fig. 1(a). As Fig. 1(b) shows, the single gun assembly of the Trinitron means that the electron lens system is effectively increased in diameter by a factor of about two. The larger the diameter of the electron lens the better the definition, so in addition to increasing the brightness the picture is sharper as well.

With the in-line arrangement of the cathodes misconvergence is almost entirely in the horizontal plane. This means that the amount of convergence correction required with the Trinitron tube is much less than that required with a shadowmask tube, and in fact the convergence procedure is extremely simple.

Screen and Grill

The arrangement of the phosphor stripes on the tube face with the aperture grill behind is shown in Fig. 2. Two further advantages of the aperture grill arrangement are that it is less sensitive to terrestrial magnetism and that it produces pictures free of moiré patterning. The latter effect occurs in a shadowmask tube as a result of the shadowmask pattern being superimposed on the dot pattern on the screen—the effect is greater when the spot size is decreased, i.e. the focusing made sharper, so that

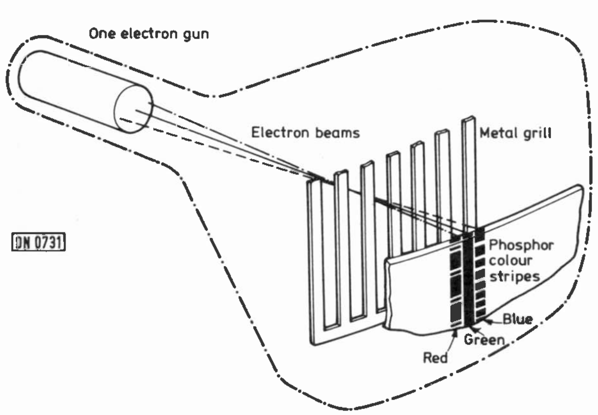


Fig. 2: Arrangement of the phosphor stripes and aperture grill of the Trinitron tube.

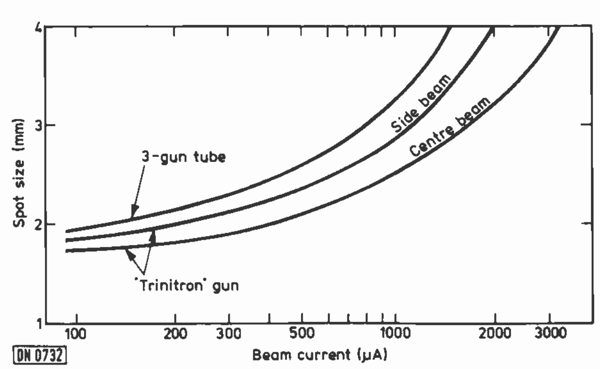


Fig. 3: Relationship between spot size and tube beam current.

SERVICING television receivers

L. LAWRY-JOHNS

ITT/KB VC200 CHASSIS—continued

IF Preamplifier

A separate i.f. preamplifier stage TX1 amplifies the output from the tuner unit before the signals are passed to the main i.f. panel. No a.g.c. is applied to this preamplifier and the voltages in this stage should approximate to those given on the circuit diagram (this time there's an emitter resistor—R31—the voltage across which should be 7.3V). TX1 can oscillate causing patterning on Band V: the cure for this is to increase R29 from 18Ω to 22Ω.

The coil cores in the i.f. strip should not be disturbed: if a coil is not carrying out its proper function the associated components should be suspected.

AGC Troubles

A rhythmic pulsing of the vision and sound signals should direct attention to the electrolytic capacitors in the i.f. and a.g.c. circuits, particularly C47 (6.4μF) which smooths the a.g.c. applied to the first i.f. stage TX3. The electrolytic C64 (100μF) in the emitter circuit of the a.g.c. generator causes more of a fluttering effect when it becomes open-circuit. If the electrolytic C63 (50μF) is faulty the effect can be bent verticals at the top of the screen or again picture and sound flutter. A.g.c. flutter when the brightness is increased can be caused by C50 (100μF) being open-circuit or the print connection damaged. In earlier versions it was possible for R42 on the i.f. strip to touch the wiper of the a.g.c. preset R38: this results in tuner faults or the destruction of TX2.

Line Output Stage

Of the two timebases the line side is more likely to be the source of trouble. The main complaint appears to be lack of width, decreasing over a long period. This is almost always due to R159 (10MΩ) increasing in value until it is virtually open-circuit. We usually keep plenty of 8.2MΩ 2W types around for use in certain other receivers and there is no reason why one of these should not be used as a replacement. This does not mean that the PL504 cannot be at fault, indeed it often is, but the resistor is more often the cause. Before either of these items is checked however it pays to note the effect of the width preset as this often has a dud spot which results in poor width until the wiper is moved. Replace it if necessary (R157 500kΩ).

The writer has not yet encountered a shorted boost line capacitor (C137) on these receivers but if it does short the PY88 will be most unhappy as its cathode will be shorted to chassis with only R106 to limit the current. In this event either R108 or the fuse would fail. We say R108 because this is already working hard and the last straw on the camel's back . . . Come to think of it, an overheated resistor has a smell not unlike the camel the writer clambered upon many years ago and many miles away: but that's another story.

Other trouble spots in the line output stage are likely to be the screen feed resistor R174 and the grid circuit resistors R153 and R154.

Line Oscillator

The line oscillator is the by now conventional PCF802 with no external line hold control (the adjustment is to the core of L56). When trouble is experienced with the hold don't adjust the core; check the PCF802, the discriminator diodes D7 and D8 and resistors R143 and R144.

Intermittent line hold troubles varying with temperature can be caused by a faulty capacitor in the oscillator stage. It is also quite common for the PCF802 to stop oscillating altogether due to a faulty capacitor, with consequent overheating of the line output stage. If in doubt change C124 to C127 inclusive and have no more trouble. Do not use ceramic replacements for C124, C126 and C127—the manufacturer's suggest using Mullard polyester capacitors (metallised polyester in the case of C127).

As a matter of routine the two 47kΩ resistors R139 and R142 should not be overlooked when checking the line oscillator stage—they can change value thus upsetting the balance of the discriminator.

Output Stage Trouble Spots

To revert to the output stage again there are two other possible trouble spots. One is the S-correction capacitor C138 (0.3μF) which could short to produce lack of width with compression on the left-hand side. The other is the 1.5kΩ resistor R162 (2W) which can change value to produce striations (vertical rulings) down the left side, fading to the centre.

Field Timebase

The field timebase circuit is conventional, using a PCL805 which does not give a lot of trouble. Sudden loss of height is likely to be due to the height control itself (R81) as an exploratory adjustment may well prove. Slight loss of height accompanied by a drop

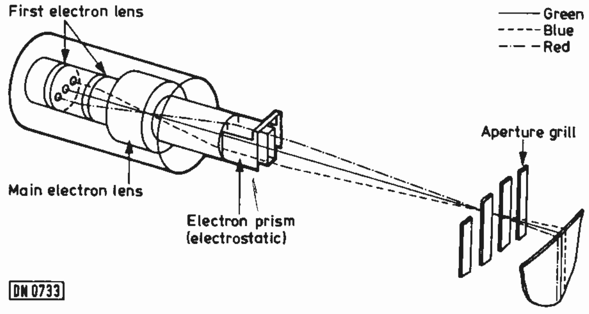


Fig. 4: The electron-optical system used in the Trinitron tube.

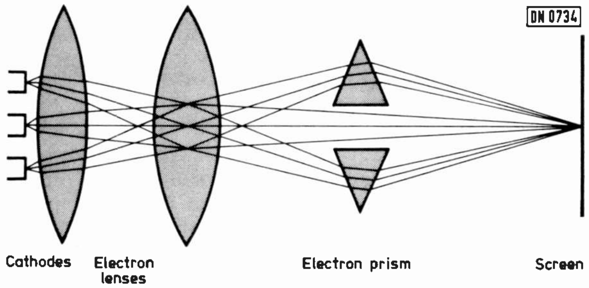


Fig. 5: Optical analogy of the Trinitron tube's electron focusing/convergence system.

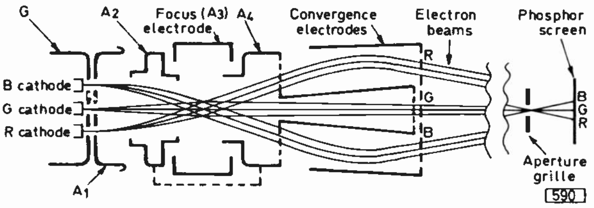


Fig. 6: More detailed depiction of the Trinitron tube's gun assembly.

the only cure is slight defocusing to minimise the moiré patterning effect.

Resolution

Fig. 3 shows how spot size varies with beam current. As can be seen both the side and centre beams of the Trinitron tube produce a smaller spot size for a given beam current than the beams of a three-gun tube, resulting in improved definition. Now the fine detail in a colour picture is provided by the luminance (Y) signal to which the original green signal contributes the greatest proportion ($Y=0{\cdot}59G+0{\cdot}3R+0{\cdot}11B$). Since the centre beam of the Trinitron tube gives the sharpest spot for a given beam current the centre cathode in the Trinitron is modulated by the green signal. There are no separate grids in the Trinitron tube so RGB drive is required.

Electron-Optical System

Fig. 4 shows the electron-optical system of the Trinitron tube, with an optical analogy in Fig. 5. It will be seen that the system consists of two electron lenses followed by an electron prism. The gun

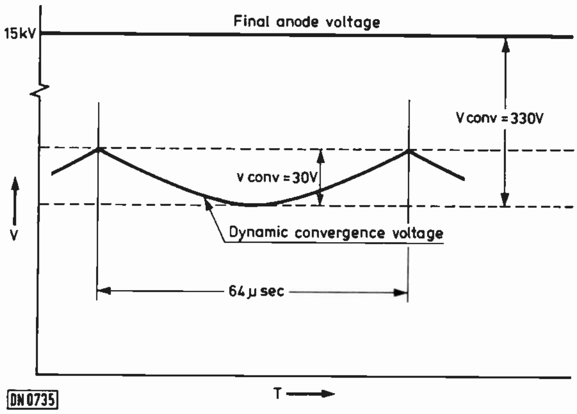


Fig. 7: The convergence potential and dynamic correction waveform applied to the deflection plates.

assembly is shown theoretically in Fig. 6. The first and second anodes comprise the first electron lens, giving prefocusing to the centre point of the main focusing electron lens (A3) where the beams cross over. Although the side beams pass through the edge of the prefocus lens there is little aberration since this lens is so weak. After passing through the main focusing lens/electrode the outer beams are converged with the centre beam as they pass through the electron prism/convergence electrodes.

Convergence Correction

Since the three beams are in the same plane (horizontal) the only convergence correction necessary is to alter the direction of the outer beams either to the right or left so as to meet the centre beam at the screen. The electron prism works on the electrostatic principle so that this can be done by adjusting the voltage applied to the plates. Dynamic convergence (very little is required due to the design of the deflection coils) is achieved by applying a parabolic waveform at line frequency (see Fig. 7) to the plates. As can be seen the ratio *V*conv (convergence voltage) to *v*conv (dynamic peak-to-peak convergence voltage) is the same: thus individual adjustment of these two voltages is unnecessary and as *V*conv is adjusted (static convergence) the dynamic convergence follows automatically.

