# SECTION 12

## KEYING WAVEFORM GENERATOR PA1/512

### Introduction

The PA1/512 accepts mixed sync pulses, field drive pulses, a d.c. line-control voltage and a d.c. field-control voltage: it produces a keying waveform used in wiping between two video signals in a mixer and also d.c. supplies for the line and field control potential dividers.

The PA1/512 comprises the following units, mounted from left to right, in a panel PN3/23:

| *Unit* | *Instruction* |
|---|---|
| Line Sawtooth Generator GE1/507A | V.10 |
| Field Sawtooth Generator GE1/506 | V.10 |
| Line Pulse Clipper GE2/507A | V.10 |
| Sawtooth Generator GE1/511 | V.10 |
| Iris Pulse Generator GE2/509 | V.10 |
| Line Bar Generator GE2/515 | V.10 |
| Field Bar Generator GE2/516 | V.10 |
| Keying Pulse Generator GE2/518 | V.10 |

A further unit, a Diode Network NE1/508 described in Instruction V.9, is mounted at the rear of the PA1/512.

The PA1/512 requires power supplies of 400 mA at 12 volts and, for relays, 200 mA at 24 volts.

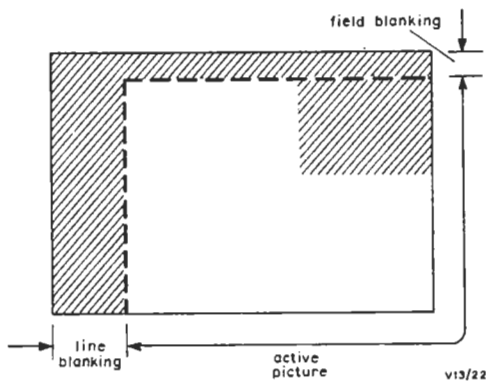


*Fig. 12.1 Keying Waveform Represented as a Raster*

### Keying Waveform

The keying waveform is a rectangular waveform used to operate an electronic high-speed switch which selects one of two video inputs. It is similar to a non-composite video waveform with only two levels (black and white). This waveform can be represented as a raster, shown in Fig. 12.1 to include the blanking periods; the black level in this diagram is shown hatched. The output of the high-speed switch is one of its inputs when the keying waveform is at white level and is the other input when the keying waveform is at black level. As the area of the keying waveform raster which is at white level is varied, a wipe is produced between the two video inputs of the high-speed switch. The blanking period of the keying waveform is all at one level so that the back porch, and thus the burst of reference sub-carrier frequency in a colour signal, is taken from only one input of the high-speed switch.

A keying waveform is obtained by feeding a waveform with an added variable d.c. component into a squaring circuit such as a Schmitt trigger circuit. Varying the level of the d.c. component varies the timing of the transistions in the keying waveform and so varies the timing of the edge of the wipe pattern. This is illustrated in Fig. 12.2.

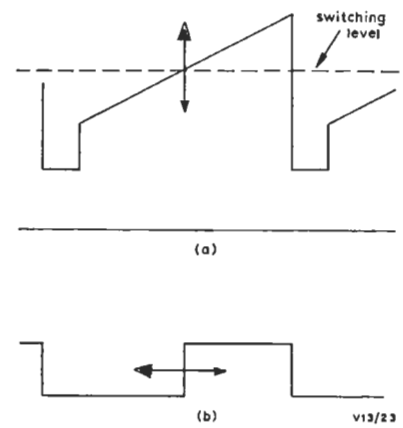


*Fig. 12.2 Diagram Illustrating the Method of Timing a Keying Waveform*

### Wipe Patterns

Fig. 12.3 shows the variety of wipe patterns available using the PA1/512. These are known as:

1. Line split.
2. Line Bar.
3. Field split.
4. Field bar.
5. Diagonal sinister.
6. Diagonal dexter.
7. Iris.

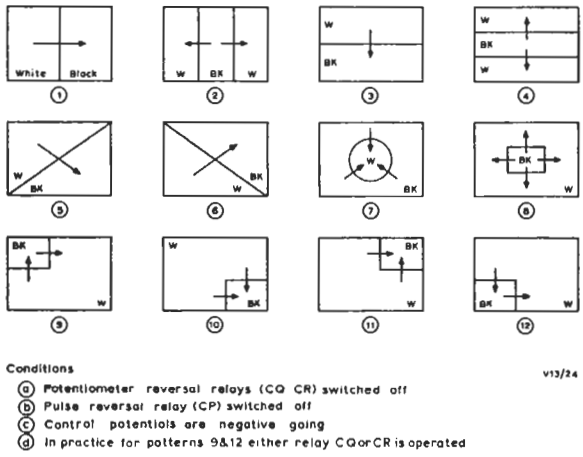


*Fig. 12.3 Wipe Patterns Available from the PA1/512*

8. Box.
9. Top-left corner.
10. Bottom-right corner.
11. Top-right corner.
12. Bottom-left corner.

A keying waveform for patterns 1 and 3 can be obtained from a line or field sawtooth as shown in Fig. 12.2. Line Frequency pulses are added as a refinement to the field sawtooth waveform. This causes the field split keying waveform to change its mark-to-space ratio by line-period increments so that the split in the wipe always occurs during line blanking and not during the active part of the line.

Bar keying waveforms are generated from triangular waveforms as shown in Fig. 12.4(a). The waveform also shows an added square-wave component used to overcome backlash in the Schmitt trigger squaring circuit. A pulse is added to the line and field sawtooth waveforms for the same purpose. A line frequency component is also added to the field triangular waveform.

The keying waveforms for the remaining wipe patterns are generated from combinations of line and field waveforms. Fig. 12.4(b) shows how a diagonal keying waveform is generated (a specimen field of only 12 lines is shown for clarity).

The iris keying waveform is generated from the voltage sum of line and field parabolic waveforms.

The box keying waveform is generated by gating line and field bar keying waveforms.

The corner keying waveforms are generated by gating line and field split keying waveforms.

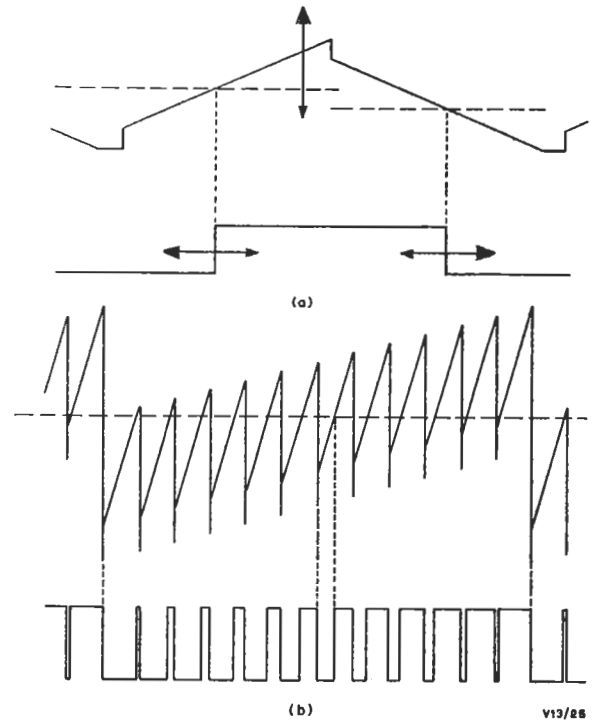


*Fig. 12.4 Generation of Bar Keying and Diagonal Keying Waveforms*

**Matrix Circuit**

The appropriate keying waveform for any required wipe pattern is selected by means of relays fed from a single-pole switch, or push-button equivalent, via a diode matrix. The matrix circuit is given in Fig. 12.5. The relays operated for each of the patterns are given in Table 1.

**Relay Functions**

The functions of the relays contained in the PA1/512, some of which are shown in Fig. 12.7, are summarised as follows:

RL1A Removes a dummy partial load from the output of the GE1/507A when the output of the pulse mixer in the GE2/507A is switched into circuit.

RL1B Switches the output of the pulse mixer in the GE2/507A from the input of the sync mixer to the input of the line switch.

RL2 Disconnects the output of the field switch in the GE2/518 from the input of the key waveform gate.

RL3 Switches off the output of the line switch in the GE2/507A.

