How to use the "DEM" & "BAR" patterns of the PM 5509 (Part 1)

Two test patterns - DEM and BAR - have proved to be of particular value for checking the performance or realigning the chroma part of a CTV receiver. This article describes how to use these test signals for alignment of the 64 µs delay line. During the alignment procedure, the screen of the picture tube can be used as indicator for on-screen alignments. Another method is to use a double-trace oscilloscope for display of the (R-Y) and (B-Y) colour difference signals. Alignment of the colour demodulators is discussed in part 2.

The "DEM" pattern facilitates quick and acc te a the delay line circuitry.

This "DEM" pattern is specially designed for aligning the colour circuitry of a PAL receiver. Before seeing how this is done, we may recall the essential features of the PAL system. Colour information is carried by two signal components, the red and blue colour-difference signals. To simplify transmission, these two signals are combined in the transmitter. The combined chroma signal must therefore be split up again in the receiver to give the two colour-difference signals. In a PAL receiver (see fig. 1) this separation is carried out by two separate circuits: the delay line with the PAL electronic switch, and the two colour demodulators. The delay line delivers a chroma signal delayed by one whole line period to the adder and subtractor stages. The resulting (B-Y) colour-difference signal at the adder is fed to the B-Y demodulator. The coresponding (R-Y) signal at the subtractor is passed to the R-Y demodulator via the PAL switch, which ensures that it is in the correct phase prior to demodulation (see fig. 2).

With the Philips K 9 and K 11 receivers, a slightly different method is used. Instead of switching the (R-Y) signal, the subcarrier frequency applied to the R-Y demodulator is line-sequentially switched to obtain the right "red colour-difference signal". The two colour-difference signals arriving at the demodulators have a mutual phase shift of 90°. Each signal is demodulated with reference to a regenerated subcarrier. The subcarrier fed to one demodulator is in phase with the original colour carrier, while that supplied to the other is phase shifted by 90°.
The "DEM" pattern of the PM 5509 consists of 4 vertical bars and a reference bar. The first bar of this pattern (fig. 3) contains PAL coded (R-Y) and (B-Y) information with (G-Y) = 0. Bar 2 and the horizontal reference bar contain no colour information.
Bar 3 contains NTSC coded, (R-Y) information i.e. the (R-Y) signal does **not** change direction by 180° each line: the burst signal, on the other hand, is PAL coded and so ensures

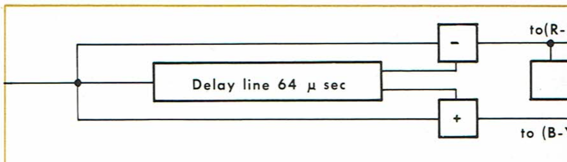


Fig. 2.

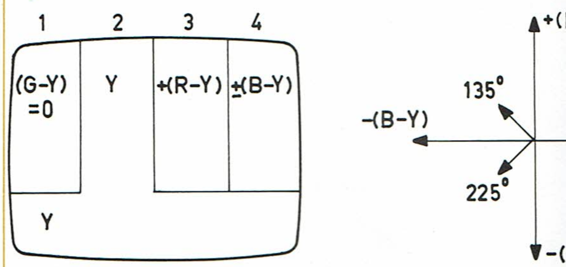


Fig. 3.