A small amount of pincushion distortion correction is applied and there is the usual purity correction. This latter is simplified however to adjustment of a single magnet.

Deflection Sensitivity

The deflection sensitivity of the Trinitron tube is high. Thus less power is required from the scanning circuits and a smaller deflection yoke can be employed.

Conclusion

The excellent picture and setting-up simplicity make the Trinitron tube attractive to both the sales and service side of the retail industry. The larger 18in. tube is now well established and Sony have announced in Japan that even larger sizes (up to 27in.) have been successfully developed. ■

receiver debugging

E. J. HOARE

PART 4 SOUND/FRINGE/COLOUR PERFORMANCE

The Sound Channel

Most of the difficulties which may crop up in the sound channel are concerned with conventional audio output stage techniques. Provided the d.c. working point of the output stage is correctly set and the speaker impedance is properly matched to the load impedance full output power should be obtained at the quoted distortion level. Care over the choice of speaker and its mounting in the cabinet should ensure satisfactory audio quality.

It is of course well worthwhile taking some trouble to match the a.f. response to the characteristics of the speaker and cabinet combination. This is a matter which is often neglected and it is rather a pity. Receivers can generally be improved by adjusting the pre-emphasis capacitor at the sound f.m. detector output to give the amount of h.f. response that suits the combination of speaker, cabinet, room acoustics and your personal preferences.

Most audio stages have bypass capacitors and simple feedback arrangements. These can often be modified to give a different balance between bass, mid-range, and top frequencies. It pays to make only one alteration at a time and then to assess the results before taking the next step.

As in all audio circuits hum can be a problem. It usually has two components in a TV set: mains hum and field sawtooth hum. The first thing to do is to make sure that the h.t. or l.t. supply to the output stage is well decoupled at low frequencies. Try taking a very large electrolytic capacitor and connecting it between the line and chassis. Assess how much the hum is reduced and this will tell you what improvement can be made by simple means. A rasping type of hum is caused by the field timebase and this usually gets into the sound channel via the supply line. Decoupling generally provides a cure.

The volume control leads often pick up mains hum and occasionally field hum as well if they happen to pass through the field of the deflection coils. These leads usually need to be screened and considerable thought should be given about where to earth the screening. Quite severe hum can sometimes be injected via a loop involving this screening and an earth connection at each end. The earth path may be long and have all sorts of mains and field currents in it. Here, as in so many other cases, good earthing technique can avoid a lot of trouble.

If you get desperate, isolate the earth of the sound channel completely and then take a single earth lead back to the common input earthing point. This is a useful dodge in any situation where some form of internal interference is being picked up by a circuit.

This brings us to our next point: line flyback pulses can get coupled into the sound channel either by direct pick-up or by earth path coupling. The sound limiter tends to limit on these pulses instead of on the sound intercarrier and the result is a rather obtrusive form of distortion. Other unwanted couplings produce odd whistles and plops as you detune the receiver.

Caption buzz is a fairly common complaint. Captions on the picture involve high-energy sidebands and some of these appear in the sound channel as the second or third harmonic of the video information. This spurious sound signal is in the region of 6MHz and although it is amplitude modulated—not f.m.—it gets through the limiter stage and detector. The only cure is to use a very narrow bandwidth in the intercarrier channel: preferably only about 300kHz. This high degree of selectivity reduces the amount of 6MHz carrier available and you may run short of gain, so some compromise may be needed.

In a very few areas difficulties may be experienced with v.h.f. Channel 1 transmissions (sound and vision carriers at 41·5 and 45·0MHz) being picked up in the i.f. circuits of u.h.f. receivers. These unwanted carriers beat with the receiver's own i.f. to give buzz on sound when the receiver is detuned. Thus a vision i.f. detuned to 39MHz will beat with the 45MHz Channel 1 vision carrier to produce a spurious 6MHz carrier which will be accepted by the sound channel. A similar mechanism causes breakthrough of the Channel 1 sound carrier when the receiver is detuned further.

Fringe Performance

Most fringe area testing is concerned with the synchronising and noise performance of the receiver. We have already discussed these items in articles earlier this year. It is important to get a good balance between i.f. gain, noise, the quality of the line and field sync, and PAL decoder performance. It is frustrating if one of these characteristics falls far short of the other three since the receiver then becomes unusuable as the result of only one inadequacy. Ideally all four should become inadequate at the same level of input signal.

In practice the performance of a receiver is limited by the noise factor of the tuner. It is usually possible to redesign or modify circuits to improve their performance but the exception is the tuner. This has to be regarded as a "black box" and if it is not good enough you either have to accept the fact or try to find a better one. In most cases it is not worth while changing tuners because the difference in noise performance is usually fairly small.

There are several forms of interference which only show up under fringe conditions since the signal circuits are then operating at or near full gain. Small interfering voltages picked up by the aerial, tuner or i.f. circuits become a significant proportion of the wanted signal voltage in these circumstances and show up on the picture. I.F. voltages radiated by the vision detector or coupled back via earth paths or supply lines may for example get into the circuits at the front end and provide positive feedback. The i.f. circuits become unstable and patterning appears on the picture at a frequency determined by the feedback path—it is not uncommon for i.f. circuits to become unstable at full gain in this way.

Similarly, i.f. harmonics at the vision detector may lie in the wanted r.f. channel passband and get picked up at the aerial or tuner. This will also cause patterning or give the picture an unstable streaky appearance. When faced with this problem note first whether the frequency of the patterning changes with r.f. tuning. Also, try coiling up a few turns of the coaxial aerial lead, hold these close to the vision detector and see if the patterning gets worse. You can then start to make a diagnosis.

Think along the following lines. The wanted r.f. carriers, both vision and sound, are at fixed frequencies which cannot possibly change as you tune the receiver. The i.f. sound and vision carrier frequencies vary with the tuning. So if an external interfering r.f. carrier beats with the wanted r.f. carrier the patterning frequency will not change with the tuning though its amplitude will. If an external source is picked up by the i.f. strip and beats with the sound or vision carriers however the patterning frequency will vary with the tuning. Similarly if harmonics of the i.f. beat with the wanted r.f. the tuning will be exceedingly critical. This latter case can also be checked by the coiled aerial feeder test mentioned above.

Now all this probably sounds a bit complicated. If you take a pencil and paper however and jot down all the frequencies involved in a particular case, marking the carriers as fixed or variable, you will begin to see daylight. You are trying to find differences between r.f. and/or i.f. carriers resulting in spurious i.f. carriers around 39·5, 33·3, and 6MHz. There are other possibilities too. The sound carrier of a programme four channels above the wanted channel can beat with the wanted vision carrier to give a spurious 38MHz signal. This will beat with the wanted i.f. to give a 1·5MHz pattern. Similarly a carrier 79MHz above the wanted vision carrier will give an "image" i.f. at 39·5MHz. The possibilities seem almost endless!

In general any non-linear device such as the tuner mixer stage or the vision detector will combine two or more signals to give two more. Thus if you mix two carriers A and B in this way you get four outputs. These are A, B, A−B and A+B. This means that you can get undesirable mixing with an unwanted carrier in the tuner and the products of this unholy alliance can get mixed at i.f. in the vision detector! A kind of double-barrelled process.

There are other forms of fringe area interference too. Any fast switching operation in the receiver generates high-order harmonics which may lie in the r.f. or i.f. passband. Typical examples are boost diodes, transistor line driver stages, and any scan rectifying diodes used to generate l.t. supplies from the line timebase. Line driver stages generate short bursts of interference about two thirds of the way across the picture but the other two sources occur at the beginning of the line scan. The effect on the picture is a thin vertical dark or white line.

Boost diode valves are usually in the line output transformer screening compartment and this may prevent the interference being picked up at the front end. In any case a small choke in series with the cathode lead will usually suppress any radiation.

A scan rectifying l.t. diode needs a small high-voltage ceramic capacitor connected across it to bypass the worst r.f. effects. R.f. currents will flow in the smoothing capacitor and in the earth path however. Once again we have to warn against the possibilities of earth path couplings!

A line driver transistor presents similar problems but can be a bit more obstinate. A small choke of about 100μH in the collector will help for a start. Then the input and output leads should be kept short to avoid forming large radiating loops. Finally, earth paths again. These same principles should be applied to any other sources of r.f. or i.f. interference resulting from high-speed switching transients.

Colour Reception

Although colour receivers incorporate a great deal more circuitry than monochrome ones it is pleasing and perhaps a little surprising to record that the problems encountered are usually not in proportion to the increased complexity. When the circuits common to monochrome reception have been debugged the job is two thirds finished. Colour circuits give little trouble apart from the usual need for troubleshooting to find constructional errors.

It is not immediately obvious why this should be so. It seems to be simply fortuitous that convergence networks do not interact with other circuits while decoders do so to only a small extent. Some difficulties do arise however so it is worth while checking out the main issues.

It has been said before in the pages of TELEVISION and perhaps it bears repetition that good colour fidelity depends upon having an accurate c.r.t. display in terms of purity, convergence, and grey-scale tracking. These are the first three essentials that have to be right before the contribution of the decoder can be assessed.

The procedures for making these adjustments have been described in earlier series so we do not need to go into the details here. The main difficulty lies in knowing when you have achieved the best results of which your particular receiver is capable.

Take purity for example. Some combinations of c.r.t. and deflection yoke can be persuaded to give near perfect purity with very little trouble. You adjust the purity magnets on the neck of the c.r.t. to give a good red ball in the lower centre of the screen and then adjust the coils to spread the red ball towards the edges of the screen. Repetition of this procedure soon gives a good result.

With other combinations however it is difficult to get a pure red field. Furthermore even when you have done so the white field shows patches of impurity. You carry on with the adjustment procedure to try to improve the white raster further but you may in the end have to accept the fact that the result is not going to be perfect. If you are really keen you can postpone this unpalatable decision by rotating the deflection coils 180°, reversing the scan coil connections and trying again. You may have better luck. Do not of course rotate the convergence coil assembly—these coils must stay opposite their appropriate guns.

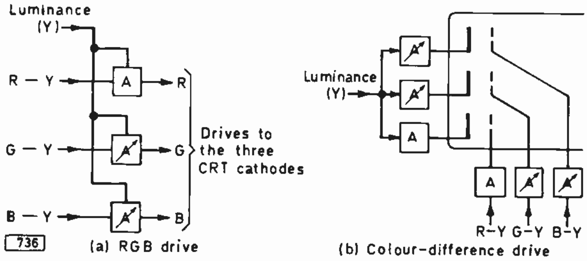


Fig. 1: RGB (a) and colour-difference (b) c.r.t. drive techniques.