TABLE 1

| *Pattern (see Fig. 12.5)* | *Relays* | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | *RL1A/B* | *RL2* | *RL3* | *RL4* | *RL5* | *RL6* | *RL7* | *RL8* | *RL9* |
| 1. Line split | | X | | | | | | | |
| 2. Line bar | X | | X | | | | | X | |
| 3. Field Split | | | X | X | | X | | | |
| 4. Field bar | X | | X | | | | | | X |
| 5. Diagonal | X | X | | X | | | | | |
| 6. Diagonal | X | X | | | | | | | |
| 7. Iris | | X | X | | | | X | | |
| 8. Box | X | | X | | | | | X | X |
| 9. Corner | | | | | X | | | | |
| 10. Corner | | | | X | | X | | | |
| 11. Corner | | | | | | | | | |
| 12. Corner | | | | X | X | X | | | |

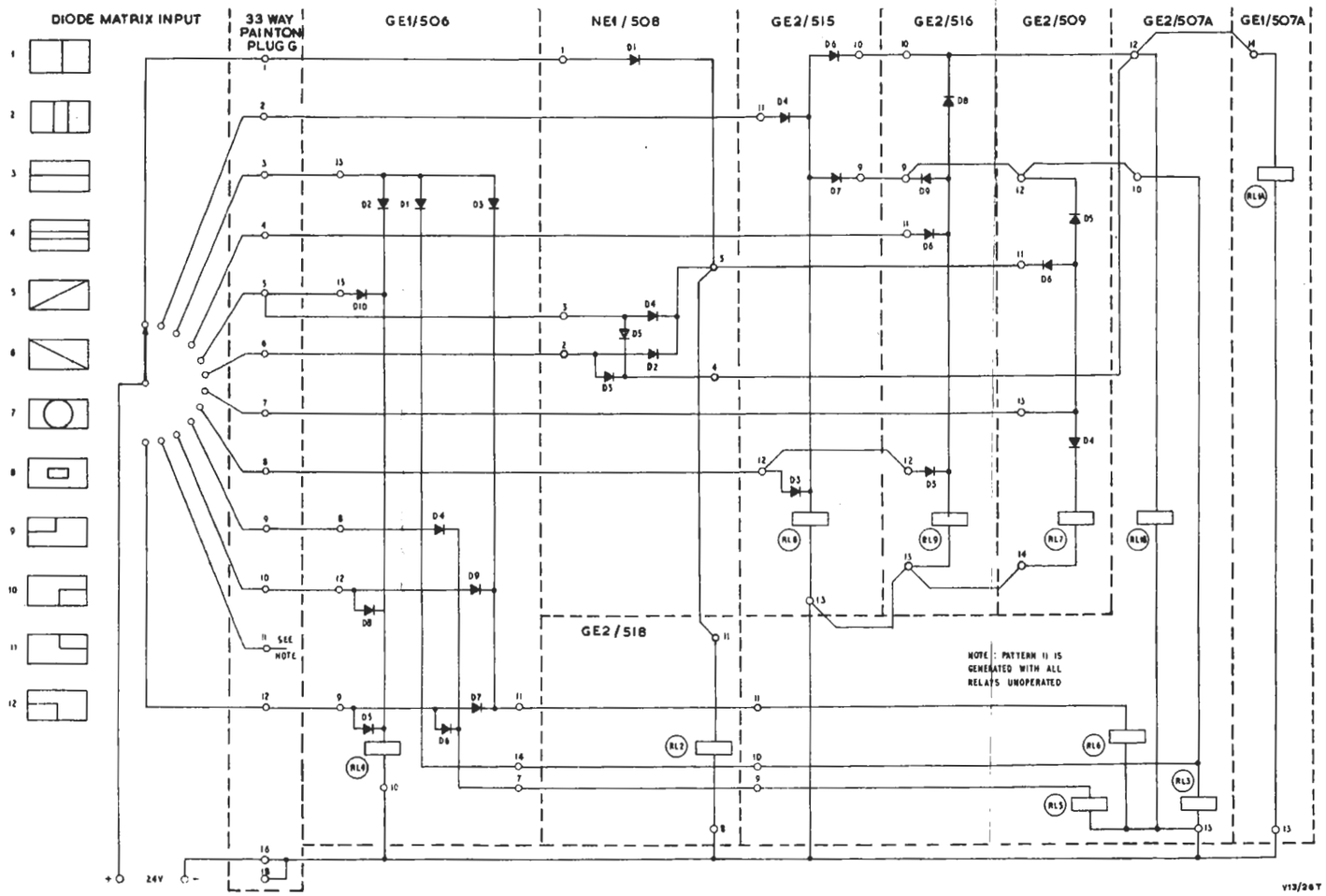


*Fig. 12.5 Matrix Circuit in the PAI/512*

RL4 Inverts the field sawtooth output of the GE1/506.