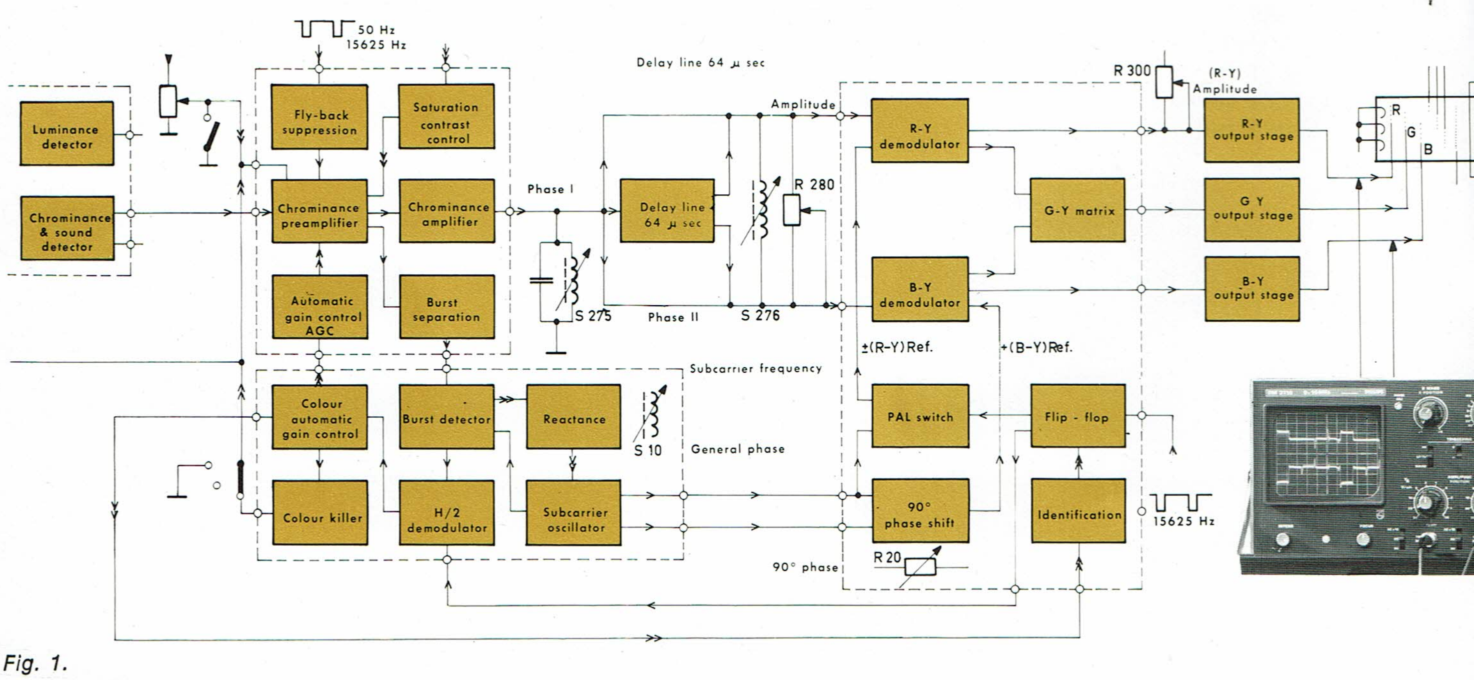
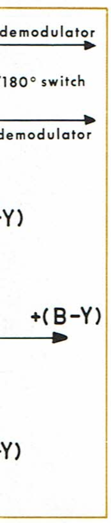
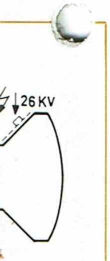


Fig. 1.





normal operation of the PAL switch in a colour receiver. The 4th bar contains only (B-Y) information which is switched through 180° each line. When this pattern is reproduced on the screen of a correctly aligned receiver the first bar will appear yellowish while the remaining three bars, and the reference bar, will appear grey (fig. 4).

We shall now describe how this "DEM" pattern can be used to check the chroma delay line circuitry. There may be an amplitude and/or phase error between the delayed and direct signals.

Delay-line errors. Since the (R-Y) signal in bar 3 is NTSC coded, the subtractor circuit in the delay line should eliminate all (R-Y) information during this bar (the information in successive lines being subtracted).

When an **amplitude error** exists between the direct and delayed signals, the subtractor output of the delay line will produce (R-Y) information during bar 3. Due to the action of the PAL switch, this information will appear inverted on alternate lines to give the "Venetian-blind" effect.

When a **phase error** exist between the direct and delayed signals, (R-Y) information will also appear at the subtractor during bar 4. The Venetian-blind effect will then be visible in bars 1 and 4.

Extreme misalignments or a faulty delay line can cause the Venetian-blinds to be visible in bars 1, 3 and 4 (fig. 5); e.g. a large amplitude fault will cause a phase error.

On-screen alignment

The alignment can most conveniently be carried out by viewing the CTV screen from an angle.

An amplitude fault is corrected by adjusting the amplitude potentiometer R 280 in fig. 1 until no "Venetian blinds" are visible in the 3rd bar.

The phase is then corrected by adjusting S 275 ("phase") until no Venetian-blind effect appears in bars 1 and 4. After realignment of the amplitude and the phase with R 280 and S 275 respectively, it is possible that Venetian-blinds are still visible in the **first bar** only, indicating that the phase difference between the two colour-difference signals (R-Y) and (B-Y) is wrong. This can be corrected by adjusting S 276 until the Venetian-blind effect in bar 1 disappears.

When the delay line is aligned properly in amplitude and phase, only the first bar contains colour, while the other three appear grey, like the reference bar (fig. 4).

