

## SYNC PULSE STABILISING AMPLIFIERS AM18/513 SERIES

### Introduction

These stabilising amplifiers are used in video mixing equipments<sup>1, 2</sup> to clamp the video output at blanking level, to replace the existing sync pulses with reconstituted pulses of the correct shape and amplitude, and (for colour versions) to stabilise the amplitude and phase of the colour burst. Integral power supplies are provided and the units are multi-standard and colour-compatible.

The differences between the various versions of the AM18/513 are listed below:

The AM18/513 forms part of an EP5/502 Video Mixing Equipment and is equalised for 150 feet of delay cable.

The AM18/513A forms part of an EP5/503 Video Mixing Equipment and is equalised for 600 feet of delay cable.

The AM18/513B replaces both the AM18/513 and the AM18/513A for colour working.

The AM18/513C is similar to the AM18/513B but has additional facilities to permit a cue dot to be inserted in the video output.

The AM18/513D is an up-to-date version of the AM18/513C.

The basic AM18/513 and AM18/513A stabilising amplifiers consist of the following units mounted on a PN3/23 chassis:

- Equaliser EQ5/510
- Processing Amplifier AM18/514
- Error Signal Amplifier AM3/503
- Pulse Generator GE2/519
- Sync Pulse Generator GE2/504
- Gating Pulse Generator GE2/503A
- Power Supplier PS2/10A

The AM18/513B has the following additional units compared with the AM18/513:

- Video Amplifier AM1/570
- Burst Error Amplifier AM1/558

Moreover the AM18/513B contains a PS2/57A in place of PS2/57 GE2/503B in place of GE2/503A.

To make room for the extra units the EQ5/510 Equaliser is removed from the PN3/23 assembly and positioned elsewhere on the mixer bay.

The AM18/513C differs from the AM18/513B in containing a Cue Dot Insertion Unit UN9/563. Moreover:

AM18/514A replaces AM18/514

GE2/503C replaces GE2/503B

The AM18/513C differs from the AM18/513D in that Pulse Generator GE2/577 replaces GE2/519.

### General Specification

<i>Gain</i>	0 dB
<i>Impedances</i>	
Video input	75 ohms
Separated syncs input	3.3 kilohms
Output	75 ohms
<i>Frequency Response</i>	±0.1 dB from 10 kHz to 5.5 MHz
<i>k-rating (625 line)</i>	less than 0.5 per cent
<i>Differential-gain Distortion</i>	less than 1 per cent on a 10-step 625-line signal
<i>Differential-Phase Distortion</i>	less than 0.6 degrees at 4.43 MHz
<i>Hum-level Reduction</i>	28 dB ± 2 dB
<i>Max. Ambient Temperature</i>	40 degrees Centigrade
<i>Rise Time of Output Syncs</i>	0.2 μs to 0.25 μs
<i>Mains Input</i>	240 volts
<i>Power Consumption</i>	15 watts
<i>Weight</i>	21 lbs (fully equipped)

*Continued overleaf*

General Description

Block diagrams of the different versions of the AM18/513 are given in Figs. 1, 2 and 3.

AM18/513 and 513A

The video input is obtained from a studio mixer such as the MX1/503 or MX6/501 and the separated mixed-sync input from a sync switch panel such as the PA18/508 or PA18/509. To ensure correct operation of the sync-gate stage the video input must be delayed by about 0.6 μs with respect to the sync input. This allows the gating circuits to become low-impedance before the leading edges of the sync pulses contained in the composite video waveform reach them. Part of the required delay occurs in the electronics of the mixer and the remainder is introduced by the delay cable used to connect the mixer output to the input of the stabilising amplifier.

The high-frequency loss caused by the delay cable is made good in the equaliser EQ5/510 and the equaliser output is fed to the processing amplifier AM18/514. In the video amplifier section of this unit the signal is amplified, clamped at blanking level (by the action of an error signal amplifier), clipped at white level and applied to the sync gate stage. Here the original sync pulses are removed from the waveform which is then applied to the sync mixer and output amplifier stage where reconstituted sync pulses of the correct shape and amplitude are added to the signal.

Synchronising, clamping and gating pulses are

generated in the GE2/519 from a feed of separated mixed-syncs. Part of this unit inverts and clips the incoming pulse feed. The pulses so obtained are fed to the GE2/504 sync-pulse generator and are also used to drive the other part of the GE2/519. This is a clamping pulse generator which produces two sets of pulses, one wide and one narrow, for use in the sampling circuits of the error signal amplifier.