The same situation crops up with convergence. You want the result to be perfect but in practice it simply isn't possible. Some c.r.t. and deflection coil combinations give good results and others do not. The trick lies in knowing how good it is possible to make the convergence and then to stop at that point. Further efforts will simply result in a different set of compromises over various parts of the picture area but the same overall subjective impression.

Always begin by adjusting the convergence along the centre horizontal and vertical lines of the picture. Then, having done your best, stand back and assess the results. Look at each part of the picture in turn and analyse the faults. It may be worthwhile degrading the convergence slightly along the centre lines in order to improve the corners. But only slightly.

Grey-scale tracking is a little different. At one end of the range you are trying to get pure, neutral, dark grey tones. Dark grey is a pretty unambiguous colour: if there is any hint of red, green, or blue the tone is simply *not* correct. The adjustments are usually critical and care and practice are needed to get them right. If you cannot get a pure grey then the range of one of the c.r.t. first anode preset voltage potentiometers is ill chosen and needs to be altered.

The highlight colour is more difficult. You are seeking a pure neutral white but this is exceedingly difficult to judge. The best way is to view the blank raster in total darkness (avoid yellow tungsten lighting) and ask yourself whether there is any hint of red, green, or blue. If so try adjusting again.

Sometimes the tracking of the red, green and blue displays is faulty between dark grey and the highlight tones. Light greys and mid tones become slightly tinted. This is usually due to differences in the gamma characteristics of the three guns in the c.r.t. and there is nothing that can be done about it.

It is clearly important that the grey scale remains stable. The grey end is the most critical so use good quality potentiometers for the first anode voltage supply. Avoid any temptation to save space by using small components unless you are sure of their quality. Any resistors in series with the potentiometers will have high values and these tend to be unstable. Use 1W carbon film or small metal oxide types.

If your receiver has RGB drive you have to check only two other items in order to be sure of getting good colour fidelity. First look for blinds. The presence of blinds is a sure indication of possible decoding errors. The absence of blinds means that the decoding as such is correct. (See *A Closer Look at PAL* February 1972).

Next check the relative amplitudes of the R−Y, B−Y and G−Y outputs from the decoder on a colour-bar signal. They should be in the ratio 0·79:1·0:0·47 but you will need an oscilloscope to measure them. One of the most important advantages of RGB drive is that in setting up the grey scale the drives are accurately adjusted to suit the relative gains of the three guns. If the three colour-difference outputs from the decoder are correct then the sum of the luminance signal and these outputs—giving the R, G and B voltages—will also be correct. You do not have to adjust the R−Y, B−Y and G−Y outputs to suit each c.r.t. gun as you do with colour-difference drive. See Fig. 1.

If your receiver features colour-difference drive it will be necessary to adjust the decoder outputs to suit the characteristics of the c.r.t. as you do when making grey-scale adjustments. You can do this without test equipment by using the following procedure.

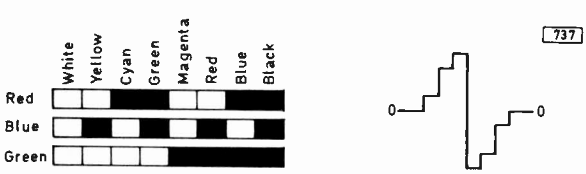
First adjust the grey-scale very carefully. Next adjust a colour-bar test pattern for normal brightness, contrast and saturation and then switch off the blue and green guns. Now slightly readjust the contrast and saturation to make the four red bars shown in Fig. 2 (top left) of equal brightness. Switch off the red gun, turn on the blue one and adjust the B−Y gain control to make the four blue bars of equal brightness. Switch off the blue, turn on the green, and adjust the G−Y gain control so that the four green bars have equal brightness also.

If you want to set the G−Y matrix (mixing) control you will need an oscilloscope. The control should be adjusted before the G−Y gain control so that a completely symmetrical waveform is obtained as shown in Fig. 2(b).

Finally turn on all three guns and you should then have good colour fidelity. Note that if you have RGB drive you can use this same inspection procedure for checking the accuracy of your decoder outputs. It avoids having to use an oscilloscope except for the G−Y matrixing. This latter is a critical adjustment: if in doubt leave it alone.

Even after carrying out all the foregoing adjustments it still sometimes happens that the colour fidelity is not correct. It may be tempting to assume an error in the decoder and go scratching about trying to find it. Unless there is an obvious fault however there isn't one there at all! Either your ideas of correct colour are not quite right or else the adjustments we have just described need a further touch-up. This is the beauty of the PAL system: minor errors in the decoding are cancelled out so you have only the outputs to adjust. Go through the whole adjustment procedure again and you will get better results.

A luminance delay line is used to slow down the wideband luminance information so that it arrives at the c.r.t. screen at the same time as the narrowband chrominance information. A narrowband



(a) Colour-bar displays for each gun. All four bars should be of equal brightness

(b) The G−Y waveform adjusted for symmetry above and below the zero axis

Fig. 2: Adjusting the colour-difference drives.

channel slows down the signal. If the chrominance information lies to the right of the luminance then the luminance delay needs to be longer or the chrominance bandwidth wider. If the chrominance information lies to the left the luminance delay is too long.

Generally speaking you want a chrominance bandwidth of $\pm$1MHz and any delay time correction has to be carried out on the luminance delay line. This should normally give a delay of about 600-700nsec. An error of 100nsec is just about acceptable. You cannot easily lengthen a line, but it is possible to take some turns off to shorten the delay. You can only do this once, so be careful!

Any picture patterning which disappears when you turn the saturation control down, kill the colour or disable the decoder is due to chrominance information of some sort. There are two likely causes. 4·43MHz patterning which appears on monochrome areas of the picture is caused by the reference oscillator voltage getting into the luminance channel. Enhanced patterning in coloured areas may be due to either the chrominance subcarrier or the reference oscillator. The colour-difference or RGB output stages carry 4·43MHz carriers and operate at quite high currents. The earth paths (yes, again!) carrying these currents have to be routed carefully to avoid unwanted couplings.

Some demodulators generate quite large amplitude harmonics of the 4·43MHz carriers and these can be radiated to the tuner or i.f. circuits. The beats generated with the signal voltages can then appear at video frequencies on the picture. Demodulators should have filter circuits at the outputs to prevent harmonics escaping.

Colour killing circuits can be a little tricky to design correctly. If the threshold at which the killer "sees" the burst signal and turns on the decoder is set too high the decoder will remain turned off when a weak fringe signal is applied. If the threshold is too low and there is even a whiff of burst on a monochrome transmission (it sometimes happens) the decoder will be turned on and coloured noise will appear all over the screen.

It is important in fringe areas to adjust the gain of the colour killer to achieve a careful compromise between these two conditions. The more gain a decoder has, and the better the a.c.c. action, the more difficult it becomes to achieve the right setting. Under service area conditions there is no problem: if the colour does not kill satisfactorily you probably need to reduce the gain of the killer circuit.

Inevitably we have not been able to discuss all the possible defects and their causes that crop up in a newly constructed receiver and sometimes even in a manufactured one. We have nevertheless covered quite a large number. It seems to show what a vast field of potential interest lies in store for the television enthusiast, whether professional or home constructor.

We are not trying to suggest that all these defects occur in every receiver. They do not. And in many cases they are so slight that only a discerning eye will see them at all. Thus for most purposes they are unimportant. As a home constructor you can draw your own demarcation line between those defects you want to cure and others you can afford to ignore. The choice is yours and this is part of the fun. ■

INTERNAVEX 73

I.R.SINCLAIR Reports

INTERNAVEX is the International Audio-Visual Aids Conference and Exhibition: if this title leaves you as wise afterwards as before, Audi-Visual Aids are the gadgets that are now used in schools in place of teachers to lull our kids to sleep. The attraction for those concerned with television is the CCTV equipment—the educational market (including training departments inside large firms) is the largest user of CCTV and tends to dictate the shape of this important branch of television.

The main attraction this year had been billed as the World's first demonstration of 3-D colour TV. It was rather unfortunate that none of the people behind the enquiry desk had been told of this while only the show organiser knew that the demonstration had been cancelled. Had it taken place it would have consisted of two colour Eidophors (see TELEVISION November 1972) projecting on to a wide-screen system. It was hinted that a grooved screen similar to those used for the now-familiar 3-D stills might have been employed. It seems that we shall have to wait a while for the holographic techniques which are undoubtedly on the way to give 3-D television displays.

Colour

In the event the show was marked by colour and cassettes. If the use of videotape for educational purposes is to have any real impact it must be of comparable quality to the highly professional colour broadcasts which over a million families in Britain watch every night: we are no longer at the stage where fuzzy black and white pictures will cause an admiring chorus. Colour was predominant therefore on most of the stands, whether from slide projectors or from TV receivers, while the predominant colour receiver was our old friend the Sony Trinitron.

It was rather impressive to see a bank of about 24 Trinitron receivers working and giving bright pictures in the full lighting of Olympia: it contrasted with a British "Brand X" receiver which even with a hood over it was showing quite the worst colour pictures we have ever seen. Apart from the impressive display of Trinitron receivers—which incidentally cost no more than some of the monochrome receivers used by educational authorities—colour receivers were shown by National Panasonic, Hitachi and Decca. As usual the smaller screen sizes were more impressive in terms of sharpness and contrast.

Projection Monitor

One projection monitor, black and white alas, appeared on the Audio-Video Rentals stand. This used a projection tube working at a final anode voltage of 40kV (stabilised) and had an elaborate optical system to ensure reasonably low optical distortion. The same firm were also showing an impressive character-generator for use in titling. Several other makes of character-generating equipment were on show.

Videotape

In the field of videotape recording several familiar open-reel machines were seen, with National Panasonic showing time-lapse and remote-control versions. Cassette machines look like dominating the market in the near future however. The predominant need is to produce machinery which is "teacher-proof" since the teachers most likely to use videotape are also those least likely to understand anything mechanical. Painful experience with open-reel audio machines has convinced manufacturers that cassettes are a considerable advantage in this market and the same seems likely to be the case with video applications, especially in view of the shortage of qualified technicians (who are paid even less than the teachers) to look after the machinery.

The well-known Philips Video Cassette Recorder (VCR) deck appeared in several different guises on the stands of Philips, Pye and Radio-Rentals. Pye were also showing a video-enhancement adaptor which sharpens the video signal and so compensates for the high-frequency losses inevitable in the recording technique. The Philips system is being taken up by a large number of companies, notably Thorn in

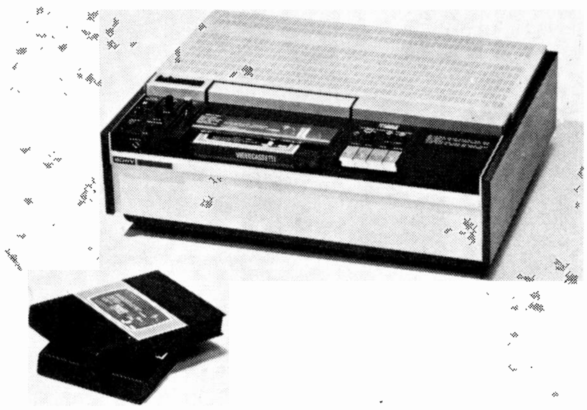
National videocassette recorder/players. Above, the NV5125 $\frac{1}{2}$in. model; below, the NV2125 $\frac{3}{4}$in. model. There are PAL and NTSC versions. Tuners and an r.f. unit are incorporated as standard. The video modulation system is double-sideband f.m.

this country, but also including Telefunken, Blaupunkt, Grundig, Lenco, Loewe Opta, NordMende, Saba, Zanussi and 3-M.

