Step–By–Step Guide To Diagnosing and Tracing Faults on the Decoder Panel

In order to service decoder panels correctly and quickly certain test-gear must be available, in fact it is false economy to attempt to manage without it. An oscilloscope similar to those recommended in Know How No.2 is most essential. A multi-meter such as Avo Model 8 should be no problem and if funds will allow a Colour-Bar Generator, e.g. Philips PM5506 will really speed up the service of decoder panels and colour television receivers in general.

Without a Colour-Bar Generator you will have to rely entirely on the BBC colour-bar transmission, remembering that colour-bars also occupy the first four lines of each field during the transmission of Test-Card "F" and can be displayed separately on an oscilloscope triggered from the field scan.

If a fault develops in the decoder it invariably gives one of the following effects:—

(1) a perfectly good monochrome picture with no colour at all,

(2) a good monochrome picture but colours very weak and desaturated,

(3) a good monochrome picture but on turning up the colour control the colours are either incorrect and/or appear as coloured stripes across the picture.

Sometimes the fault might prove too difficult to rectify in the customer's house. In such cases it is possible to remove the decoder panel for repair in the workshops and leave the colour receiver working, giving a perfectly good monochrome picture while the panel is away. If this is done, all leads which were unplugged should be left neatly dressed; it is important that the free end of the green lead which was removed from socket SK7 is connected to chassis.

TRACING FAULTS

SYMPTOM NO. 1:— Monochrome, but no colour at all.

STEP 1 Tune in colour-bar transmission.

STEP 2 Connect scope to TP18 and TP19; waveform should be as shown in Figures 1 and 2 respectively.

Fig.1. Colour control at MAX. Test Point 18

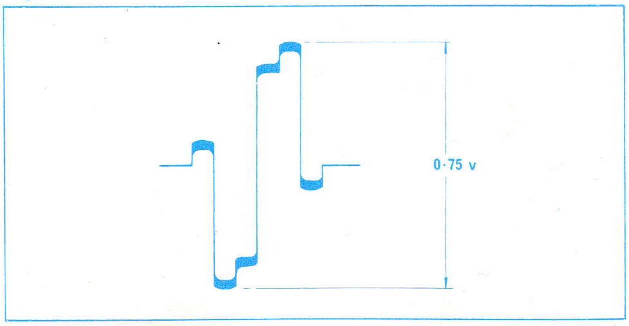


Fig.2. Colour control at MAX. Test Point 19

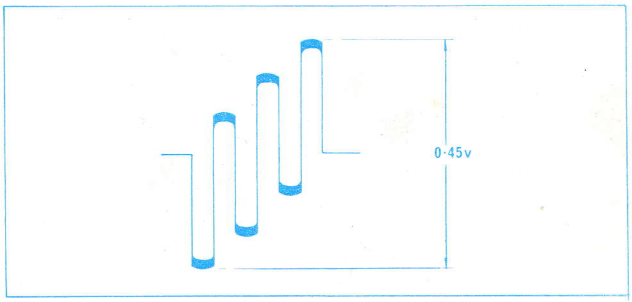
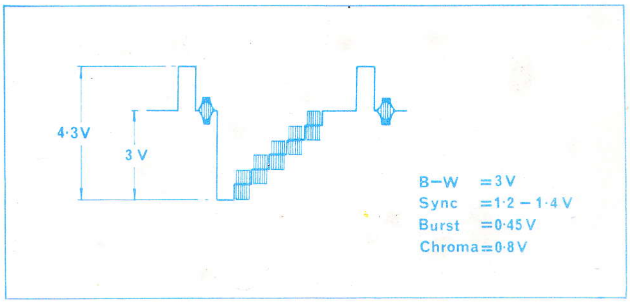


Fig.3. SK6.



STEP 3 If no output at TP18 and TP19 connect scope to TP20; waveform should be as shown in Figure 3. If no signal at this point fault is likely to be in connectors PL5A and SK6.

If signal at TP20 is correct the fault is definitely in the decoder.

STEP 4 Check supply voltages at PL8A and PL8B. If incorrect check appropriate power supplies.

STEP 5 Measure the DC voltage at TP21. On a colour transmission this should be +3 volts approximately.
The result of this check allows one to place the fault into one of the two halves of the decoder, using the decoder circuit diagram as a guide:—

(a) If the voltage at TP21 is correct, the fault is to the right of this point on the circuit, and is associated with the colour control circuit, or the transistor stages VT20, VT21.
(b) If the voltage at TP21 is missing or very low then the fault is to the left of this point on the circuit diagram, and is associated with the transistor stages VT12, VT13, VT14, VT15, VT16, VT17, VT18, VT19 and the components associated with diode D22 could also be suspect.

EXAMPLE NO. 1(A).