The error signal amplifier forms, together with the video amplifier section of the processing amplifier, a feedback clamp. It samples the blanking level of the video signal in the processing amplifier and, if this deviates from earth potential, produces a d.c. correction signal which is fed back to the processing amplifier in such a way that blanking level in the incoming video signal is clamped to earth potential.

Sync pulses are fed from the GE2/519 to the GE2/504 in which they are delayed and clipped. The delay ensures that sync pulses and video signals have the correct time relationship when the two are combined. The pulses then pass through a shaping network, which gives the edges a sine-squared shape, before they are added to the video signal in the output stage of the processing amplifier. Pulses from the input stage of the GE2/504 are applied to the GE2/503A gating-pulse generator. This unit provides push-pull gating pulses for the operation of the sync-gating stages in the processing amplifier.

AM18/513B

Only those parts of the unit which differ from the AM18/513 are described below.

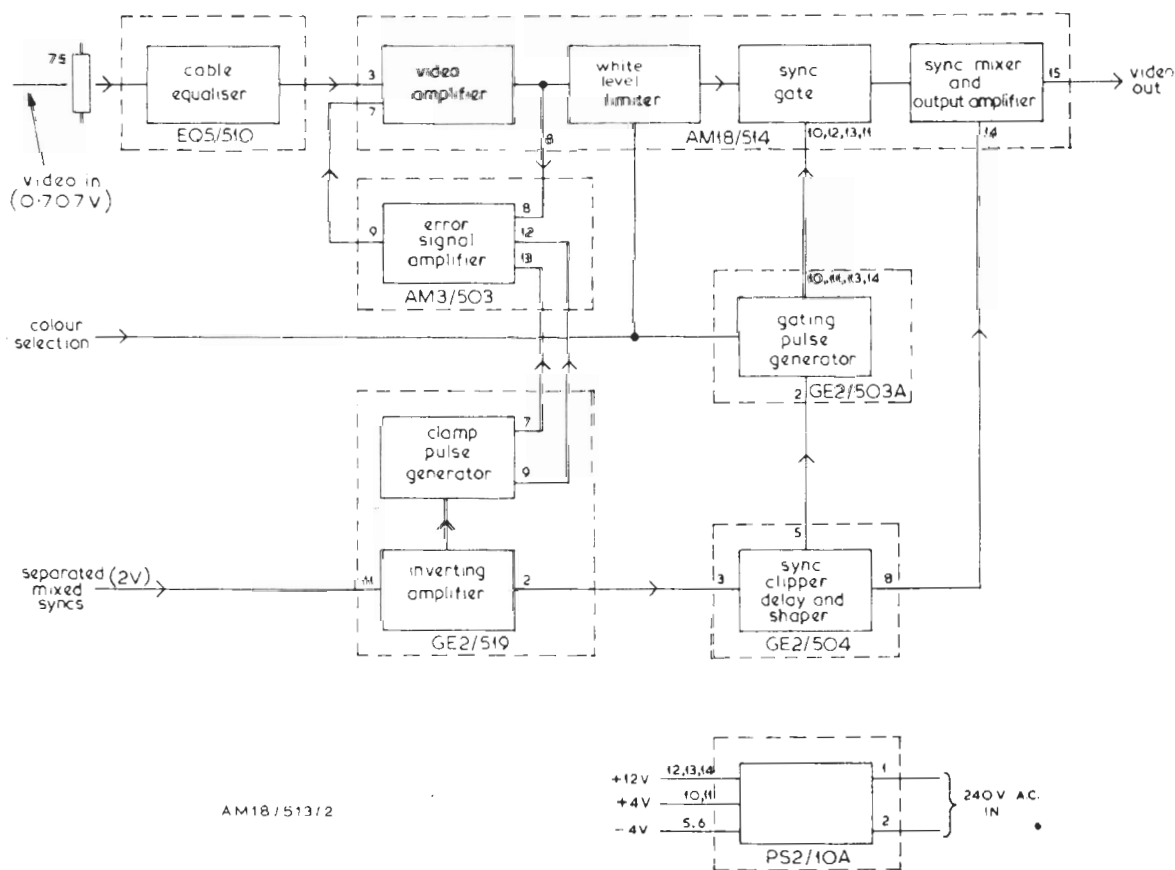


Fig.1 Block Diagram of the AM18/513 and AM18/513A

The video input signal passes through an input amplifier stage in the AM1/570 video amplifier and is then fed to a delay network and to the AM1/558 burst-error amplifier. In the AM1/558, the burst component of the signal is subtracted from a reference burst and the resulting difference signal is fed back to an adder stage in the AM1/570 to maintain the burst component of the original signal at a constant level. The delay network in the AM1/570 compensates for the delay introduced by the AM1/558.