When bars 3 and 4 exhibit colour information but **no Venetian-blinds** after realignment, this indicates that the PAL delay line is correctly adjusted, but that the subcarrier frequency to the colour demodulators needs correction.

Alignment with aid of 'scope

If the alignment of the delay line is carried out with the aid of the PM 3110 dual-trace oscilloscope, the Y_A and Y_B input are connected to the R and B grids of the picture tube respectively.

The R-Y and B-Y signals of a delay line correctly adjusted in amplitude and phase displayed on the screen of the oscilloscope are shown in fig. 6. Note that only the first bar shows a R-Y and B-Y information.

An amplitude error shows up in the 3rd bar, and a phase error in the 1st and 4th bars.

The display with a combined amplitude and phase error is shown in fig. 7. Compare the difference in amplitude in bars 1, 3 and 4 of the R-Y and B-Y signals of successive lines. The amplitude correction is made by adjusting R 280 until the R-Y signal is zero in bar 3. Check successive lines. The phase error is corrected by realigning S 275 until the 4th bar of the R-Y and B-Y signals show no colour information. Bar 1 of the R-Y signal of successive lines should have the same amplitude. The same applies to B-Y signal.

It may be necessary to repeat the amplitude-phase alignment to obtain the display of fig. 6.

The alignment can also be performed with the oscilloscope's line triggering set to negative and the time vernier adjusted so that the odd lines are added to the even lines. We then see about $2^1/_4$ lines on the oscilloscope screen.

Fig. 8 shows the trace produced with this set-up by a combined amplitude and phase error. Note the double lines produced in this way at the top of the bars in which errors are indicated. You can correct the amplitude and phase as described above, watching the 3rd bar for the amplitude and the 1st and 4th bars for the phase.

As an error is reduced the distance between the double lines at the top of the bars in question narrows until a single trace is produced when the error is completely corrected (fig. 6).

to be continued

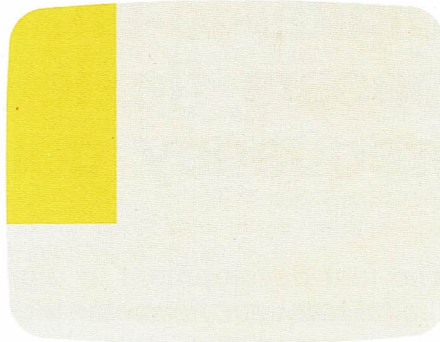


Fig. 4.

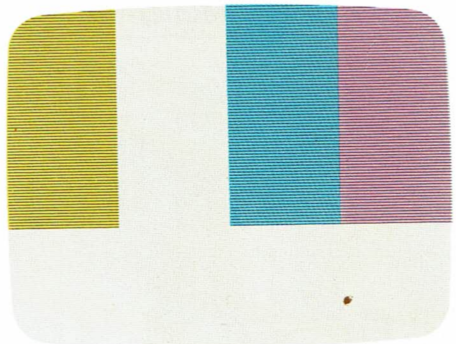


Fig. 5.

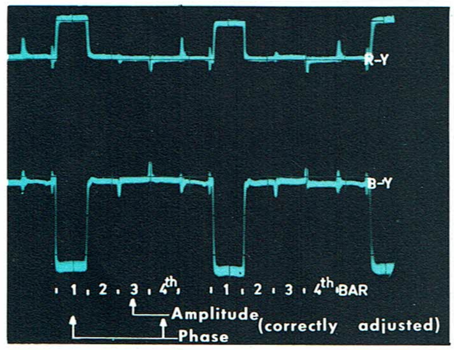


Fig. 6.

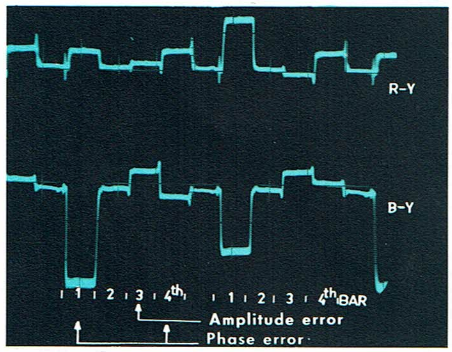


Fig. 7.