If the voltage at TP21 is correct, i.e. +3 volts proceed as follows:—

STEP 6 (COLOUR CONTROL)

Connect the oscilloscope to TP11. The voltage waveform should be as shown in Figure 4; if this signal is missing:—

(a) Check that the DC voltage on the slider of RV11 (colour control) can be varied between 0 + 1.25V.
(b) Check the connection in socket SK11
(c) Check diodes D23, D24 and the components associated with them.

STEP 7 (VT20)

If the signal at TP11 is correct the oscilloscope should be connected to VT20 collector. The voltage waveform should be as shown in Figure 5. If this signal is missing:—

(a) Check the base, emitter and collector voltages of VT20. The correct readings are shown in Table 1.
(b) Check transistor VT20.
(c) Check all components and connections associated with VT20.

STEP 8 (VT21)

If the signal at VT20 collector is correct, the oscilloscope should be connected to VT21 collector. The voltage waveform should be as shown in Figure 6. If this signal is missing:—

(a) Check the voltages on VT21 against those shown in Table 1.
(b) Check transistor VT21.
(c) Check all components and connections associated with VT21.

TABLE 1 DECODER

CONDITIONS

1) All voltages taken on AVOMETER Model 8 with respect to chassis.
2) Normal signal input.
3) Saturation 6dB down on maximum.
4) Letters in brackets indicate AVO range, e.g.:—
   (a) = 2.5V Range
   (b) = 10.0V Range
   (c) = 25.0V Range
5) Supply voltage at PL8A is —20V, and at PL8B is +15.3V. Both readings are taken on AVO 25V range.

STAGE	COLLECTOR	BASE	EMITTER
VT12	13.8V (c)	0.68V (a)	0
VT13	15.0V (c)	0.90V (a)	0.35V (a)
VT14	15.0V (c)	0.06V (a)	0.75V (a)
VT15	5.0V (c)	0.31V (a)	0.38V (a)
VT16	11.5V (c)	4.75V (c)	3.75V (c)
VT17	11.5V (c)	3.38V (b)	3.1 V (b)
VT18	13.2V (c)	1.78V (a)	1.81V (a)
VT19	13.6V (c)	4.05V (b)	5.2 V (b)
VT20	8.8V (b)	3.1 V (b)	2.48V (b)
VT21	12.2V (c)	5.3 V (b)	4.7 V (b)
VT22	5.8V (b)	0.39V (c)	0
VT23	5.8V (b)	0.39V (c)	0