This list looks impressive but unfortunately most of the educational authorities are using Sony reel-to-reel recorders at the moment and will naturally be inclined to change to Sony videocassettes which are not compatible with the Philips system nor with the Japanese EIAJ standards. The differences lie in tape speeds and widths and in the methods used for encoding the video and chrominance signals for recording. It seems most unlikely now that we shall see any single standard adopted worldwide, so we can expect a long and painful battle over standards for several years. Some educational advisers commented that they had yet to see a cassette system which was compatible even between two machines of the same make: this probably reflects standards of maintenance rather than standards of manufacture.

National Panasonic seemed to be backing two horses with a ½in. tape cassette running at 16.32 cm/sec on the PAL system and to EIAJ standards and also a ¼in. tape width cassette with a tape speed of about 9.5 cm/sec.

Just to be different Hitachi showed an EVR player (remember EVR?) of neat and compact design. But it did seem rather submerged amongst all the videocassette recorders and cannot of course offer the advantages of recording broadcast programmes directly.



The Sony U-matic colour videocassette machine. There are two versions: the VO1601D has both recording and playback facilities while the VP1001D is for playback only. An optional r.f. unit is available. A rotary two-head helical-scan system is used and the luminance signal is frequency modulated.

Single-tube Colour Camera

Technically the highlight of the show was on the Electrocraft Instruments stand. It was a single-tube colour camera using the RCA Spectraplex vidicon (see TELEVISION June 1973) and measured an impressive 8½ x 3 x 3in. excluding the lens. The camera contained little more than the vidicon and its immediate circuitry however, a fair rackfull of equipment being required as backup. Nevertheless the picture was most impressive and the demonstration a very worthy effort from a small British company who deserve to succeed in this highly competitive market.

Incidentally there may soon be a British made tube to compete with the Spectraplex and we can expect the price of single-tube colour cameras to come down noticably in the future.

Finally a note of mixed congratulations and puzzlement. Congratulations to the man on the Philips stand who had the foresight to set out the massive stereo recorder with a pair of earphones and a programme of music very much to my taste. The puzzle—why should an audio recorder not even sporting Dolby cost as much as a colour videocassette recorder? ●

SERVICING TV RECEIVERS

—continued from page 25

tode anode from HT1. Here then we have some clues as to what is at fault and what is not.

Fault Clues

If the screen is lighting up obviously the line timebase is working; so is the h.t. to most sections and therefore the supply to the PCL86 triode anode and pentode screen. The supply to the pentode anode however is derived from a separate source HT1 which does not feed any other part of the receiver: it is the smoothing resistor (R102) in this supply that is likely to become open-circuit, leaving the screen of the valve glowing as it takes the full current.

Quick Checks

With the chassis the way it is in the operating position it is quite easy to take the voltage readings at the PCL86 base and then work back to the h.t. supply, remembering that the output transformer primary connects directly to pin 6 and that there is a further resistor R128 (100Ω) from the transformer to the h.t. supply at R102.

Brightness Circuit

As already mentioned the tube is grid modulated. The brilliance control is in the cathode circuit and so to increase the brightness the voltage applied to the cathode must be reduced. With an average voltage of 45V applied to the tube grid the brilliance control swings the cathode from about 80V (maximum brilliance) to about 200V (minimum brilliance). The line and field flyback blanking pulses applied to the cathode via D11 and developed across R164 are positive-going.

Summary

All in all then this is an interesting and reliable chassis with only a few weak points. These may be itemised as: occasional failure of one of the wire-wound smoothing/dropper resistors on the left-hand side, lack of width due to the 10MΩ resistor R159 going high-resistance, defective capacitors in the line oscillator circuit, damage in the audio output stage due to the PCL86 shorting internally, intermittent picture due to the video output transistor becoming open-circuit with heat, faulty electrolytics in the a.g.c. circuitry and occasional failure of the transistors in the tuner unit.

THE 'TELEVISION' COLOUR RECEIVER FORUM

THIS new feature is devised as a platform on which basis we hope that constructors who have successfully completed the TELEVISION Colour Receiver will join the magazine staff and consultants in discussing matters that we think will help others to obtain good results.

We have already been in touch with several successful constructors some of whom have agreed to take part. Some have expressed their own ideas on various technical aspects and we expect to be able to publish some of these.

We invite you to contribute brief but helpful comments or suggestions in writing. We can make use of clear sketches, and welcome monochrome photographs of sets or parts of sets where these might help to support your notes. We would like to make it clear however that all material sent to us will be carefully studied before publication. We reserve the right to delete or amend any parts and we cannot necessarily agree that material published in this feature will be suitable for adoption in all constructors' receivers. Our aim is to pass on helpful hints, solutions to particular problems and any improvements that individual readers may devise.

Please do not send any parts of your receiver to us unless we specifically request you to do so; we cannot guarantee their safe return. All contributions published in this feature will be paid for at our normal rates. Contributors' addresses will not be published. We cannot answer telephone enquiries regarding this feature or the set itself.

The last provisional date for using our Fault Finding Advisory Service (form in the August, September and October issues) is November 30th. We shall make an announcement next month about the possibility of an extension.

Dear Sir,

FIELD FLYBACK BLANKING; PICTURE SHADING; LINE OSCILLATOR COIL

The circuit shown in Fig. 1 was devised for field flyback blanking and has been found to give excellent results. It takes the flyback pulses from the field oscillator stage, inverts them and applies them to C703 on the c.r.t. base panel. C702, R710, R711 and D702 are omitted when using this circuit which can be built up on a piece of Veroboard and mounted in any convenient position, e.g. at the top of the cabinet above the c.r.t. base panel. The type of transistor used is not critical, e.g. BC107/BC147 etc.

Shading on the picture may be experienced as a result of the supply to the c.r.t. first anodes not being smoothed. A solution which we have tried and works well is to decouple pins 4, 5 and 13 of the c.r.t. Use 0·01μF capacitors rated at 1·5kV for this purpose: they can be mounted quite easily on the reverse side of the c.r.t. base panel, from the appropriate pin connections to the nearest earth section of the print.

A suggestion for getting correct line oscillator tuning—adding an 0·01μF capacitor in parallel with C322—has already been made. This does not seem to give very satisfactory results. The problem appears to be that the coil tapping should be well towards one end of the coil. The simplest solution is to use a standard line oscillator coil—these can be obtained from Forgestone Components—and to tune it with C322 (0·0033μF) alone as originally specified. For some reason that has caused puzzlement to us a PCF80 seems to work more satisfactorily in this circuit than a PCF802.

DECODER LINK; WIRING ALTERATIONS

The decoder modification shown in Fig. 2—adding an earthing link between L3 screen earth and the decoder centre earth plane—reduces the earth line impedance at this point and makes a worthwhile improvement to the picture.

A number of wiring alterations which make worthwhile improvements are listed below.

(1) Use screened wire for the connections to the brightness and volume controls, the connections from 1F to 3D, 1E to 3E and 1D to tag 9 on the line output transformer; also for the voltage feed from the tuner control panel to 8H on the tuner/i.f. preamplifier panel. Earth the screens of the leads from 1F to 3D and 1E to 3E at both the decoder and the RGB board.

(2) Use twin screened wire for the connections between 8F and 2F, and 8G and 2G, making the earth connection at 2J only; also for the connections between L124/5 and 8L, 8M, again earthing at 2J only. Note that there is less susceptance to noise pick-up if the leads from L124/5 are taken direct to

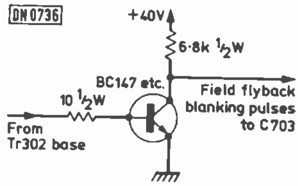
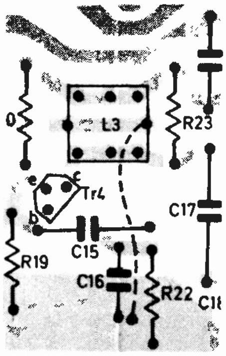


Fig. 1: Field flyback blanking circuit suggested by E. Erven. Use screened lead for the input from the timebase board, earthed at 4J only. Remove C702, R710, D702 and R711.



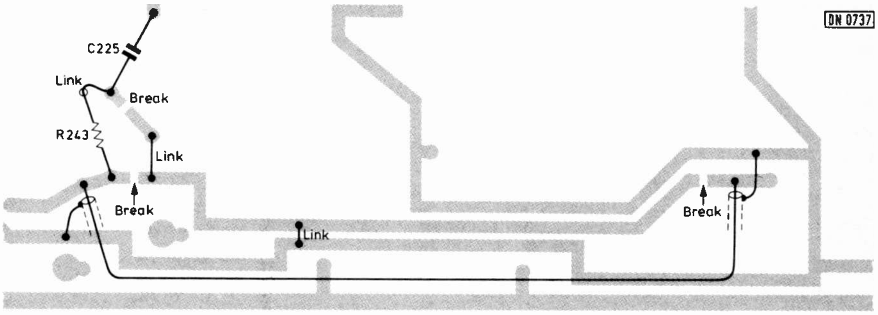


Fig. 2: (above left): Adding a link from L3 screen earth to the decoder board centre earth copper cleans up the picture.

Fig. 3 (above right): This modification to the RGB board removes a bright line down the left of the screen.

the tuner control panel instead of via 8M and 8L on the tuner/i.f. preamplifier panel.

(3) A worthwhile improvement to the performance of the i.f. strip is obtained by making the power supply connections 2A and 2J at the delay line end of the board adjacent to R155 and C150 as specified in the alignment procedure (page 318, May 1973) instead of to the points at the other end shown in Fig. 1, August.

(4) Make sure that 1J and 2J are connected, also 8D and 2J; remove the connection from 1J to 6C and make sure that 8D has not been earthed to 6C. 2J is connected to 6C of course.

The three signal boards—i.f., decoder and tuner/i.f. preamplifier—can be mounted side-by-side on a sheet of hardboard at the left-hand side of the cabinet. This simplifies the interconnections between them and improves the performance. It is also possible to mount the RGB output board vertically to the left of the c.r.t. towards the centre of the cabinet: this, provided R401, R402 and R403 are moved to a position nearby, enables short leads to be taken to the RGB input points on the c.r.t. base panel, improving the frequency response—a piece of plastic can be used to keep the three leads neatly separate from each other.