RL5 Inverts the output of the line switch in the GE2/507A.

RL6 Inverts the field drive pulse added to the field sawtooth in the GE2/507A.

RL7 Switches on the output of the Iris Pulse Generator.

RL8 Switches on the output of the Line Bar Generator.

RL9 Switches on the output of the Field Bar Generator.

RLA Increases line-frequency constants in the GE1/511 for 405-line working.

RLB Increases field-frequency time constants in the GE1/511 for 525-line working.

CO (Mounted at the rear of the PA1/512.) Links the operation of relay CP with a relay RLA in a PA18/507 as shown in Fig. 12.6. RLA determines the source of the output-signal blanking (including colour burst).

CP Inverts the keying waveform before blanking is added.

CQ Reverses the d.c. supply to the line control potential divider.

CR Reverses the d.c. supply to the field control potential divider.

**General Description**

A simplified block diagram of the PA1/512 is given in Fig. 12.7. Mixed sync pulses are fed to the Line Sawtooth Generator GE1/507A. This sawtooth with line pulse and d.c. components is fed to the Line Pulse Clipper GE2/507A.

Field drive pulses are fed to the Field Sawtooth Generator GE1/506. Relay RL4 selects the output of the required polarity. This output is fed to the GE2/507A.

Field drive pulses are added to the field sawtooth waveform (patterns 3 and 9 to 12) via relay contacts RL1B and RL6 in the GE2/507A. Sync pulses are added to this waveform so that the switching of horizontal boundaries occurs during the line blanking period and not during the active line period.