Fig.4. Test Point 11

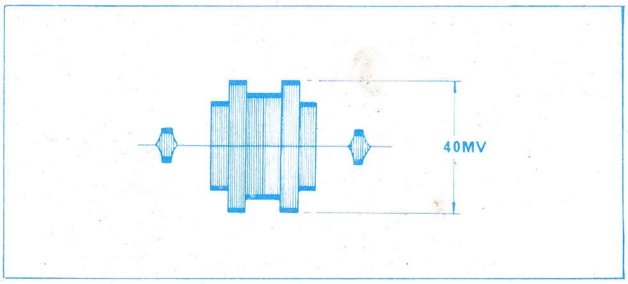


Fig.5. VT20 Collector

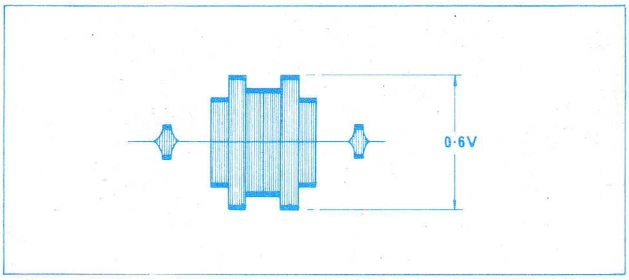


Fig.6. VT21 Collector

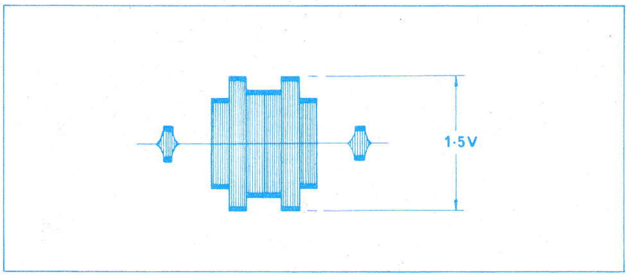


Fig.7. (R—Y) Junction D30/D31

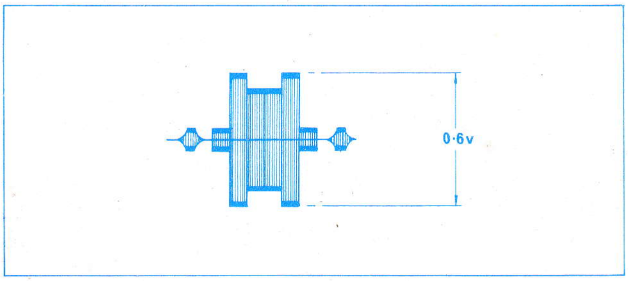
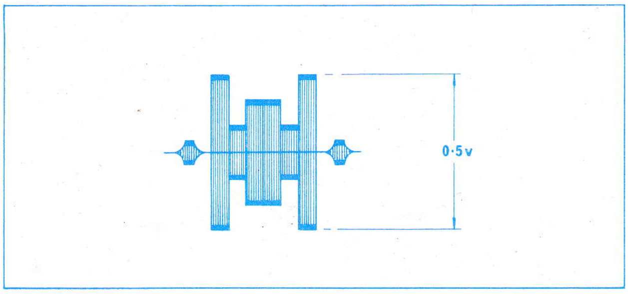


Fig.8. (B—Y) Junction D34/D35



STEP 9 (DELAY LINE)

If the signal at VT21 collector is correct, connect the oscilloscope in turn to the junctions of D30, D31, D34 and D35. The voltage waveforms should be as shown in Figure 7 and Figure 8 respectively. If these signals are missing:—

(a) Check the delay line and the components and connections associated with it.

STEP 10 (DEMODULATORS)

If the input to the demodulators is correct, check that the sub-carrier is applied to the demodulators, i.e. remove the yellow plug from SK6 and:—

(a) Connect the oscilloscope to the junction of D30, D33 and/or the junction of D31, D32; the voltage waveform should be as shown in Figure 9.
(b) Connect the oscilloscope to the junction of D34, D37 and/or the junction of D35, D36; the voltage waveform should be as shown in Figure 10.

If these readings are missing check the components and connections between the demodulators and TP7.

Re-insert the yellow plug in SK6.

Fig.9. Taken with plug removed from SK6 Junction D35/D36

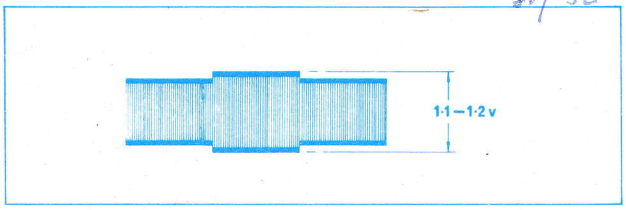


Fig.10. Taken with plug removed from SK6 Junction D35/D36

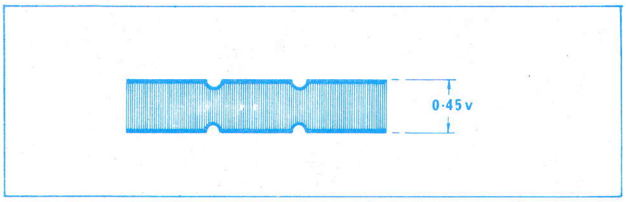


Fig.11. Test Point 2

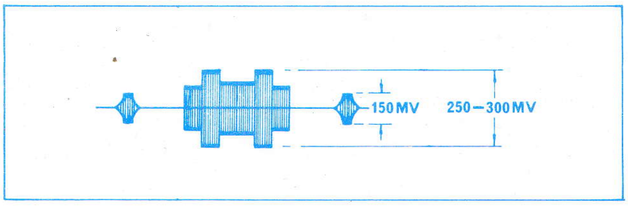
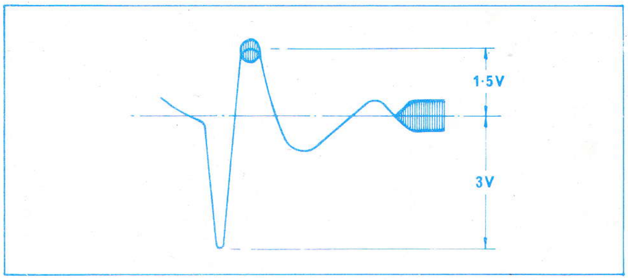


Fig.12. Test Point 3



EXAMPLE NO. 1(B)

If the DC voltage at TP21 is missing, i.e. zero volts, proceed as follows:—

STEP 11 (VT12)

Having previously established that the signal at TP20 was correct, the oscilloscope should be connected to TP2. The voltage waveform should be as shown in Figure 11. If this signal is missing:—

(a) Check VT12 voltages against those given in Table 1.
(b) Check transistor VT12.
(c) Check all components and connections associated with VT12.

STEP 12 (VT13)

If the signal at TP2 is correct, connect the oscilloscope to TP3. The voltage waveform should be as shown in Figure 12 where it will be noted that the signal is a combination of chrominance and gating pulse.

The phasing is such that the reference burst should be located at the peak of the positive gating pulse; this is achieved by tuning L28.