BRIGHT LINE ON L-H SIDE

A bright line down the left-hand side of the screen could be moved by adjusting the horizontal shift control. This was traced to pulse pick-up at the base of the B−Y preamplifier transistor Tr202. The modifications shown in Fig. 3 provide a complete cure, reducing the pulse to a level far below that of the video signal. Break the tracks at the three points shown and connect R243 and R244 by means of a screened lead along the edge of the board with the screening earthed as shown; move R243 and C225 as shown and add the three links indicated.

—*E. Erven.*

L403 (LINE LINEARITY) AND L408

Reversing the connections to the line linearity coil L403 (cut tracks and bridge across) gives improved operation and removes striations. It may be necessary to drill a hole in the board beneath L408 to allow the core to pass through for optimum adjustment.

CONTRAST CONTROL

Poor sync performance has been traced to

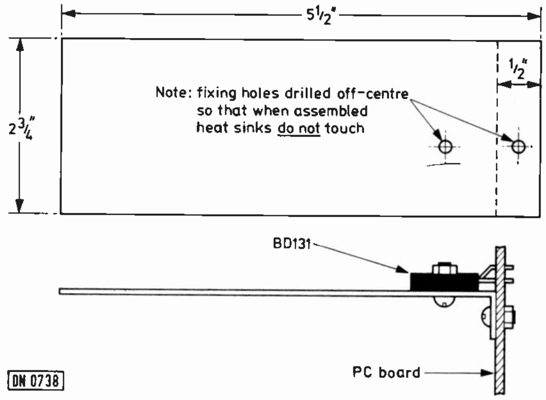


Fig. 4: Simple, effective heatsink for the BD131 field output transistors.

inadequate sync pulse amplitude being developed at Tr109 collector. The use of a 500Ω contrast control potentiometer as in the original Mullard circuit overcomes this problem.

BD131 HEATSINKS

Some constructors have reported that the BD131 field output transistors run hot as we warned in the September issue. A solution is to mount them on the simple heatsinks shown in Fig. 4. These—one is required for each BD131 transistor—are made of 14 s.w.g. aluminium sheet. Some constructors have used the type of heatsinks specified for the RGB output transistors. These are certainly adequate.

IDENT COIL

We have received varying reports about the output obtained from the ident coil on the decoder board. Readers who have been unable to obtain adequate ident output (about 8V peak-to-peak should be obtained) to over-ride the colour killer might like to know that Forgestone Components are offering a service to bring the coil up to an improved specification.

POWER SUPPLIES

Probably one of the most important of the various requirements in the published power supply design is

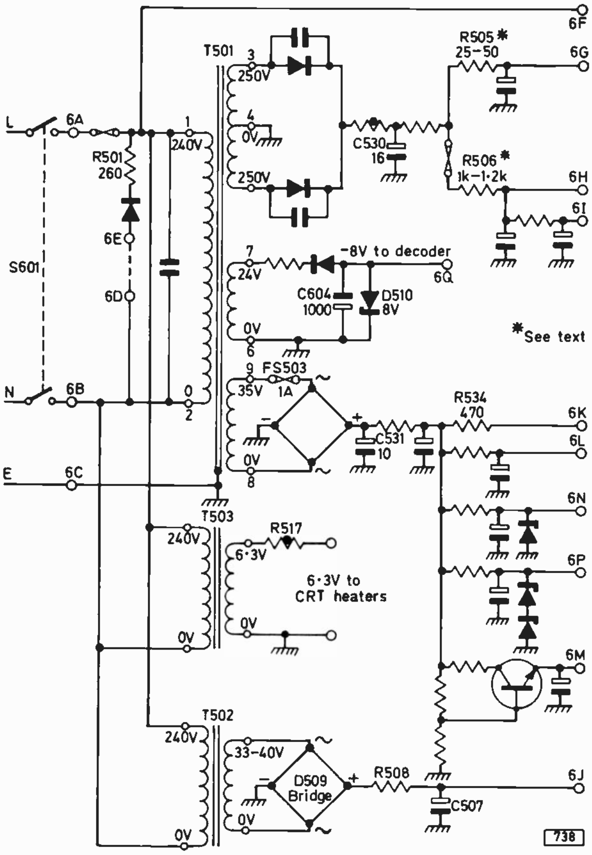


Fig. 5: Suggested alternative power supply circuit. Previous modifications are also incorporated. Only those components which have been changed in position or value are marked. Additional components required are a 2A 100V bridge rectifier (D509), an 8V zener diode (D510), a heater transformer (T503) with 240V primary and 6.3V 1A (minimum) secondary winding, and a mains transformer (T502) with 240V primary and 33-40V, 1.5-2A secondary winding (rated at 50VA minimum). T502 and T503 can be a single transformer.

that the d.c. outputs and chassis should be totally isolated from the a.c. mains supply. It was mentioned in the January issue that the aim was electrical safety. Consequently among other assets it does mean that the constructor can provide a safe audio feed to a hi-fi system.

Such a design, particularly for a colour receiver, means that to drive all circuit boards it is necessary to use a large mains transformer. The power requirements were set out in the January issue and although it was not stated it did imply that the loads were going to be fairly large.

To undertake this task a transformer was designed within certain cost versus performance limitations. This transformer (supplied in Pack 18) provides the required voltages under modest loading conditions but when the current demand goes up the transformer has been found to react in various ways, partly due to magnetic saturation. One of these reactions is the reflection of voltage variations from one supply line on to another and this can give rise to apparently faulty operation of some of the circuits. This particular effect is exaggerated if the source impedance of the transformer windings is too high, or if there is little or no form of voltage stabiliser used for loads that are subjected to variation during operation.

There are a number of ways of overcoming the problem but we will look here at two that are appropriate to this project. The simplest is to use a larger transformer with very low winding resistance, though this would be considerably more expensive than the original. In order to minimise secondary winding resistance it is sometimes beneficial to wind the low-voltage secondary windings first, the high-voltage secondary windings next and the primary on the outside. By using larger gauge wire for the secondaries the resistance of these can be reduced but a larger core size to accommodate the extra copper will be required.

The alternative is to use more than one transformer. This is probably the most satisfactory method in any application, although the demands on space will increase. This does provide some isolation between high-voltage and low-voltage secondary windings however.

Either approach can be adopted for this particular project but it is likely that many constructors will have already purchased a transformer of some kind. If you have the transformer supplied in Pack 18 by Electrokit the following procedure can be tried (refer to Fig. 5, and Fig. 1 January).

Maintain the h.t. supplies driven from the 250-0-250V winding as published. If you choose you could incorporate a voltage stabiliser using a 2N3055 transistor though it may operate close to its limits. If you keep the smoothing arrangement shown you could reduce R505 to about 25Ω (10W) to give a little more flexibility on the line timebase h.t. supply. With the value of R506 originally shown you may not be able to achieve sufficient RGB h.t. voltage but you should still be able to get reasonable results. It may be worth dropping R506 to 1kΩ or 1·2kΩ (15W).

The voltage at the diode cathodes (D502, D503) should read 350V d.c. on an Avo Model 8 when no load is connected to 6G, 6H and 6I but will drop when loaded. The manufacturers quote a nominal a.c. rating on this secondary winding of 600mA but it will tolerate higher peak values. C530 (16μF, 450V) should be included between the junction of R503, R504 to chassis as recommended in the August issue.

Next the 35V winding. This supplies a number of circuits of widely differing load requirements from a couple of milliamps to more than 1A. Since the field timebase draws more current than any of the others on this chain (around 600mA average to 1·25A peak) it may be better to take this feed from a separate transformer or secondary winding. To do this disconnect R508 from the positive line from D504 and connect instead to a second bridge rectifier with the same ratings. It is probably easiest to cut away some of the copper strip on the board and solder a connecting wire to the R508 pad from the new rectifier which can be mounted on the new auxiliary transformer.

The range of suitable readily available transformers is limited, but there are some multi-tap types produced by Douglas and Osmabet that can supply 33 to 40V. The current rating should be a minimum of 1·5A.

This modification should relieve the pressure on the existing winding and avoid problems with the

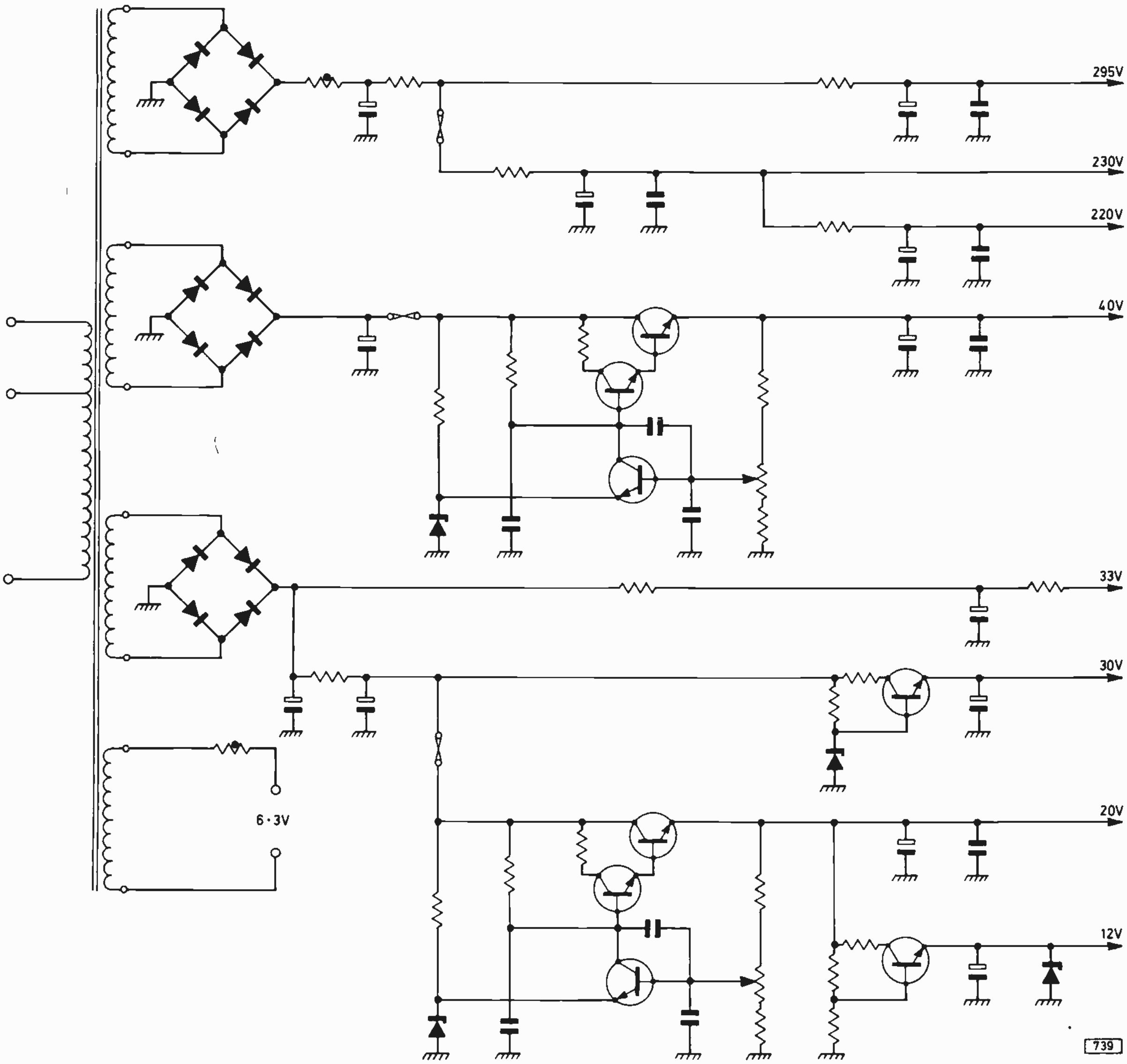


Fig. 6: Full details of this very stable power supply circuit which a reader has devised for use with the colour receiver will appear shortly.

other feeds. C531 (10μF, 63V) should be added from the junction of D504 and R509 to chassis as recommended in our August issue. The off-load voltage across C531 should read about 50V on an Avo Model 8. Change FS503 to 1A.