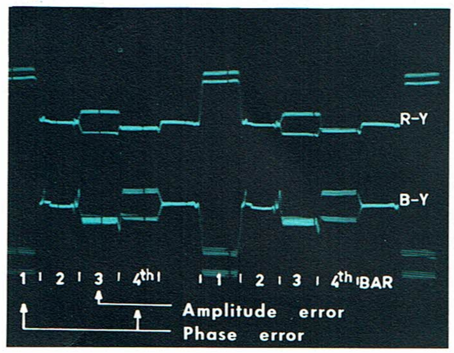


Fig. 8.

How to use the "DEM" & "BAR" patterns of the PM 5509 (Part 2)

Delay line and demodulators correctly adjusted.

Two test patterns - DEM and BAR - have proved to be of particular value for checking the colour performance or realigning the chroma part of a CTV receiver. Alignment of the delay line was described in the first part of this article. Alignment of the colour demodulators is discussed in the present part.

The "DEM" pattern displayed on the screen of a correctly aligned colour receiver is illustrated in fig. 9; it has colour only in bar 1. If at the same time the R-Y and B-Y signals available at the grids of the CRT are displayed on an oscilloscope we see fig. 10; note that only the first bar contains R-Y and B-Y information.

When the phase of the subcarrier fed to a demodulator is correct, only the appropriate input can be demodulated, i.e. the R-Y demodulator will demodulate only (R-Y) information and the B-Y demodulator only (B-Y) information.

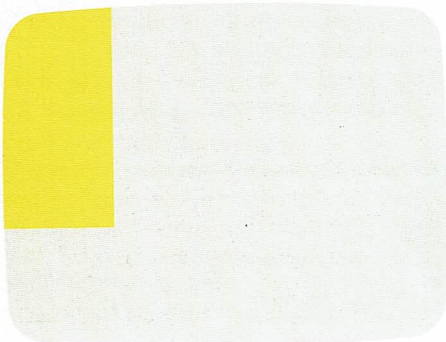


Fig. 9.

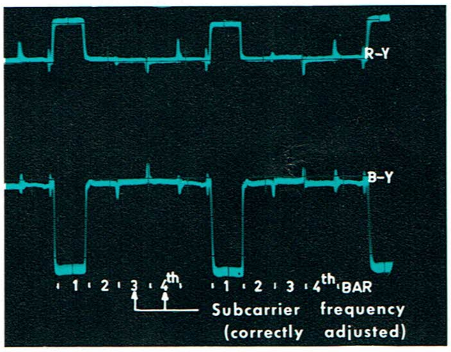


Fig. 10.

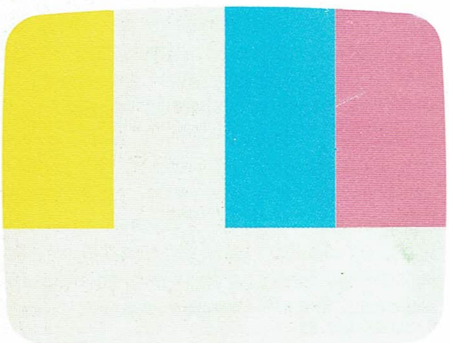


Fig. 11.

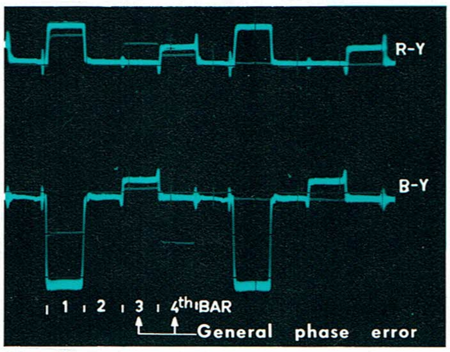


Fig. 12.

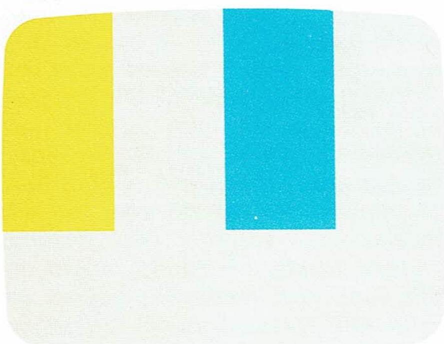


Fig. 13.

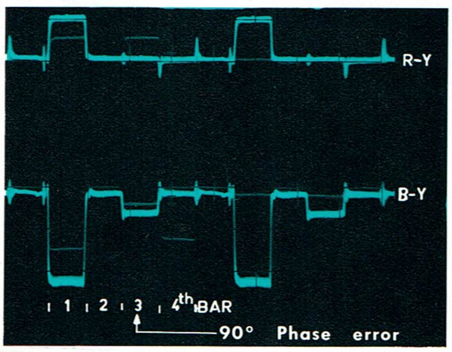


Fig. 14.