If the chrominance portion of the signal is missing:—

(a) Check VT13 voltage readings against those in Table 1.
(b) Check transistor VT13.
(c) Check all components and connections which are associated with VT13.

GATING PULSE

If, however, the chrominance signal is present at TP3 but the gating pulse is missing:—

(a) Check that the gating pulse is present at socket SK7. (The amplitude should be greater at this point.
(b) If the gating pulse is missing at SK7, a similar check should be made at SK5.
(c) Check L28 and all components and connections associated with it.

STEP 13 (VT14)

If the composite signal at TP3 is correct and L28 is correctly tuned, the oscilloscope should be attached to TP4 where the voltage waveform should be as shown in Figure 13. If this signal is missing:—

(a) Check VT14 voltage readings,
(b) Check transistor VT14,
(c) Check all components and connections associated with VT14.

STEP 14 (APC)

If the voltage waveform at TP4 is correct, connect the oscilloscope in turn to each end of T9 secondary. The voltage waveform should be as shown in Figure 13; if missing at one end or both:—

(a) Check T9 and all components connected to the secondary winding.

This transformer has a 1:1 ratio; the signals at VT14 collector and each end of T9 secondary are the same.

Fig.13. Test Point 4. T9 Secondary

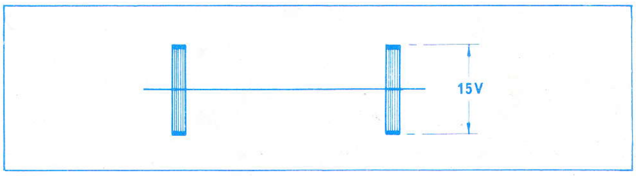
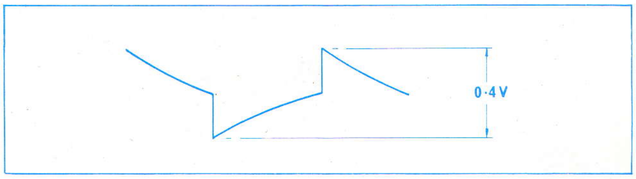


Fig.14. f=7.8 kHz VT15 Base



STEP 15 (VT15 BASE)

If all signals and components etc. associated with T9 are correct the oscilloscope should now be connected to the base of VT15 where the voltage waveform should be as shown in Figure 14. If this waveform is missing:—

Fig.15. Test Point 7

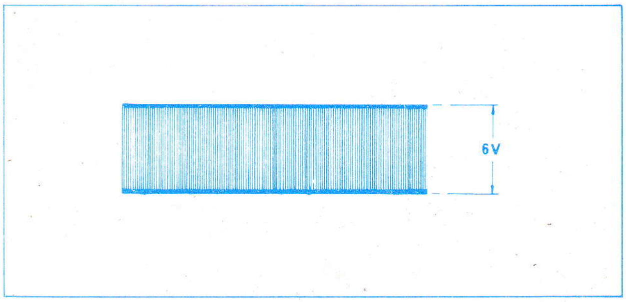
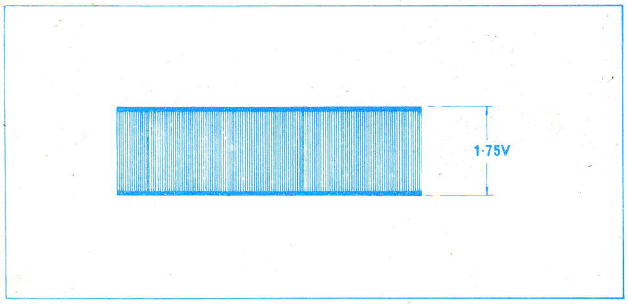


Fig.16. VT16 Base



(a) Check transformer T10,
(b) Check other components and connections in VT15 base circuit,
(c) Check that the sub-carrier oscillator is functioning by connecting the oscilloscope to TP7 where the voltage waveform should be as shown in Figure 15.

N.B. If the sub-carrier oscillator has stopped, the APC circuit would not operate correctly resulting in no 7.8 kc/s waveform at VT15 base.

STEP 16 (VT16, VT17)

Check the sub-carrier oscillator by connecting the oscilloscope to the base of VT16 where the voltage waveform should be as shown in Figure 16. If this signal is missing:—

(a) Check VT16 voltage readings,
(b) Check transistor VT16,
(c) Check the crystal and all other components and connections associated with this stage.

If the signal at the base of VT16 is correct, but the signal at TP7 is missing:—

(a) Check VT17 voltage readings,
(b) Check transistor VT17,
(c) Check all components and connections associated with VT17.