The other secondary winding at 24V can be used if convenient to feed the −8V supply required by the colour killer circuit in the PAL decoder, retaining R516 and D505 but removing R517 (the VA1033 thermistor). The −8V line is taken direct from D505 anode, an 8V zener diode being added with its anode connected to D505 and its cathode to the large copper pad to transformer terminal 6. Use terminal 6Q for the −8V line and replace R517 by a wire link. Connect C604 across the 8V zener diode.

We now have a spare VA1033 thermistor which is ideally suited to connect in series with the 6·3V 1A (minimum current rating) winding of another transformer. This is used to supply the c.r.t. heaters completely independently of any other circuit, a precaution against possible expensive damage if a heater-cathode short or flashover occurs in the c.r.t.

Fig. 5 indicates the circuit details only and includes the modifications previously published. The alterations to the wiring and component connections are minimal and can be carried out in a matter of minutes once the extra components are to hand. It is important to keep the transformers well away from the signal carrying boards and wiring in order to keep hum down.

A constructor with whom we have been in touch has developed for the colour receiver the power supply circuit shown in outline in Fig. 6. This is based around the use of a large mains transformer and gives extremely stable results. The components used in this circuit, which we hope to publish in full next month, include most of those supplied in the original Pack 18 plus a few extra ones.

LONG-DISTANCE TELEVISION

ROGER BUNNEY

AUGUST usually brings declining Sporadic E conditions, with an enhancement in tropospherics if settled weather is prevalent. This year has certainly been an exception, with Sporadic E receptions at a reasonable level and what can only be described as excellent tropospheric receptions from a very wide area. There was also some Meteor Shower activity particularly on the evening of the 11th—this was the predicted Perseids shower.

Sporadic E gave reasonable openings throughout most of the month, declining somewhat during the last ten or so days. Signals from all parts seem to have arrived —both long and short skip. During an opening here (Romsey, Hampshire) on the morning of the 10th DFF (East Germany) was noted carrying a new identification on their test pattern—DDR-F 1. One mystery—on ch.R1/E2a—the checkerboard pattern as used by RTP/TVE was noted at 0850 CET. Another query has been solved thanks to our friend Seppo Pirhonen in Finland: the YLE card had been noted carrying the lettering "CNCT YLE" which he tells us is the abbreviation for "Centre National Controle Technique".

The slow-moving high-pressure areas during the month provided what can be described as a field day for long-distance television enthusiasts. Graham Deaves came on the telephone during the morning of the 13th to tell us of East Anglican receptions which when logged resembled the EBU station list! These conditions continued throughout the following week and even in my valley location—but thanks to new aerials (see later)—I logged four new Band III transmitters (including Denmark as a new country in Band III) and 24 new u.h.f. transmitters in France, Belgium (as a new country on u.h.f.) and West Germany! Norway/Sweden have also been reported at good locations.

Aerials

On August 12th the new aerial system went into operation here. Another 10ft of lattice has been added lifting the Band I/II (TV) aerial to 42ft, the 13-element Band III array to 45ft and the u.h.f. array to 51ft —all wideband arrays. The u.h.f. aerial is somewhat unusual, consisting of a 7ft high by 5ft wide paraboloid covering all u.h.f. with a very high gain. As space is short this month I will leave description and illustration until next month when I hope to deal with aerials rather more fully.

Log

Now to the log—up to the 12th reception was via a wideband two-element Band I array facing East and an eight-element wideband Band III array also directed towards the East.

1/8/73 DFF (East Germany) E4—MS (Meteor shower); TSS (USSR) R1, 2; TVP (Poland) R1, 2; DFF E3; SR (Sweden) E2, 3, 4; NRK (Norway) E2, 3, 4—all SpE.

2/8/73 DFF E4; CST (Czechoslovakia) R1—both MS; TSS R1—SpE; NOS (Holland) E4—trops.

3/8/73 DFF E4; CST R1—both MS; WG (West Germany) E2—SpE.

4/8/73 DFF E4; WG E2—both MS; TVE (Spain) E3, 4—SpE; BRT (Belgium) E10—trops.

5/8/73 DFF E4; TVP R1—both MS; CST R1—SpE; BRT E8, 10—both trops.

6/8/73 DFF E4; CST R1—both MS.

7/8/73 DFF E4—MS; NOS E4—trops.

8/8/73 CST R1; TVP R1—both MS; SR E2, 4; TVE E2, 3 twice, 4; RAI (Italy) IB; WG E4—all SpE; NOS E4; BRT E10—both trops.

9/8/73 DFF E4—MS; ORF (Austria) E2a—SpE.

10/8/73 TSS R1, 2; DFF E3, 4; also various unidentified signals—all SpE; NOS E4—trops.

11/8/73 TSS R1; TVP R1, 2; CST R1; MT (Hungary) R2; SR E2, 3, 4; NRK E2 twice, 3, 4 twice; RAI IA; TVE E2, also unidentified signals —all SpE; NOS E4—trops.

12/8/73 DFF E4; TVP R1—both MS; MT R1; NRK E2, 3—both SpE.

13/8/73 DFF E4—MS.

14/8/73 DFF E4—MS; RAI IB; TVE E2; Switzerland E2—all SpE; also excellent tropospherics—Kiel ch.E5 (new transmitter) and various u.h.f. stations up to ch. E56 from NOS, WG, ORTF.

15/8/73 DFF E4—MS; NRK E3—SpE; also tropospherics into Central France at u.h.f.

16/8/73 DFF E4; CST R1—both MS; BRT E8, 10 —trops.

17/8/73 DFF E4—MS; TSS R1, 2—SpE; NOS E4—trops; also trops into central France at u.h.f.

18/8/73 NRK E2 twice; TVE E2, 3, 4; RTP (Portugal) E3—all SpE; NOS E4; BRT E10; plus trops into central and eastern France.

19/8/73 CST R1—MS; also trops into France and Belgium at u.h.f.

20/8/73 TVE E2—SpE; also trops into France u.h.f., Belgium v.h.f.

21/8/73 DFF E4—MS; MT R1, 2; RAI IA, IB—both SpE; also trops into Belgium v.h.f./u.h.f., France u.h.f.

22/8/73 DFF E4—MS; TSS R1, 2; DR (Denmark) E3; MT R1—all SpE; also trops into Belgium v.h.f./u.h.f., France u.h.f.

23/8/73 DFF E3, 4; CST R1; SR E4—all MS; also trops ORTF (France) u.h.f.; BRT u.h.f.

24/8/73 CST R1—MS; also excellent trops into Denmark v.h.f., NOS v.h.f./u.h.f.; WG v.h.f./u.h.f.; ORTF v.h.f./u.h.f.

25/8/73 NRK E2; MT R1—both SpE; also excellent trops into WG v.h.f./u.h.f.

26/8/73 DFF E4; CST R1—both MS; NOS E4—trops; also trops BRT u.h.f., ORTF u.h.f.

27/8/73 DFF E4; ORF E2a; NRK E4—all MS; trops BRT v.h.f./u.h.f., ORTF u.h.f.

28/8/73 DFF E4—MS; trops ORTF u.h.f., BRT u.h.f.

29/8/73 DFF E3, 4; DR (Denmark) E3—all MS.

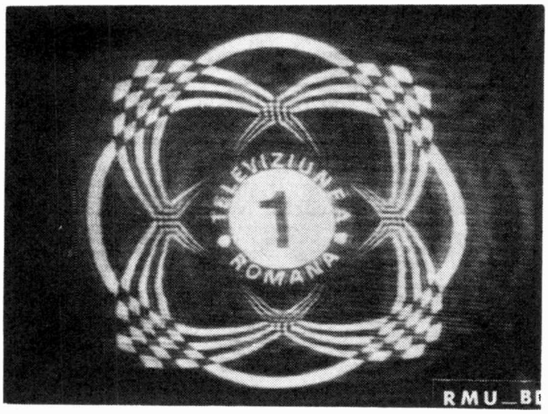
A great effort has been made this past month to log DFF (East Germany) on ch. E4 on a daily basis via MS: unfortunately this goal has yet to be reached! The excellent tropospherics have certainly put the new dish array through its paces but even on dead days it has been possible to log Paris ch. E22 with a signal of sorts—previously Paris could be logged only during "good" conditions.

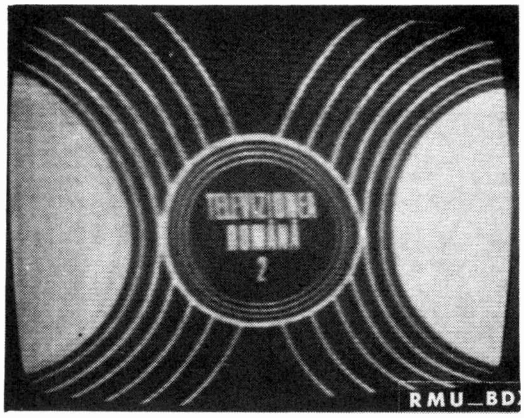
Comments

Our congratulations to both Garry Smith (Derby) and Clive Athowe (Norwich) who have at last successfully logged Albania ch. IC on test card (11th August at 1650 CET). Clive also has a mystery—ch. E2 at 1823 CET, a system B signal comprising a film with French subtitles.