General phase fault

When the subcarrier frequency has a phase error, (R-Y) information is passed to the B-Y demodulator during the 3rd bar. Similarly, the R-Y demodulator will receive (B-Y) information during bar 4.

Thus, a phase error in the subcarrier at both demodulators (i.e. a general phase fault) will cause both demodulators to pass incorrect information, the fault showing up on screen as colour in bars **3 and 4** (fig. 11 & 12).

90° phase fault

A phase fault which is confined to the subcarrier with 90° phase shift will cause only one demodulator to pass incorrect information. The fault will reveal itself as colour in bar 3 **or** bar 4 depending on the type of receiver (fig. 13 & 14).

In on-screen alignment we correct a **general phase fault** by adjusting the phase of the subcarrier frequency S10 of the reference combination by the K9 - K11 (see the block diagram of part 1 of this article) until only the first bar contains colour information. The **90° phase difference** between the (R-Y) and (B-Y) demodulators is adjusted in a similar way with R 20 of the demodulator unit until no colour is present in bar 3 or bar 4 (fig. 9). As regards the oscilloscope display, when the system is correctly adjusted, only the first bar has (R-Y) as well as (B-Y) information, while the other three bars have no chroma at all (fig. 10).

Bar

The final pattern used in TV alignments is the familiar colour-bar pattern (fig. 15 & 16). The vertical bars in this pattern are coloured white, yellow, cyan, green. magenta, red, blue and black. The horizontal reference bar is white and has the same video amplitude as the vertical white bar.

The colour-bar pattern in fact provides sufficient information for a good overall check on colour performance, including:

- saturation
- burst keying
- subcarrier regenerator
- PAL identification circuit
- delay colour versus black/white

The colour-bar pattern is also used when adjusting the amplitude of the colour-difference signals from the demodulators and matrix.
For example, to check the amplitude of the (B-Y) signal the red and green guns of the picture tube are switched off.
The brightness contrast and saturation controls are then adjusted so that no difference in brightness can be observed between bars 1-3-5 and 7, and the reference bar, while the other bars are black (fig. 17). The amplitude of the (B-Y) signal (see fig. 18) depends on the type of CTV set involved.
Some CTV receivers have facilities for adjusting the amplitude of the B-Y signal to the specified level.
In the K9 receiver the output level of the B-Y signal is fixed and only the R-Y amplitude can be adjusted.
When the picture of fig. 17 is obtained the amplitude of the blue colour difference signal has the appropriate amplitude. Now the R-Y signal has to be checked. The blue gun (G2) is switched off and the red gun is switched on.
The contrast, brightness and saturation controls are not touched. When the R-Y demodulator is correctly adjusted, there is between bars 1-2, 5-6 and the reference bar no difference in brightness (fig. 19 & 20) while the others are black.
If there is a distinct brightness difference, the amplitude of the R-Y demodulator is adjusted with the aid of a potmeter (R 300 in receivers K9 - K11) until fig. 19 is obtained.

Matrix

In many CTV sets, the G-Y signal derived from the matrix can be adjusted in amplitude and phase. In the K9 and K11 sets, the G-Y signal automatically has the proper setting when the colour-difference signal R-Y has the right amplitude.
When the green gun is switched on, after switching the red gun off, fig. 21 and 22 are then obtained showing a properly functioning matrix circuit. In case there is a distinct difference in brightness in the first four bars and the reference bar it indicates a fault

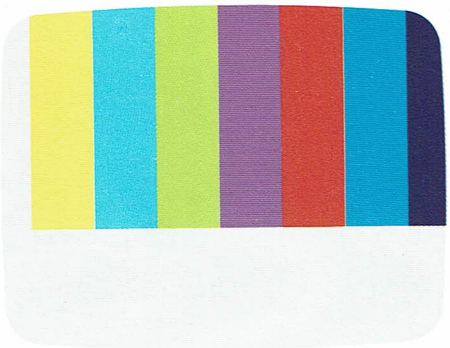


Fig. 15.