STEP 17 (VT15)

Having established that the oscillator is functioning correctly and that the voltage waveform at the base of VT15 is correct, if there is still no colour, the oscilloscope should be attached to TP5 where the voltage waveform should be as shown in Figure 17. If this waveform is missing:-

Fig.17. f=7.8 kHz Test Point 5

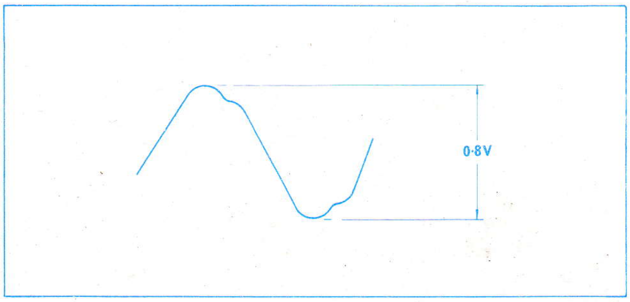
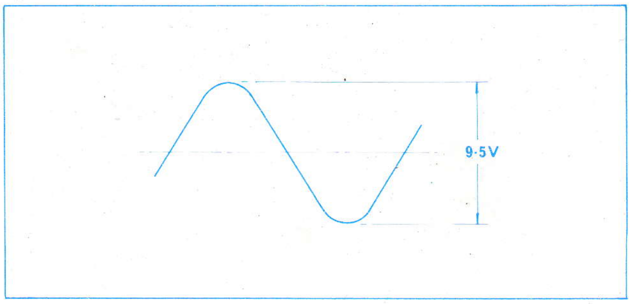


Fig.18. f=7.8 kHz Test Point 8 & 9



(a) Check VT15 voltage readings,
(b) Check transistor VT15,
(c) Check all components and connections which are associated with this stage.

STEP 18 (VT18)

If the voltage waveform at TP5 is correct, then connect the oscilloscope to TP8 where the voltage waveform should be as shown in Figure 18. If this voltage waveform is missing at this point:—

(a) Check VT18 voltage readings,
(b) Check transistor VT18.
(c) Check L27 and all other components and connections associated with VT18, including a possible short-circuit in diode D19.

STEP 19 (VT19)

If the signal at TP8 is correct the oscilloscope should be connected to TP9 where the voltage waveform should be as shown in Figure 18. If this waveform is missing:—

(a) Check VT19 voltage readings.
(b) Check transistor VT19,
(c) Check all other components and connections associated with VT19.

STEP 20 (COLOUR KILLER)

If the voltage waveform at TP9 is correct, using Avo Model 8 check that the DC voltage at TP17 and TP21 is +8 volts and +3 volts respectively. If these DC voltages are approximately zero—

(a) Check C122, D22, D21, C123, C124.
(b) Check that the DC voltage at the junction of R133, R134 is +3 volts,
(c) Check all other components and connections which are associated with diodes D21 and D22.

The fault which we have been tracing, i.e. monochrome pictures but no colour at all should now have been diagnozed and rectified.

SYMPTOM NO: 2:— Monochrome good. Colours of correct hue but desaturated.

Several things can affect the density of the colours in a coloured picture e.g.

(a) Aerial amplifier lacking bandwidth.
(b) Vision channel lacking bandwidth.
(c) Sub-carrier trap (L15) detuned.

STEP 1 Connect the oscilloscope to TP20. If the signal input to the decoder (TP20) is correct as shown in Figure 19 then the points mentioned above can be eliminated.

When examining the signal at TP20 it is not sufficient just to measure the peak-to-peak amplitude of this composite signal. There must be a correct relationship between the amplitudes of the luminance and chrominance signals. Make sure that the signal at TP20 is as follows when tuned correctly to standard colour-bars:—

SYNC = 1.0 – 1.25 volts,
BURST = 0.4 – 0.5 volts,
CHROMA = 0.8 – 1.0 volts,
BLACK-WHITE = 3.0 volts

It will be noted that the ratio of luminance/chrominance is approximately 3:1.

STEP 2 To establish that the fault is in the decoder, the oscilloscope should be connected to TP18 and TP19 in turn where the voltage waveform should be as shown in Figures 20 and 21 respectively. If these outputs lack amplitude then the cause of weak colours is due to a fault in the decoder. Proceed as follows:—

STEP 3 Connect the oscilloscope to TP2; the voltage waveform should be as shown in Figure 22; if this waveform is low in amplitude then:—

(a) Check the voltages on transistor VT12 against those shown in Table 2.
(b) Check transistor VT12,
(c) Check all components and connections associated with VT12,
(d) Check D15, C105, R105,
(e) Check the adjustment of RV9 (set AGC control). If this stage is functioning normally it should be adjusted on colour-bars for an output of approximately 250mV peak-to-peak at TP2, i.e. as shown in Figure 22.