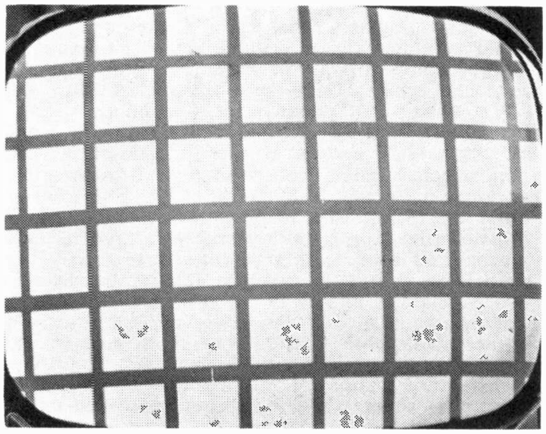
Rounding up the miscellaneous news items P. F. Vaarkamp (Holland) reports that: the Belgium TV Dutch second service will commence at v.h.f. on Novem-

DATA PANEL 28—2nd Series





Radio Televiziunea Romana (Rumania) network identifications, TVR1 left, TVR2 right. Courtesy Ryn Muntjewerff



Test-grid used by Compagnie Libanaise de Television (CLT)—Lebanon. Since CLT now transmit colour (SECAM) we assume additional test charts are in use.

Tele-Orient use the Marconi No. 1 test chart (see August 1971 Data Panel).

Algeria—Television Algerie—station identification crest.

Jordan Television use the Marconi No. 1 chart and have been reported recently using the Philips PM5540 pattern.

Photographs courtesy Advision, Beyrouth (left) and Garry Smith, Derby (right).

ber 13th this year; CST (Czechoslovakia) have commenced regular colour transmissions using SECAM as of May 9th last; the NOS network news has been seen carrying an insert from DFF—a photograph was enclosed and prominently displayed are the "ak" initials for the "Aktuelle Kamera" news programme (consequently some care should be taken to avoid logging this during programme hours as DFF, especially at u.h.f. if a weak and fading signal); CST have purchased a PM5544 pattern generator for the Bratislava studio—no comment!

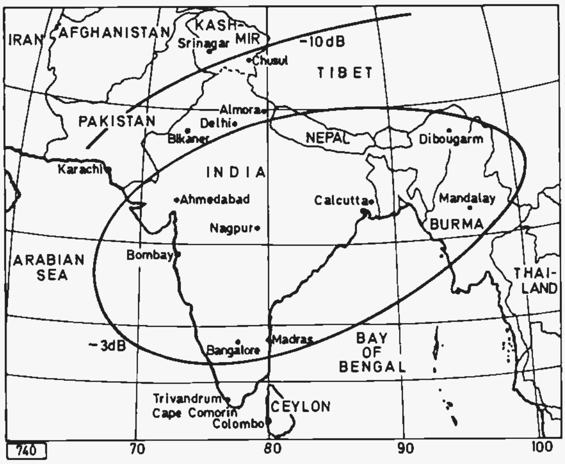
News Items

Malta: Michele Dolci (Italy) tells us that plans are afoot to construct a high-power v.h.f. transmitter (commercial) on the island to transmit in Maltese and Italian. The coverage will include a great part of Sicily.

Libya: The TV network operating out of Cirenaica is using test card C and the other network operating out of Tripoli the "eagle" type card. The mystery E4 transmitter is operating from the Tripoli network. Information from M. Dolci.

East Germany: DFF have started regular SECAM colour transmissions on the first network. At present these are carried over Berlin E5 and Dresden E10. Later this year they will be extended to Cottbus E4, Lobau E9 and Leipzig E9. Information received from Dieter Scheiba (Belgium).

Denmark: Although now something of historical note the following is worth putting on record. The ch. E4 transmitter near Copenhagen was destroyed by fire on the night of April 10th 1973. Following this the Swedish ch. E2 transmitter at Horby relayed the Danish TV programme (from April 11th, 1630 CET). Meanwhile a standby ch. E4 transmitter from the Swedish Finnveden transmitting site was rushed to Denmark and was in operation by 1930 on the 12th and at 2000 Horby resumed



Coverage of the satellite TV transmitter providing a service to the Indian subcontinent. Courtesy NASA.

its normal role. If anyone received the Danish PM5544 card on ch. E2 during this period, that is the full story! *New EBU transmitter listing:* Filipstad, Sweden (second chain). Ch. E33 horizontal, an increase in e.r.p. from 1kW to 1000kW. Location approximately 130 miles west of Stockholm.

Graham Deaves (Norwich) has brought to our notice a system of transmitter identification which is used by TSS transmitters. A series of identification signals are inserted during the field flyback period along with the various test signals. If anyone has information however vague relating to this we would be interested in hearing.

Satellite Transmissions

Much has been said about the great possibilities opened up by satellite transmission to land masses, giving a coverage that could only be achieved with a great many land based transmitters. Later this year NASA will be launching the ATS-F satellite into an Equatorial synchronous orbit to provide educational and instructional programming to the Indian Continent. The coverage is shown in the accompanying map. The primary service area will receive a calculated e.r.p. of 120kW. Programmes will initially be for up to 6 hours daily, originating from TV centres at Ahmedabad, Bombay and Delhi, using an uplink frequency of 5950MHz. The satellite will retransmit the television signal back to Earth at a frequency of 860MHz ± 15MHz with f.m. video modulation, using an 80W transmitter feeding into a 30ft dish reflector. Programmes will be received directly by special receivers set up in village centres or at existing and predicted v.h.f. transmitter sites, the latter then retransmitting them at v.h.f. The experiment will last for one year initially and it is anticipated that a fully fledged system using high-power transmitters could be in operation in the late 1970s. The satellite will be some 36000km high at 35°E longitude. I feel that the chances of receiving signals at the frequency noted above are small but I certainly consider it worthwhile at least trying to do so. If any further information comes to hand we will of course pass it on immediately.

0dB = 1 MICROVOLT OVER 75 OHMS

dB	μV	dB	μV	dB	μV	dB	μV	dB	μV
1	1.12	21	11.2	41	112	61	1120	81	11200
2	1.26	22	12.6	42	126	62	1260	82	12600
3	1.41	23	14.1	43	141	63	1410	83	14100
4	1.59	24	15.9	44	159	64	1590	84	15900
5	1.78	25	17.8	45	178	65	1780	85	17800
6	2	26	20	46	200	66	2000	86	20000
7	2.24	27	22.4	47	224	67	2240	87	22400
8	2.51	28	25.1	48	251	68	2510	88	25100
9	2.82	29	28.2	49	282	69	2820	89	28200
10	3.16	30	31.6	50	316	70	3160	90	31600
11	3.55	31	35.5	51	355	71	3550	91	35500
12	3.98	32	39.8	52	398	72	3980	92	39800
13	4.47	33	44.7	53	447	73	4470	93	44700
14	5.01	34	50.1	54	501	74	5010	94	50100
15	5.62	35	56.2	55	562	75	5620	95	56200
16	6.31	36	63.1	56	631	76	6310	96	63100
17	7.08	37	70.8	57	708	77	7080	97	70800
18	7.94	38	79.4	58	794	78	7940	98	79400
19	8.91	39	89.1	59	891	79	8910	99	89100
20	10	40	100	60	1000	80	10000	100	100000

(Courtesy R. Smith Aerials, Luton)

Aerial Gain Chart

We commented recently on the aerials available from R. Smith Aerials, Luton. Their catalogue contains an interesting and useful chart comparing decibels against microvolts from a reference point of 0dB at 1μV over 75Ω. Decibel ratings are logrithmic and this chart gives an appraisal of signal increases to be expected.

From Our Correspondents . . .

A very long letter has come from our varicap f.e.t. aerial amplifier expert Dave Bunyan (Sittingbourne) detailing reception over the Summer period with it seems excellent results. Dave has had successes in Band II (TV) using an "upconverter", including TSS, TVR (Rumania), RAI ch. 1C and MT. Dave also comments at length on a certain aspect of tropospheric propagation, selective fading from cosited u.h.f. transmitters such as Goes E29 and E32 (NOS), Lille E21/E24 etc. At times one transmitter is being well received whilst the other of the pair is poorly received, then the situation reverses. At times both transmitters are received equally well. Dave thinks the complex relationship between the two channels is related to the refractive index (k) of the troposphere, and that the effect of independent fading is most noticeable in conditions of turbulence. Possibly it's a case of random variations in the troposphere enhancing the scatter on one channel whilst not on the other, a slight shift/redistribution (wind-shift) then favouring the other channel. So far no answer can be found as to why Band III can at times be dead and u.h.f. open whilst at other times both are open. Can anyone comment?

A number of new correspondents have written in to report the enhanced conditions within recent weeks. Raymond Allison (Brigg, Lincs) has been using J Beam MBM70s with a colour receiver to successfully log various Dutch and West German u.h.f. stations. He anticipates using the 4MBM70 and a two-stage varicap-tuned masthead amplifier in the near future—with this apparatus I feel that ATS-F is an assured signal in the Lincolnshire countryside!

Roy Ford (Bristol) has also been active with Sporadic E this past season, with it seems all countries in Europe received (excepting RUV, Iceland).

Nigel Hanwell (Sheffield) has like Roy been active but experiences problems with his local ch. B2—Holme Moss. However the h.f. end of Band I has been well searched during recent months, with great success from various Scandinavian countries.

E. G. Duncan (St. Andrews, Fife) has sent in a number of photographs which have come out very well. One of his shots shows the new TSS electronic pattern. For the record he uses a single-lens reflex (Praktica) with 1/15th second exposure at either f5.6 or f8 on FP4, the film being developed in ID11 for 6½ minutes at 20°C.

We have rather bad news from an old friend, Frank Smales of Pontefract. A serious eye complaint has resulted in a loss of sight in one eye and a deterioration of sight in the other; all this is in addition to a long standing chest complaint. I am sure all readers will wish to endorse my best wishes to Frank.

YOUR PROBLEMS SOLVED

★ Requests for advice in dealing with servicing problems must be accompanied by an 11p postal order (made out to IPC Magazines Ltd.), the query coupon from page 43 and a stamped, addressed envelope. We can deal with only one query at a time. We regret that we cannot supply service sheets or answer queries over the telephone. We cannot provide modifications to circuits published nor comment on alternative ways of using them.

ULTRA 6703

If channels are changed within 3-4 minutes of switching on from cold field sync is lost. After a few seconds the picture settles down with about 10 fields one above the other. By switching the receiver off and on again quickly normal scan is obtained. A further channel change however necessitates repeating this procedure. Changing channels once the set has warmed up does not cause loss of sync.—T. Rowntree (Bacup).

The trouble is in the field oscillator stage, in the vicinity of C423 and W421 on the field timebase board. Check by disturbance all components in this area, suspecting dry-joints and poor connections. (BRC 3000 chassis.)

MURPHY CV2511

The monochrome picture is normal but on colour the red information is displaced to the right of its correct position by about $\frac{3}{8}$in., producing a cyan border to the left of objects and a pink border to the right.—T. Eversley (Loughborough).

We suggest you check the 120μF capacitor 5C27 in the emitter circuit of the R−Y preamplifier transistor 5VT4. If this electrolytic is open-circuit it will affect the frequency response of the stage, delaying the R−Y signal to produce the symptoms you describe.

FERGUSON 3626

Full width is obtained when there is no signal but with a signal present there is a $\frac{1}{2}$in. gap at each side of the screen. The width control is hard against its stop. The voltages in the line timebase are correct except for the line oscillator anode voltage which is high—all components in this stage have been tested and found to be correct however. The line timebase valves have been replaced without improvement.—J. Code (Tavistock).