**AM18/513C**

Only those parts of the AM18/513C which differ from the AM18/513B are described below.

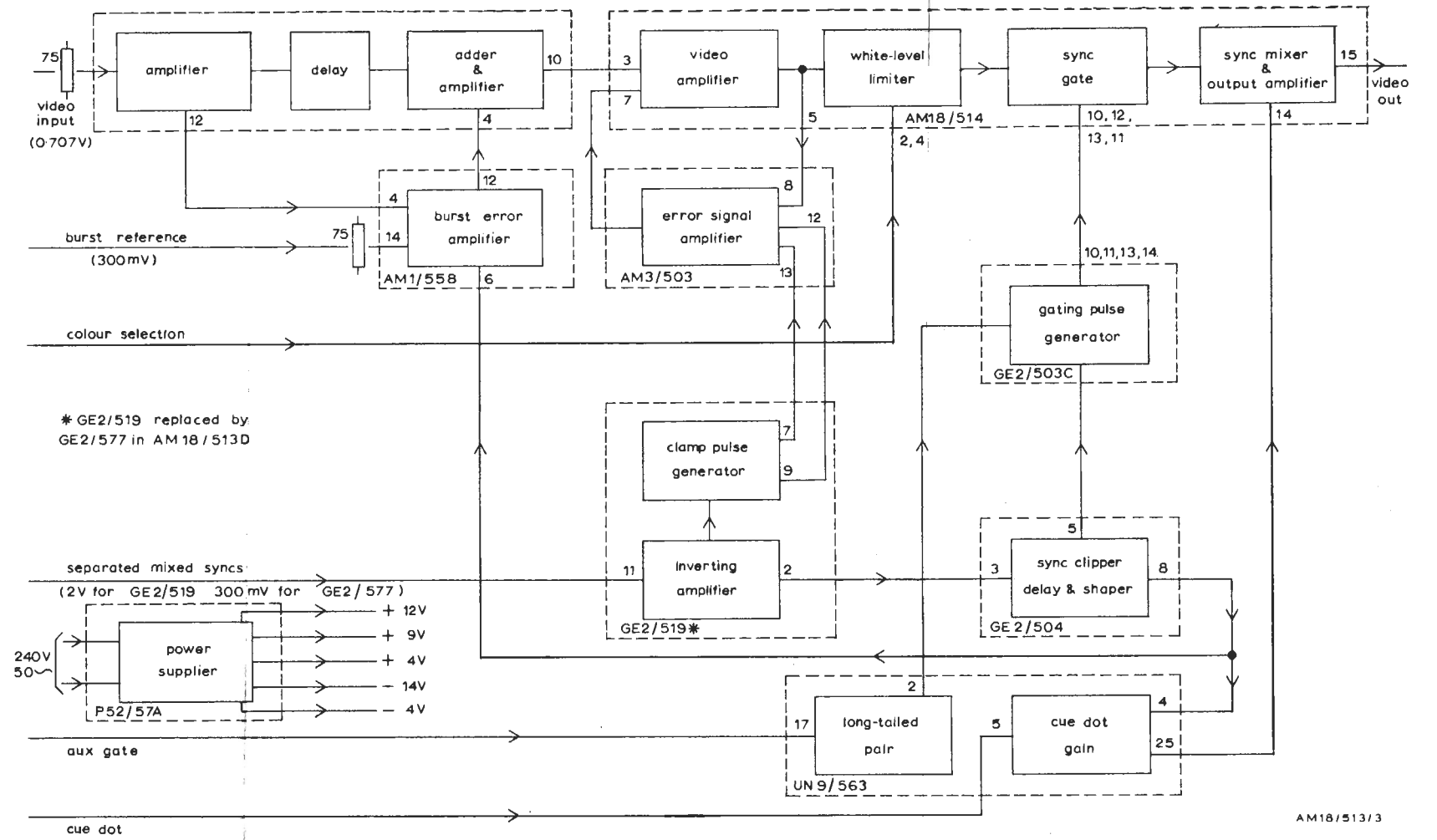
The UN9/563 is used to apply auxiliary-blanking and cue-dot signals to the stabilising amplifier. The effect of these signals is to introduce, as required, a white-black-white combination of vertical bars in a small area at the top left-hand side of the picture.