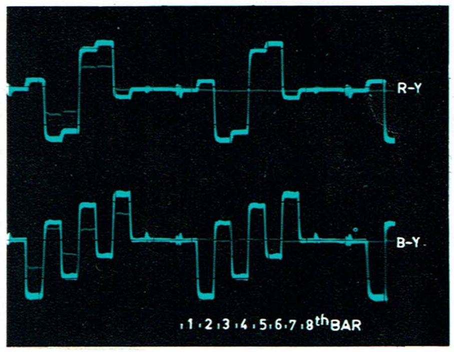


Fig. 16.

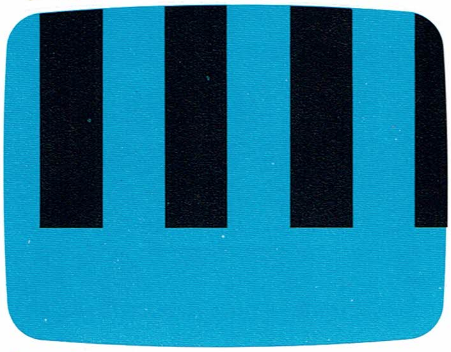


Fig. 17.

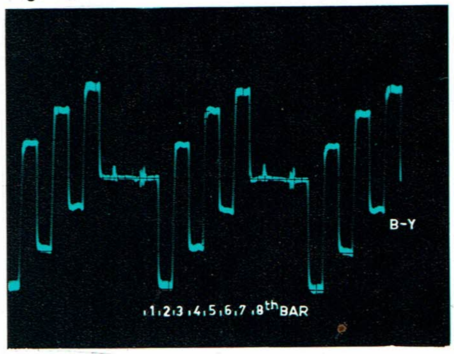


Fig. 18.

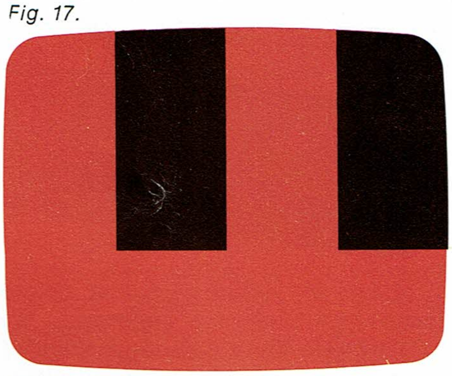


Fig. 19.

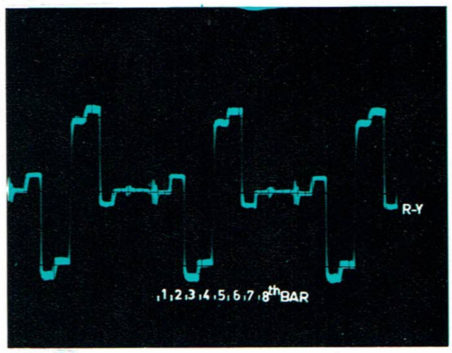


Fig. 20.

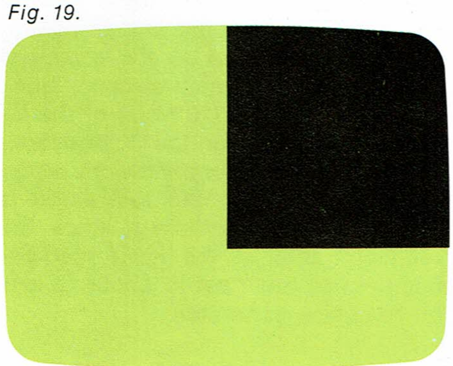


Fig. 21.

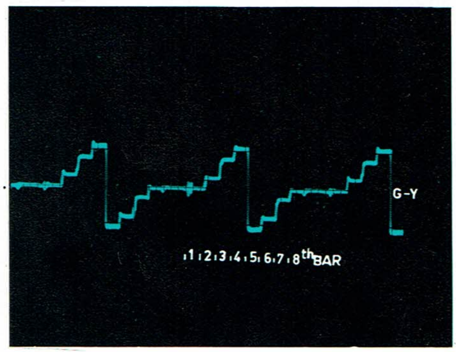


Fig. 22

or misalignment in the matrix circuit. After the G-Y signal has been checked, the blue and red guns are switched on and the complete bar pattern is seen on the screen (fig. 15).
Making use of these two patterns (Dem and Bar) of the PM 5509, the most complicated alignments and checks on a CTV can be carried out in an extremely short period of time. This means a very considerable saving of time (and money) both for the service technician and for his customers.

In addition thanks to the easy interpretation of these patterns faultfinding is made even simpler and the technician is able to make a diagnoses more quickly and more accurately.

For further information, please check reply card ②