TABLE 2 DECODER

CONDITIONS

1) All voltages taken on AVOMETER Model 8 with respect to chassis.
2) Normal signal input.
3) Saturation 6dB down on maximum.
4) Letters in brackets indicate AVO range, e.g.:—
   (a) = 2.5V range
   (b) = 10.0V range
   (c) = 25.0V range
5) Supply voltage at PL8A is –20V, and at PL8B is +15.3V. Both readings are taken on AVO 25V range.

STAGE	COLLECTOR	BASE	EMITTER
VT12	13.8V (c)	0.68V (a)	0
VT13	15.0V (c)	0.90V (a)	0.35V (a)
VT14	15.0V (c)	0.06V (a)	0.75V (a)
VT15	5.0V (c)	0.31V (a)	0.38V (a)
VT16	11.5V (c)	4.75V (c)	3.75V (c)
VT17	11.5V (c)	3.38V (b)	3.1 V (b)
VT18	13.2V (c)	1.78V (a)	1.81V (a)
VT19	13.6V (c)	4.05V (b)	5.2 V (b)
VT20	8.8V (b)	3.1 V (b)	2.48V (b)
VT21	12.2V (c)	5.3 V (b)	4.7 V (b)
VT22	5.8V (b)	0.39V (c)	0
VT23	5.8V (b)	0.39V (c)	0

Fig.19. SK6.

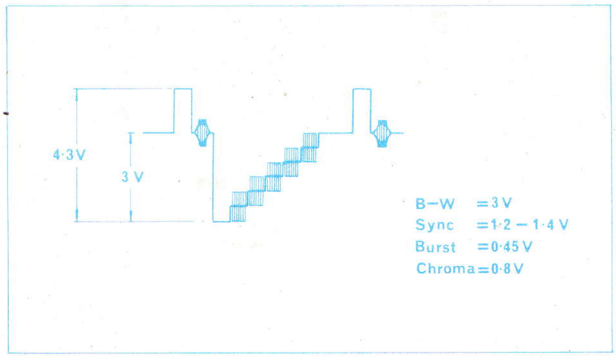


Fig.21. Colour control at MAX. Test Point 19.

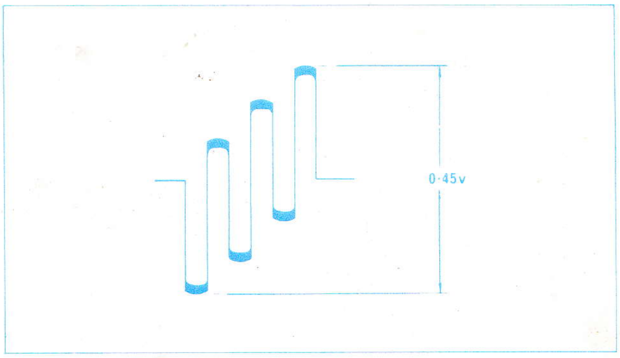


Fig.20. Colour control at MAX. Test Point 18.

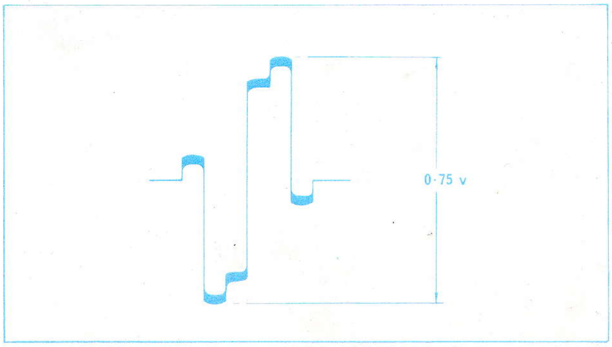
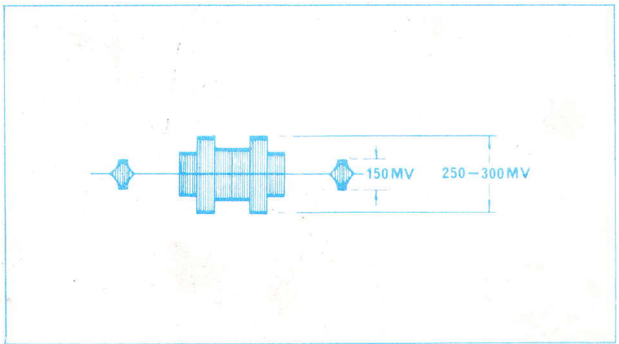


Fig.22. Test Point 2.



STEP 4

If the voltage waveform at TP2 is correct, the oscilloscope should be connected to TP11 where the voltage waveform should be as shown in Figure 23.

If this waveform is low in amplitude then:—

(a) Check that the DC voltage on the slider of RV11 (colour control) can be varied between 0 and + 1.25 volts.
(b) Check diodes D23, D24 and the components associated with them.

STEP 5

If the signal at TP11 is correct the oscilloscope should be connected to VT20 collector; the voltage waveform should be as shown in Figure 24.