**AM18/513D**

The AM18/513D differs from the AM18/513C only in using a GE2/577 unit, to provide clamp and inverted-sync pulses, instead of a GE2/519.

**Alignment**

The units comprising a stabilising amplifier of the AM18/513 series must be aligned as an integral assembly. Unless otherwise stated, all adjustments are carried out with the appropriate unit mounted on a chassis extender. In some instances the presence of the extender affects the adjustment; when this happens a further small adjustment may be required after the unit has been replaced in the main assembly and the effect of the initial adjustment noted.



AM18/513/3

Fig.2 Block Diagram of AM18/513B

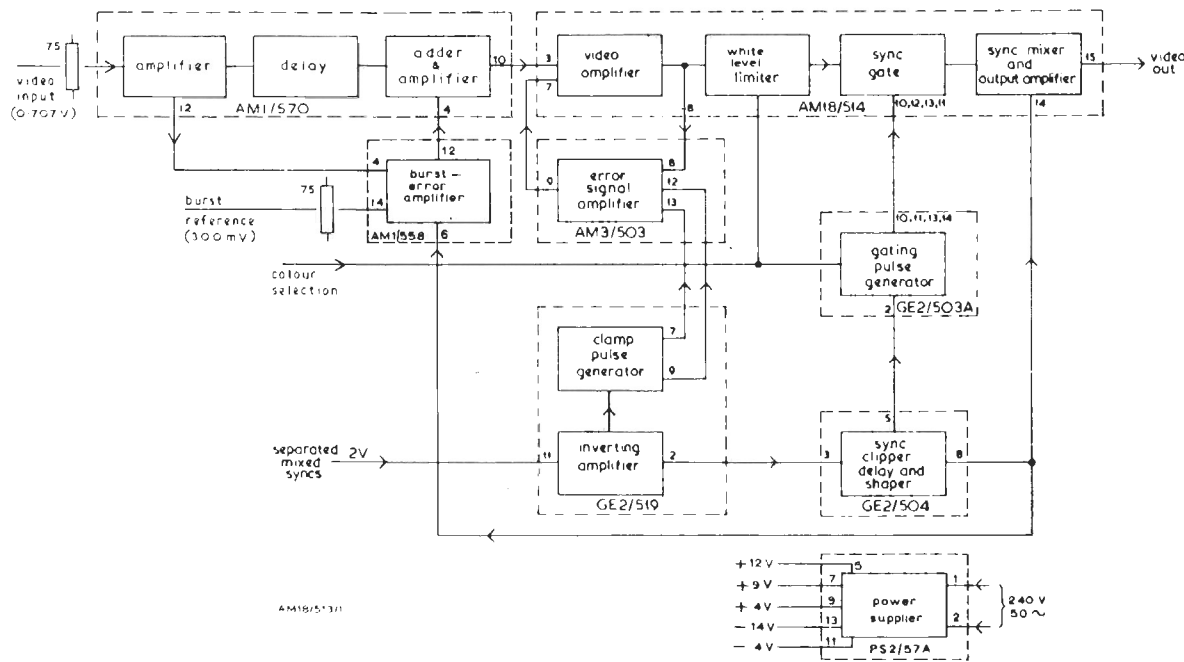


Fig.3 Block Diagram of AM18/513C and AM18/513D

The waveforms present at various points in the AM1/570 and AM1/558 units are shown (for a colour-bar input signal) in Figs. 4 to 6; the waveforms present in the other units are shown in the appropriate circuit diagrams.

The alignment procedure (for an AM18/513B) is given in tabular form. This allows any step in the alignment to be readily identified if a partial line-up is all that is needed. When aligning an AM18/513 or AM18/513A (monochrome only) stabilising amplifier, ignore those steps in the alignment procedure which are marked with an asterisk.