The first thing to check is the width circuit—the v.d.r. and associated resistors. If these are in order there is little left to check and the suspicion must fall on the line output transformer or the deflection coils. (BRC 900 chassis.)

GEC C2103

The convergence panel had to be replaced but we are having difficulty setting up the new one. Red and green can be accurately superimposed but trouble comes when trying to line up blue. The blue raster takes on a diagonal slant in relation to red/green and no amount of adjustment to the appropriate controls will remove this. Data supplied with the new panel suggested connecting a 150Ω resistor across R605 in the blue shape circuit if necessary but this does not improve matters. Shifting the deflection yoke has also been tried without success. Also the width of the blue raster cannot be correctly set, stopping short at each side of the screen.—L. Crafer (Pontefract).

The trouble you are having is most likely to be due to a dry-joint or poor earth connection on the convergence panel so you will have to make a detailed investigation to try to find this.

HMV 2648

Various repairs were carried out, including fitting a new e.h.t. tray, in order to get this set working. The problem now is that even with the width control at minimum the width is excessive—about $1\frac{1}{2}$ to 2in. at each side of the screen on both systems. All the components in the width circuit have been carefully checked and found to be in order. The line output stage voltages are also correct. The controls work normally except for the focus control which is rather critical. I am wondering whether I was supplied with the wrong e.h.t. tray?—B. Talbert (Oldham).

The e.h.t. tray you were supplied with should have a white disc to indicate that it is a 20kV type. The presence of a different disc marking (pink or green) on the e.h.t. tray would indicate that it is a lower voltage type. Low e.h.t. would of course result in a larger picture, with impaired focus. Since you have checked all other likelihoods this does seem to be the cause of the trouble. (BRC 1400 chassis.)

FERGUSON 3639

Both the line and field hold are extremely unstable, requiring constant adjustment: they are also affected sometimes by the setting of the contrast and brightness controls. The video, sync and timebase valves have been checked and the hold controls changed. There is also intermittent opening out of the top half of the field scan—when this happens the field hold control has no effect.—R. Williams (Salisbury).

The cause of the poor sync performance lies in the video amplifier circuit where you will find that the bias stabilising resistor R26 (39kΩ) has changed value. It is also worthwhile checking the value of the anode load resistor R27 (10kΩ) in this stage. The intermittent field scan distortion could be due to a number of causes. We suggest you check first the field charging capacitor C55 (0.047μF), then C58 (0.01μF) in the field linearity circuit, the print connections to these components, then the linearity feedback loop generally. (BRC 980 chassis.)

CHALLENGE TV26

The set works perfectly on both standards when first switched on but after three or four minutes there is a "plop" and the picture goes haywire—grey with loss of sync on both standards. The sound is still there on v.h.f. when the volume control is turned up, while on u.h.f. a noise like vision-on-sound appears on top of the normal sound. Voltages have been checked and the only one which seems to be out is the triode anode voltage of the PCL84. All preceding voltages are reasonably accurate. The r.f. and i.f. amplifier valves and the PCL84 have all been replaced.—G. Snow (Warley).

We suggest you try the effect of shorting the grid (pin 1) of the triode section of the PCL84 to chassis —this section of the PCL84 generates the a.g.c. potential. If this action restores a normal though over-contrasted picture check the capacitors associated with this stage—C145 at the anode, C147 at the grid and C234 at the cathode, then if necessary the a.g.c. line decouplers. If on the other hand the picture becomes grossly unstable check the decoupling in the second i.f. stage (EF184). (Plessey dual-standard chassis.)

MURPHY 2423

The picture on this single-standard set started to flicker then both vision and sound disappeared. Changing channels brought the set back to life but after a few minutes it went off again. When the picture and sound go a dark noisy screen (as if the aerial has been unplugged) is left. The transistors in the tuner were changed and the set worked for a few days before going off again. A further BF180 was fitted but this lasted only six hours. If the set is left a day the sound and vision come on normally but the picture becomes snowy and the sound fades after about five minutes, virtually disappearing after ten minutes. The l.t. rail voltage is correct.—G. Regan (Cardiff).

In view of the noise present when the signals fade it is likely that the trouble is in the tuner unit: the best course of action is to check the transistor voltages to see which vary and then check the associated resistors, etc. The alternative course is to fit a replacement tuner unit.

SOBELL 1020

Persistent buzz on sound is experienced on u.h.f. This can only be eliminated by detuning the fine tuner until the picture is lost. Operating the contrast control reduces the amplitude of the buzz but also the picture. The EH90 sound detector valve has been checked and found to be in order. Sound and picture are otherwise fine.—R. Waverley (Bolton).

Replace the 32μF electrolytic capacitor C93 which decouples the h.t. to the video amplifier screen grid and also the EH90 anode. Then if necessary adjust the EH90 oscillator coil L47 (situated between PL1 and the EH90). Whilst attending to this stage check the screen feed resistors R92 and R93 since they tend to change value resulting in distortion.

GEC BT454DS

The original trouble with this set was lack of width but a new line output valve cured that. The line scan subsequently became unstable however, with wavering verticles. All components in the line output stage have been changed without improving matters. The wavering stops for a time periodically.—D. Heyward (Grantham).

The trouble could be due to a poor soldered contact, maybe in the vicinity of the flywheel sync discriminator diodes MR2 and MR3. If the soldering is OK, check these diodes and their associated load resistors (R106 and R107, both 330kΩ) and feed capacitors (C125 and C126, both 470pF). A further possibility is faulty smoothing.

SOBELL 1010

The problem with this set is lack of height at the top and bottom. The field timebase valve has been replaced without improving matters.—J. Porter (Upminster).

It is common for R132 (1.2MΩ) which feeds the height control from the boost rail to change value on these sets so this should be checked. It is situated near V11 (PY800). Also check C187 (50μF) in the main smoothing block (behind the line output transformer). This smooths the supply (HT4) to the field output stage.

DER 236

This set works perfectly on 405 lines but on 625 lines there are two faults. First when the aerial is pushed in fully and the set tuned to BBC-2 it also receives BBC-1 faintly while when tuned to ITV it also has BBC-1 faintly. If the aerial plug is withdrawn slightly so that just the screen makes contact these symptoms disappear but there is a lot of snow. The aerial and the connections from the aerial socket to the u.h.f. tuner are in order. The second 625-line problem is lack of interlace and a lot of tearing.—P. Howes (London E7).

It seems that the signal input in your area is excessive so that you will have to fit an attenuator at the aerial input to reduce the interference from channel 26. The poor interlace and tearing experienced on 625 are probably due to excessive contrast. We suggest you check the overload protection diode W3—this is a combined type (BA116) with W1. Also check the PFL200 video/sync valve and its associated components. (BRC 950 chassis.)

GEC BT336

There is a raster and sound but no picture, also the brilliance is perhaps a little down. There is a "socket contact" marked "green lead cathode socket" on the printed board but no green lead is attached. I am wondering whether this set has been tampered with. If I short this "socket contact" to chassis I get a good, brilliant picture but the field does not lock and the line locking is erratic.—F. Gaunt (Manchester).

There should be a 270Ω resistor decoupled by a 1600pF capacitor from the socket in question to chassis. The socket (with others) is provided to enable modifications to be made in the "plus f.m. radio" versions of this chassis. These two components form the cathode bias network for the video output valve and the voltage across them should be 3·2V. Check these components, also the value of the bias stabilising resistor R48 (33kΩ) which is connected from their positive end to the h.t. rail. With these points in order the picture should be present and stable. If the locking is still poor check the sync separator valve V18 (Z749) and its grid feed capacitor C133 (0·5μF, connected to pin 2).

SOBELL 1021

There is no e.h.t. and no line whistle on this set. The line timebase valves have all been replaced without restoring correct operation. On inspection the new PY800 was found to be glowing red and on putting back the old one the PL500 got red hot.—C. Fredricks (Chatham).

If the line oscillator (PCF802) is working correctly it should be possible to measure 3.4V at its cathode while if the coupling capacitor C173 (0.01μF) to the output stage is also in order approximately −60V should be obtained between the grid of the PL500 line output valve and chassis, using a 20kΩ/V meter.

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TELEVISION NOVEMBER 1973

TEST CASE

131

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

? *A Philips Model G19T211A gave perfectly satisfactory sound but the vision was intermittently affected by horizontal lines which were sometimes violent and bright and at other times relatively mild in effect. On occasion, particularly after a session of bright flashes, the raster would disappear almost completely.*

The symptom was unlike ordinary electrical interference and had virtually no influence on the horizontal or vertical locking of the display. Tapping the inside of the cabinet and the circuit boards tended to affect the periods between the flashes, and by this means they could sometimes be temporarily cleared or indeed precipitated. It was impossible however to locate an area which was particularly sensitive in this respect. In fact the symptom sometimes appeared to be affected by tapping the neck of the picture tube.

The picture tube biasing remained essentially constant during the disturbances and a 'scope display at the tube cathode revealed that the video signal was also substantially unaffected during the flashes—apart from very slight transient pulses of interference riding on the peaks of the waveform.

An intermittent short or disconnection in the picture tube was first suspected, though passive testing failed to bring to light any such possibility. Before making a decision to prove the picture tube by substitution—a protracted exercise—the technician made three more tests—one of voltage—and then arrived at the source of the trouble.

What would these tests most likely have been and what was the most likely component to have been responsible for the symptom? See next month's TELEVISION *for the solution and for a further item in the Test Case series.*

SOLUTION TO TEST CASE 130

Page 571 (last month)

When a d.c. amplifier is used in a flywheel line sync circuit line drift can be caused by any component which affects the current in this stage. It will be recalled that valve replacement failed to effect a cure. The technician would then normally investigate the biasing of the stage, since any change in bias would alter the anode voltage and thus cause a change in line oscillator frequency.

The nominal bias in the circuit concerned is established by a potential divider which supplies the valve's cathode. Tests proved that the cathode resistor (to chassis) was of correct value (2·2kΩ) but that the top resistor in the divider (to the h.t. line) had dropped to about 50kΩ from its correct value of 82kΩ. Replacement cleared the fault. The drift in line frequency was caused of course by the 82kΩ resistor changing value with rise in temperature.

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EL90/1	40p	PCL85 }	40p	UY85	30p	30L1	33p		
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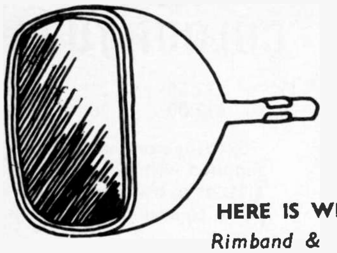

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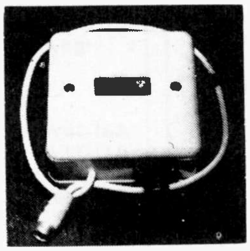

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