If this waveform lacks amplitude then:—

(a) Check the voltages on VT20,
(b) Check transistor VT20,
(c) Check all components and connections associated with VT20.

STEP 6
(VT21)

If the signal at VT20 collector is correct the oscilloscope should be connected to VT21 collector.

The voltage waveform should be as shown in Figure 25: if this signal lacks amplitude then:—

(a) Check the voltages on VT21,
(b) Check transistor VT21,
(c) Check all components and connections associated with VT21.

N.B. If a fault develops in the delay line circuit it could still function as P.A.L.'s.

Although the colours might be slightly desaturated, hanover blind effect would predominate.

Fig.23. Test Point 11

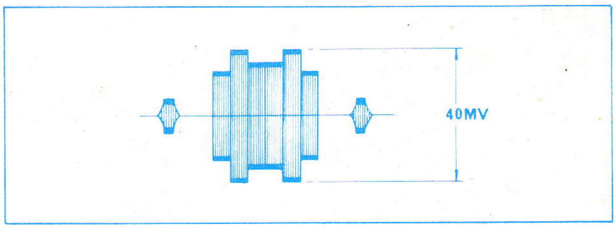


Fig.24. VT20 Collector

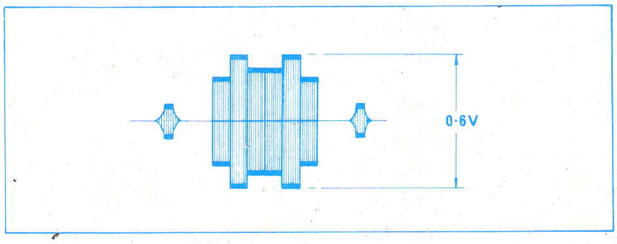
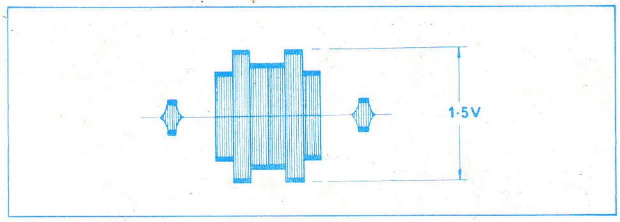


Fig.25. VT21 Collector



These combined symptoms indicate a fault in this stage.

(a) Check transformer T13 (fitted in early receivers only),
(b) Check the delay line (L32),
(c) Check the adjustment of RV12 and L31. The procedure for doing this is given in the service manual.

SYMPTOM NO. 3:— A good monochrome picture, but on turning up the colour control the colours are either incorrect and/or appear as coloured stripes across the picture.

SYMPTOM 3(a) Bands of incorrect colours and/or saturation across the screen, where the individual bands coincide with changes of colours down the extreme left hand edge of the picture.

This effect is more apparent when observed on TEST-CARD "F" when the bands of incorrect colours and saturation will coincide with the coloured castellations down the left hand edge of the test-card.

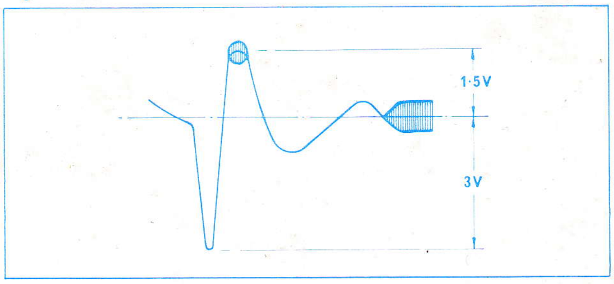
This is due to a maladjustment, or fault in the burst-gating circuit allowing picture information to pass to the reference generator.

To correct this proceed as follows:—

STEP 1

(a) Connect oscilloscope to TP3 where the voltage waveform should be as shown in Figure 26,
(b) Tune L28 to locate the reference burst at the peak of the positive gating pulse,
(c) If this coil fails to tune correctly check L28 and C126.

Fig.26. Test Point 3.



SYMPTOM 3(b) Multiple coloured horizontal stripes across the picture, each approximately 0.25 inches wide.

This fault is due to the reference oscillator being unlocked from the reference burst. Probably caused by a faulty component or maladjustment of RV10 and/or L26. The following procedure should lock in the oscillator:—

STEP 1

(a) Observe the picture and adjust RV10 for a stable coloured picture (i.e. to remove coloured stripes).
(b) Connect Avo 8 on 25 volt range to TP5, i.e. positive lead to TP5,
(c) Adjust L26 for meter reading of 5 volts DC.

NOTE Readjust RV10 if necessary to retain a stable coloured picture (i.e. without coloured stripes).