The field sawtooth without drive or sync pulses

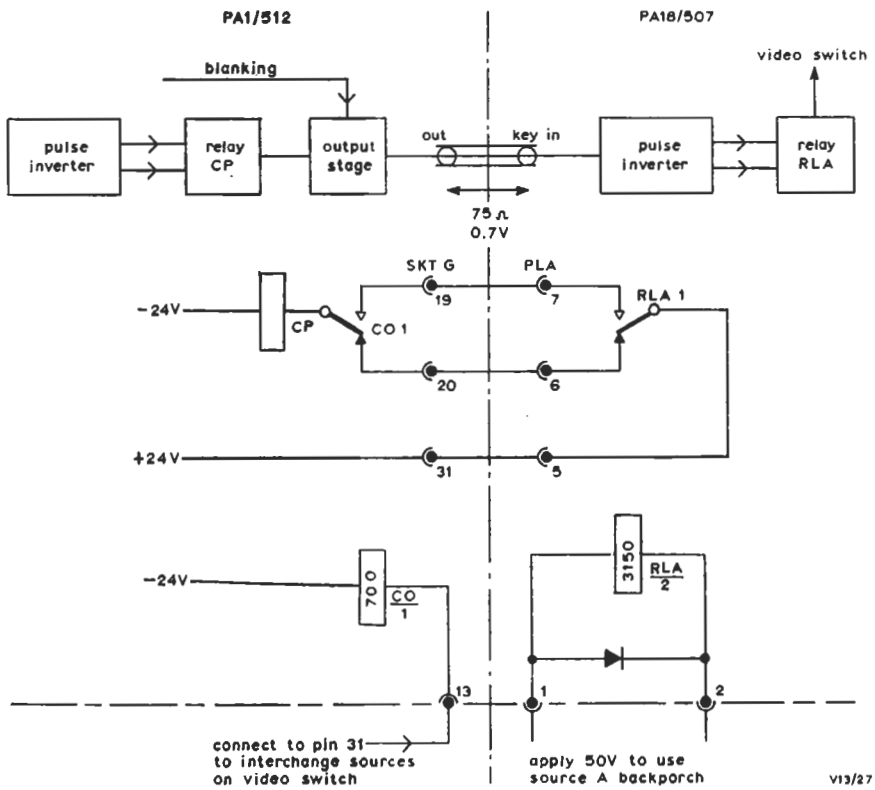


*Fig. 12.6 Relay Interconnections between PA1/512 and PA18/507*

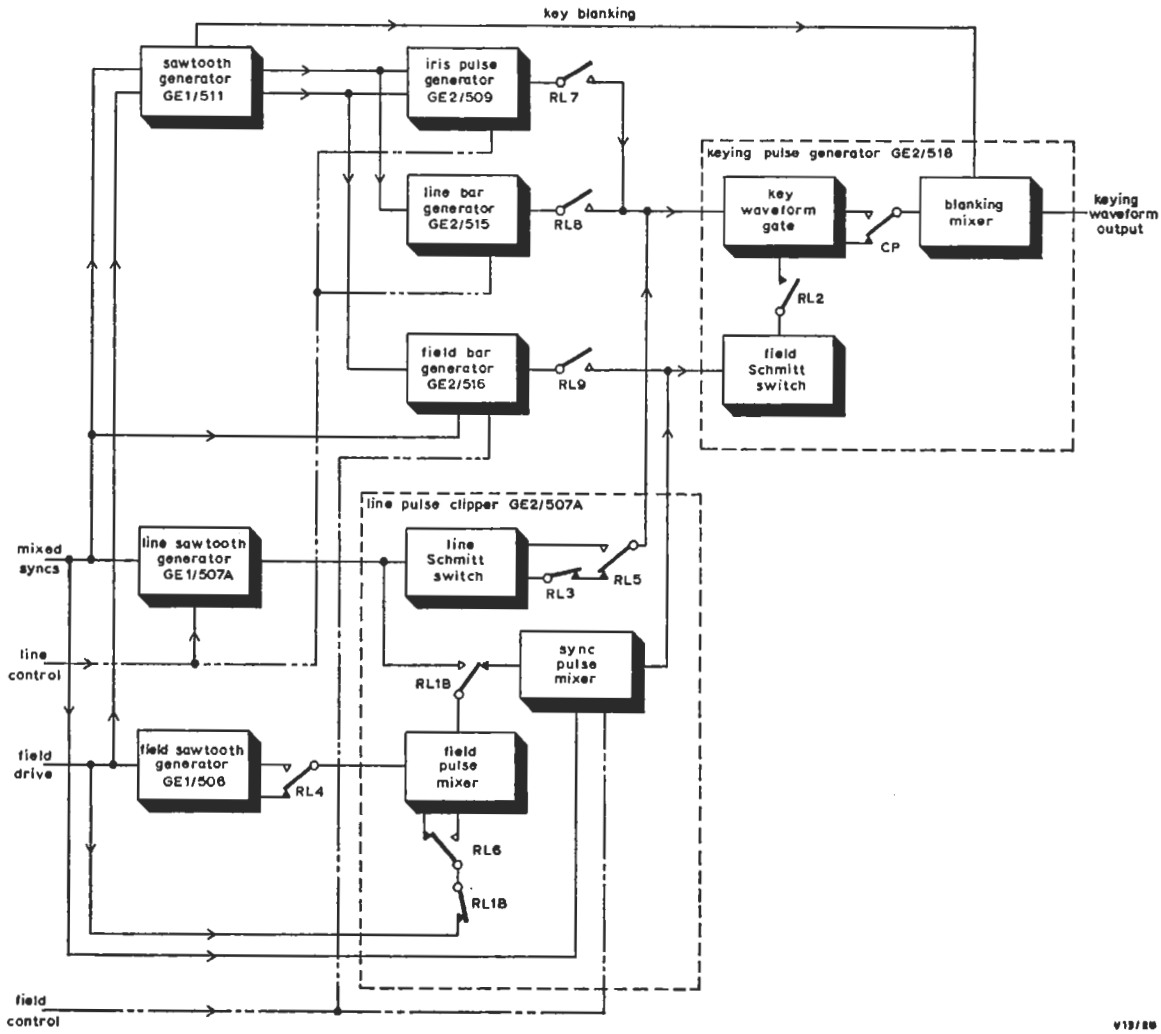


*Fig. 12.7 Simplified Block Diagram of the PAI/512*

can be fed (patterns 5 and 6) to the input of the line switch in the GE2/507A to give a waveform similar to that shown in Fig. 12.4(b). The output of the line switch can be of either polarity, selected by means of relay contact RL5, or can be switched off by means of relay contact RL3.

The mixed sync and field drive pulses are also fed to the Sawtooth Generator GE1/511. This generates line and field sawtooth waveforms, line and field clamp pulses and a key blanking waveform. The clamp pulses are fed only to the Iris Pulse Generator GE2/509 which also accepts the line and field sawtooth waveforms from the GE1/511.