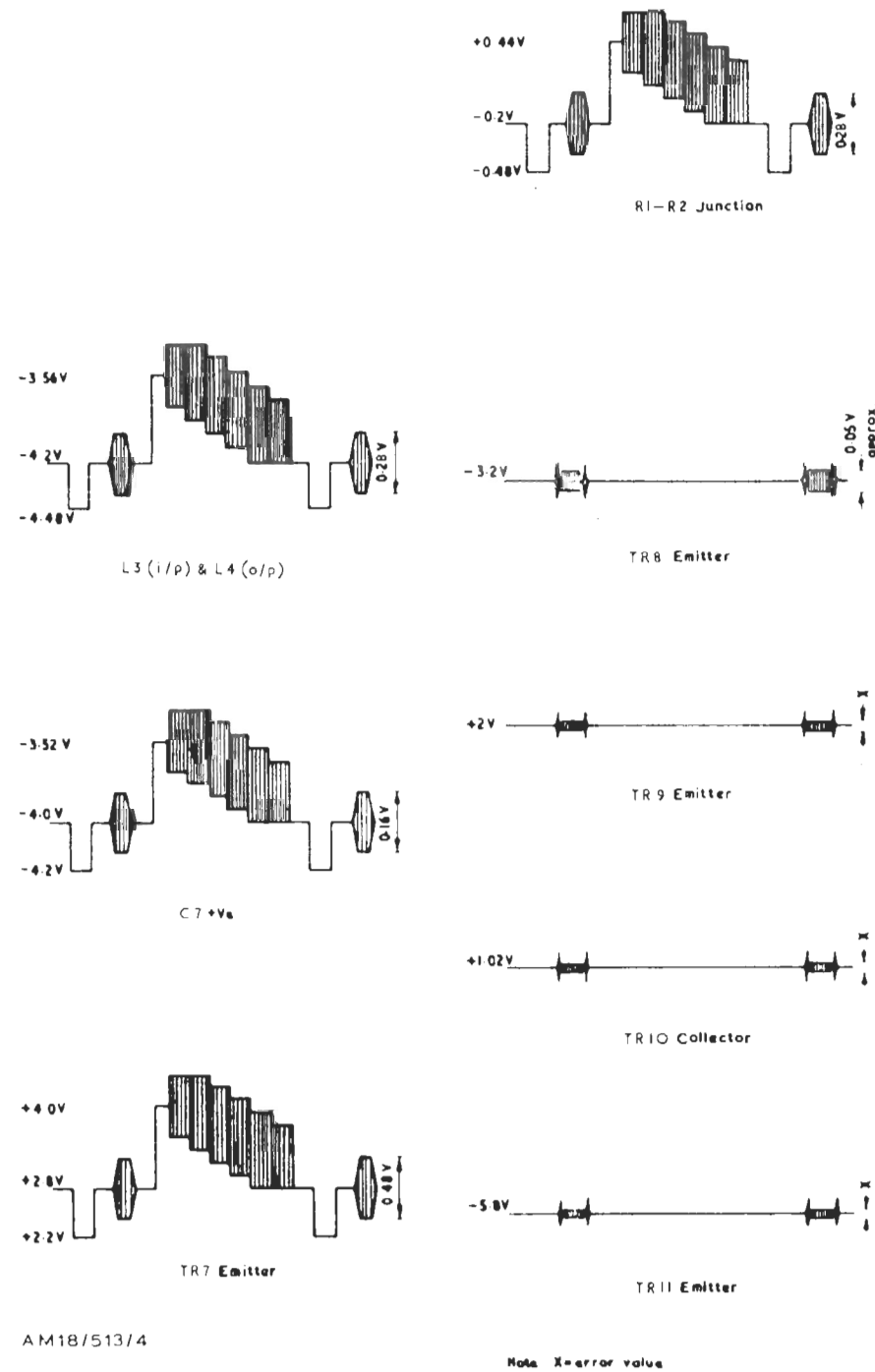


Fig.4 Waveforms in the AM1/570

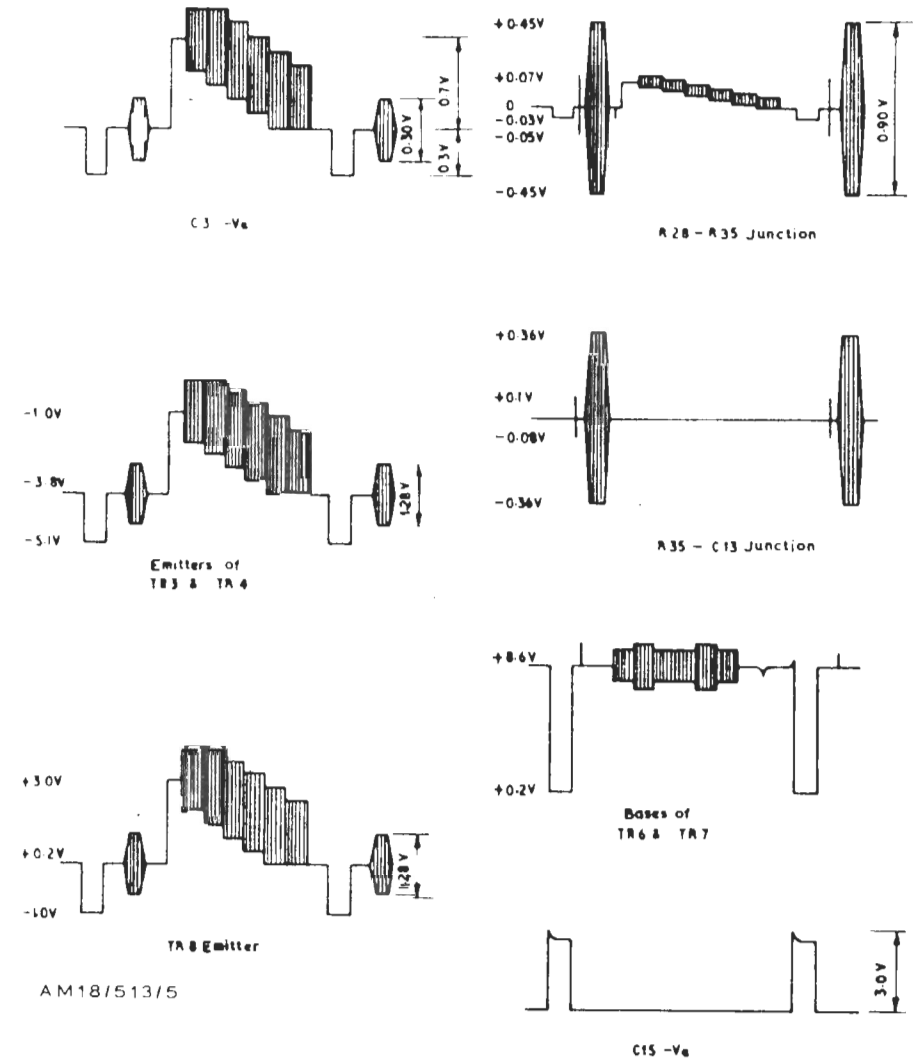


Fig.5, Waveforms in the AM1/558 (1)

<i>Subject</i>	<i>Unit</i>	<i>Control Adjusted or Point Monitored</i>	<i>Check or Adjustment</i>
<b>Initial Checks</b>			
Power supplies	PS2/57A	R8, pin 5 R21, pin 7 R27, pin 9 R17, pin 13 R33, pin 11	Adjust for +12 V Adjust for +9 V Adjust for +4 V Adjust for -14 V Adjust for -4 V The ripple voltage on all outputs should be less than 1 mV p-p.
Main Unit Inputs	AM18/513B	Signal Inputs	Route a suitable colour test signal through the mixer. Check that this signal is present at the <i>Video</i> input of the AM18/513B. Check also that a syncs-and-burst signal is present at the <i>Separated Mixed Syncs</i> input
Sync Gating	AM18/514	Monitor Junctions: R27 and pin 11 R36 and pin 13	Using a high-impedance probe, monitor at each of these points in turn and check that positive-going gating pulses are present. If gating pulses are not present, check the GE2/503B unit.
		Monitor junctions: R30 and pin 10 R37 and pin 12	Using a high-impedance probe, monitor at each of these points in turn and check that negative-going gating pulses are present. If gating pulses are not present, check the GE2/503B unit.
Sync re-insertion	AM18/514	R45	Using a high-impedance probe, check that inverted sync pulses are present at this point. If they are not, check the GE2/504A unit.
Video clamping	AM3/503	Pins 12 and 13	Check that wide sampling pulses are present at pin 12 and narrow sampling pulses at pin 13. If they are not, check the GE2/519 unit.
<b>Burst Stabilising</b>			
(1) Input signals*	AM1/558	<i>Video</i> input <i>Ref.</i> input <i>Sync</i> input	Route a synchronous colour signal through the mixer. Check that a 0.93 V p-p composite signal is present at the <i>Video</i> input, a syncs-and-burst signal is present at the <i>Ref.</i> input and a 3 V p-p inverted-sync signal is present at the <i>Sync</i> input.