(d) Break the circuit link which is adjacent to TP6 and connect a + 4 volt bias supply to TP6,
(e) Readjust RV10 for meter reading of + 5 volts at TP5,
(f) Reconnect TP6 circuit link,
(g) Momentarily short decoder input to chassis, i.e. at TP20. Colours should lock in immediately; if not repeat the above adjustments.

STEP 2 If it is impossible to correct the fault with the above adjustments the oscillator stage is faulty and its frequency is too far off to be corrected by the A.P.C. circuit.

(a) Check transistor VT16,
(b) Check all voltages and components associated with the sub-carrier oscillator stage,
(c) Check the components associated with the secondary circuit of transformer T9.

SYMPTOM 3(c) All colours other than blues and yellows incorrect. Hanover blind effect very prominent.

These symptoms indicate that the P.A.L. bistable switch is not operating, causing alternate lines in a single frame, and alternate pairs of lines in a complete picture to change colour.

This effect is more apparent when observed on a standard colour bar transmission. When viewed from 6–8 feet distance, the pairs of different coloured lines will be integrated by the eye to give the following colour sensation:—

Colour-Bar	Colour of alternate pairs of lines	Colour sensation when lines integrated
White	White	White
Yellow	Yellow/Greenish Yellow	Greenish Yellow
Cyan	Cyan/Magenta	Pale Blue
Green	Green/Redish Orange	Gold
Magenta	Magenta/Cyan	Mid Blue slightly Magenta
Red	Red/Green	Muddy Brown
Blue	Blue/Blue Magenta	Blue tinged Magenta

STEP 1 (a) Check that the plug in socket SK8 is making a good connection.
(b) Connect the oscilloscope to SK8 and observe that the voltage waveform is as shown in Figure 27. If this pulse is missing check connecting leads back to L.O.P.T.
(c) Connect oscilloscope to the collectors of VT22 and VT23 where the waveforms should be as shown in Figure 28. If these voltage waveforms are absent proceed as follows:—

(d) Check the emitter, base and collector voltages of VT22 and VT23 against those readings given in Table 3.
(e) Check transistors VT22 and VT23 and all other components and connections associated with these transistors.

Fig.27. Test Point 13.

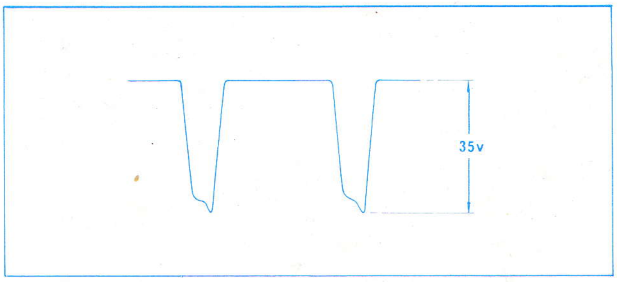


Fig.28. VT22 and VT23 Collectors

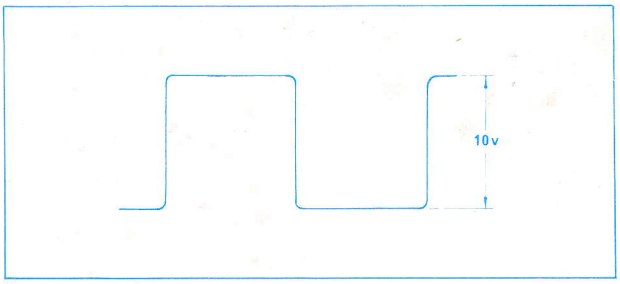


TABLE 3 DECODER

CONDITIONS

1) All voltages taken on AVOMETER Model 8 with respect to chassis.
2) Normal signal input.
3) Saturation 6dB down on maximum.
4) Letters in brackets indicate AVO range, e.g.:—
   (a) = 2.5V range
   (b) = 10.0V range
   (c) = 25.0V range
5) Supply voltage at PL8A is –20V, and at PL8B is +15.3V. Both readings are taken on AVO 25V range.

STAGE	COLLECTOR	BASE	EMITTER
VT12	13.8V (c)	0.68V (a)	0
VT13	15.0V (c)	0.90V (a)	0.35V (a)
VT14	15.0V (c)	0.06V (a)	0.75V (a)
VT15	5.0V (c)	0.31V (a)	0.38V (a)
VT16	11.5V (c)	4.75V (c)	3.75V (c)
VT17	11.5V (c)	3.38V (b)	3.1 V (b)
VT18	13.2V (c)	1.78V (a)	1.81V (a)
VT19	13.6V (c)	4.05V (b)	5.2 V (b)
VT20	8.8V (b)	3.1 V (b)	2.48V (b)
VT21	12.2V (c)	5.3 V (b)	4.7 V (b)
VT22	5.8V (b)	0.39V (c)	0
VT23	5.8V (b)	0.39V (c)	0