The iris keying waveform is produced by integration of the line and field sawtooth waveforms giving line and field parabolic waveforms. These are mixed by clamping the field parabola to a fixed voltage and clamping the line to the clamped field parabola. The GE2/509 also contains a Schmitt trigger circuit which squares the mixed parabolic waveform to produce the iris keying waveform. Backlash in the Schmitt circuit causes distortion in the shape of the iris which is most noticeable in a small iris. Backlash is minimised to reduce this distortion.

The line sawtooth waveform from the GE1/511 is also fed to the Line Bar Generator GE2/515. The

sawtooth is used to switch a Schmitt trigger circuit in the middle of the active line period. The square-wave output of the Schmitt circuit is integrated to give a triangular waveform. This triangular waveform is fed to a second Schmitt trigger circuit which produces the line bar keying waveform as shown in Fig. 12.4(a).

The Field Bar Generator GE2/516 is similar to the GE2/515.

The field sawtooth waveform from the GE2/507A is fed via a field switch in the GE2/518 and relay contact RL2 (patterns 3 and 9 to 12) to the keying waveform gate. This gate combines the line and field components. An output from the gate of the required polarity is selected by means of a relay contact CP. The keying waveform is mixed with key blanking waveform from the GE1/511 to produce the blanked keying output waveform of the PA1/512.

The d.c. supplies for the line and field control voltages are derived from the GE1/507A and GE2/518 respectively. The line control voltage is fed to the GE1/507A, the GE2/509 and the GE2/515. The field control voltage is fed to the GE2/507A and the GE2/516. These control voltages effect the change in the keying waveform which produces a wipe between the two inputs of the external high-speed switch.

**Test Procedure**

The PA1/512 can be aligned as part of a Video Mixer EP5/502 (see Instruction V.15). In this Mixer the line and field control-voltage sources are connected together (see PA8/505) so that the four line-control preset resistors in the GE1/507A are effectively in parallel with the corresponding field control preset resistors in the GE2/518.

Not all the patterns are available in some mixers and steps in the procedure relating to these patterns can be omitted.

Two dissimilar pictures should be chosen to be displayed as the two video sources. One of these pictures should have two diagonal lines so as to define the centre of the picture and the locii of the corners of a box wipe. One of the pair known as Caption Test Slide No. 56 is suitable.

The procedure outlined below calls for checking the operation of a wipe. This involves wiping between two sources at least twice, checking that the wipe is completed each time and that most of the fader travel is required for the wipe.

*GE1/507A Line Sawtooth Generator*

RV1 *Line Sawtooth Amplitude*
Adjust to give 1·0 volt p-p of uncrushed sawtooth component in the waveform at the *Line S/T* monitoring socket. If necessary, adjust the mixer group faders on the control desk to give a linear sawtooth.

RV2 *Horizontal Centreing (patterns 1 and 9 to 12)*
Remove the control connector from the rear of the PA1/512.
Adjust RV2 to put the line component of the wipe just into the blanking period at the left-hand edge of the picture.
Replace the control connector.

RV3 to RV6 *Line Wipe Limits*
In a mixer which has the d.c. supplies for the line and field controls connected, the effect of the corresponding preset resistors in the GE1/507A and the GE2/518 is accumulative.
Select a left-to-right line split wipe and proceed as shown in Table 2.
Check the operation of the line split wipes in both directions.

*GE2/507A Line Pulse Clipper*

RV1 and RV3 *Angle of Diagonal (patterns 5 and 6)* *Vertical Centreing (patterns 5 and 6)*
Select a diagonal wipe.
Set both faders at 15.
Adjust RV3 so that the line of the wipe passes through the centre of the picture.
Adjust RV1 so that the line of the wipe passes through the opposite corners of the picture.
Check the operations of the diagonal wipes in both directions.

RV2 *Vertical Centreing (patterns 3, 10 and 12)*
Select a field-split wipe.
Set both faders to 15.
Adjust RV2 to put the split in the middle of the picture.
Check the operation of the wipe in both directions.
Also check the operation of both bottom corner wipes in both directions.