Subject	Unit	Control Adjusted or Point Monitored	Check or Adjustment
(2) Burst Gating*	AM1/558	D9 cathode	Check that the clamp pulses at this point are as shown in Fig. 6. If they are not, check the waveforms at the base of TR16 and the collector of TR15 against those shown in Fig. 6.
		R22, monitor at emitter of TR12	Use a high-impedance probe at TR12 emitter and adjust R22 for zero gating step (see Fig. 6).
		R87, monitor at emitter of TR32	Use a high-impedance probe at TR32 emitter and adjust R87 for zero gating step.
		C34, C37 C42, C45 Monitor at <i>Burst Error</i> monitor point on AM1/570	Adjust these components in turn for minimum amplitude of gating spike before and after the residual burst. The best compromise is to obtain zero spike after the burst and less than 50 mV of spike before the burst, because the pre-burst spike is removed in a later gating stage.
		R87, monitor at <i>Burst Error</i> monitor point	Readjust R87 for zero step if necessary.

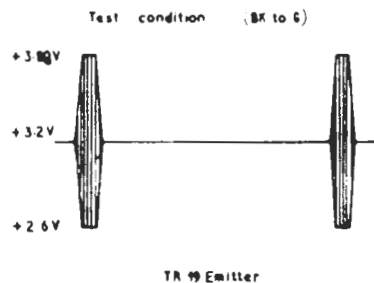
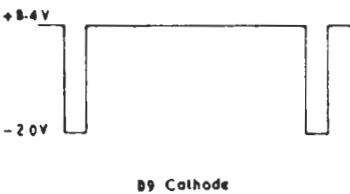
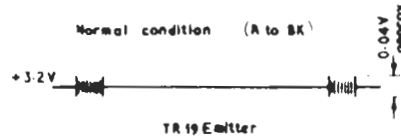
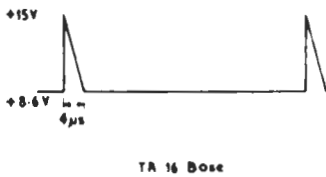
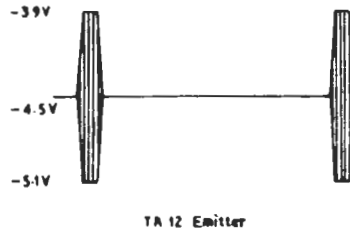
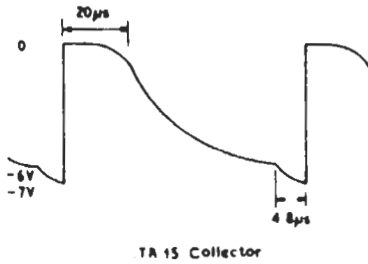


Fig.6 Waveforms in the AM1/558 (2)