TABLE 2

| *Fader A set to stop* | *Fader B set to stop* | *Procedure* |
|---|---|---|
| 0 | 30 | — |
| 15 | 15 | — |
| 2 | 28 | Adjust RV6 (GE1/507A) and RV5 (GE2/518) to put the split at the left-hand edge of the picture just into the blanking period. Anti-clockwise rotation of these controls brings the split into the picture. |
| 28 | 2 | Adjust RV3 (GE1/507A) and RV2 (GE2/518) to put the split at the right-hand edge of the picture just into the blanking period. Clockwise rotation of these controls brings the split into the picture. |
| | | Repeat the last two steps as these controls are inter-dependent. |
| 30 | 0 | — |
| 15 | 15 | — |
| 2 | 28 | Adjust RV4 (GE1/507A) and RV4 (GE2/518) to put the split at the right-hand edge of the picture just into the blanking period. Clockwise rotation of these controls brings the split into the picture. |
| 28 | 2 | Adjust RV5 (GE1/507A) and RV3 (GE2/518) to put the split at the left-hand edge of the picture just into the blanking period. Anticlockwise rotation of these controls brings the split into the picture. |
| | | Repeat the last two steps as these controls are inter-dependent. |

RV4 *Vertical Centreing (patterns 9 and 11)*
Select a top corner wipe.
Set both faders at 15.
Adjust RV4 to put the field split component of the wipe in the middle of the picture.
Check the operation of top corner wipes in both directions.

*GE1/511 Sawtooth Generator*

RV1 *Key Blanking Field Pulse Timing*
Adjust to give a pulse of 1250 μs at the *Field Clamp* monitoring socket.

RV2 and RV3 *405-line Horizontal Centreing (pattern 7)*
*625-line Horizontal Centreing (pattern 7)*
Select an iris wipe.
Set the faders to give a small iris.
Adjust the horizontal centreing of the iris.

RV4 *Line Sawtooth Amplitude*
Adjust to give 0·68 volts p-p at the *Line Parabola* monitoring socket on the GE2/509.

RV5 *Field Sawtooth Amplitude*
Adjust to give 0·30 volts p-p at the *Field Parabola* monitoring socket on the GE2/509.

*GE2/509 Iris Pulse Generator*

RV1 *Large Iris Limit*
Set the faders, giving a large iris, to stops 2 and 28. Adjust RV1 to put this iris just outside the picture.

RV2 *Small Iris Limit*
Reverse the settings of the faders (stops 28 and 2).
Adjust RV2 to make the small iris just disappear.

RV3 and C10 *Small Iris Symmetry*
Set the faders to give a small iris.
Adjust RV3 and C10 to give a well-shaped circle.
Check the operation of the iris wipe in both directions.

*GE2/515 Line Bar Generator*

RV1 *Horizontal Centreing (patterns 2 and 8)*
Select a line bar or box wipe.
Set the faders to give a narrow area.
Adjust RV1 to centre this area horizontally.

RV2 *Sawtooth Amplitude*
Adjust to give 1·9 volts p-p of sawtooth component in the waveform at the base of transistor TR11.

RV4 *Horizontal Centreing (patterns 2 and 8)*
Set the faders to give a wide area.
Adjust RV4 to centre this area horizontally.

RV3 *Line Bar Limit*
Set the faders at stops 2 and 28 giving a wide area.
Adjust RV3 to put the edges of this area just outside the picture.

*GE2/516 Field Bar Generator*

RV1 *Vertical Centreing (patterns 4 and 8)*
Select a field bar or box wipe.
Set the faders to give a shallow area.
Adjust RV1 to centre this area vertically.

RV2 *Sawtooth Amplitude*
Initially adjust RV2 to give 1·67 volts p-p of sawtooth component in the waveform at the base of transistor TR11.

RV4 *Vertical Centreing (patterns 4 and 8)*
Set the faders to give a deep area.
Adjust RV4 to centre this area vertically.

RV3 *Field Bar Limit*
Set the faders at stops 2 and 28, giving a deep area.
Adjust RV3 to put the edges of this area just outside the picture.
Select a box wipe.
Readjust RV2 and RV3 to keep the corners of the box on the picture diagonals.
Check the operation of the line bar, field bar and box wipes in both directions.

*GE2/518 Keying Pulse Generator*

RV1 *Output Amplitude*
Adjust to give 0·7 volts p-p at the *Output* monitoring socket.

RV2 to RV5 *Field Wipe Limits*
These are dealt with under the GE1/507A. However in some mixers having separate d.c. line and field controls the GE1/507A provides the supply for the line control and the GE2/518 provides the supply for the field control.
The two sets of preset resistors should be adjusted on line split and field split wipes respectively.

MJR 2/67