<i>Subject</i>	<i>Unit</i>	<i>Control Adjusted or Point Monitored</i>	<i>Check or Adjustment</i>
(3) Burst Removal*	AM1/558	C10, monitor at AM18/513 output	Set the moveable link at the reference input to <i>Test</i> (green to black). Adjust C10 for a burst amplitude of less than 10 mV. If this is not possible, set C10 to about one third of its capacitance and adjust R38 and C25 on the AM1/570 unit for minimum burst. If a gross misalignment is suspected, check step (5).
(4) Burst re-insertion*	AM1/558	R110, C28, monitor at <i>Burst Error</i> monitor point on AM1/570	Set the moveable link at the reference input to <i>Normal</i> (red to black). Feed the AM18/513B with a non-sync colour signal and adjust R110 and C28 for a burst amplitude of less than 40 mV.
(5) Chrominance/ luminance gain of burst-delay section*	AM1/570	Monitor at junction of R1/R2	Use a high-impedance probe at the junction and check that the burst amplitude is 280 mV.
		L3, L4, monitor at junction of R7/R8 and at junction of R9/R10	Check that the burst amplitude at each point is 280 mV $\pm 5\%$ . If it is not, then, initially, L3 and L4 must be adjusted to give equal amplitudes at these points. Further adjustment of L3 from this equality setting is necessary to give a constant burst phase when fading from 0 dB to 20 dB. Following any adjustment of L3, R110 and C28 must be re-adjusted (see Step 4).
<b>Picture and Sync Adjustments</b>			
(6) Video Amplifier Gain and Blanking Level	AM18/514	RV1, monitor at MP1	Adjust RV1 for a signal amplitude of 3V p-p and check that the blanking level of the signal is at earth potential. If it is not, align the AM3/503 (steps 16 and 17).
(7) Sync Gate Steps	AM18/514	RV3, RV4, monitor at output of AM18/513B	Check that the AM18/513B is terminated in 75 ohms and monitor at the output. Press the <i>Sync Pulse Removal</i> switch on the GE2/504A unit and adjust RV3 and RV4 to remove any steps that may be present during the line-blanking period.
(8) Sync Gate Transients	AM18/514	C8	Keep the <i>Sync Pulse Removal</i> switch pressed and adjust C8 for minimum-amplitude gating spikes. If, after adjustment, the spike amplitude is greater than 10 mV p-p, alter the values of capacitors C9 and C10. Note that the presence of the chassis extender seriously affects this adjustment. Release the <i>Sync Pulse Removal</i> switch.

<i>Subject</i>	<i>Unit</i>	<i>Control Adjusted or Point Monitored</i>	<i>Check or Adjustment</i>
(9) Output d.c.	AM18/514	RV5	Adjust to bring the blanking level of the output signal to zero volts.
(10) Picture Gain	AM18/514	RV6	Adjust to make the picture component of the output signal 0.7 V p-p.
(11) Sync Gain	GE2/504A	<i>Sync Gain</i>	Adjust the <i>Sync Gain</i> control which is mounted on the front panel of the GE2/504A to make the sync component of the output signal 0.3 V p-p.

#### White-level Clipper

(12) White-level clipper	AM18/514	RV2, monitor at output of AM18/513B	Apply a composite sawtooth signal with an amplitude of 1.5 V p-p to the input of the AM18/513B. Adjust RV2 to limit the picture component of the output signal to 0.8 V p-p.
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#### Frequency Response and Differential-Phase Distortion

(13) Frequency Response	AM18/514	C7, monitor at output of AM18/513B	Apply the output from an augmented pulse-and-bar generator such as the GE2/543 or the GE2/559 to the AM18/513B. Use an oscilloscope terminated in 75 ohms. Check that the pulse-to-bar ratio of both the 2T pulse and the 10T chrominance/luminance pulse is better than 1%. If it is not, adjust C7. The 1T pulse should be within 2% of the 2T pulse-to-bar ratio.
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Attenuate the pulse-and-bar input signal in 1-dB steps until it is 20 dB down on a 1-V signal. Observe the sub-carrier burst. Throughout the attenuation process the burst amplitude should not vary by more than  $\pm 2\%$  and the burst phase should not vary by more than  $\pm 1^\circ$ .

(14) Differential Phase Distortion*	AM18/514	L5	Use a Remote Signal Analyser EP1M/508 and a Non-linearity Distortion Test Signal Generator GE2M/520 (or GE4/505A with GE4/514) to check the differential-phase distortion. (See Fig. 7 and the Instruction on the EP1M/508.) The distortion should be less than $0.6^\circ$ . If it is not, adjust L5.
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#### Clamp Circuit

(15) Subcarrier Rejection	AM3/503	L1, monitor at junction of R4/C1	Remove the unit from the assembly and apply a 4.43-MHz subcarrier signal at 1 V p-p to monitor point MP1. Use a high-impedance probe. Adjust the core of L1 for minimum signal. Replace the unit in the main assembly.
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Subject	Unit	Control Adjusted or Point Monitored	Check or Adjustment
(16) Feedback Clamp, Adjustments	AM3/503	RV2, C18	Remove the input signal from the AM18/514 unit, but check that the other units of the AM18/503A are still being fed with pulses via the UN9/511A unit.
		Monitor at MP2	Set S1 on the AM3/503 to the <i>OV</i> position. Adjust RV2 to remove any step that may be present and then adjust C18 to minimise transients.
		S1	Set S1 to the $-10\text{ mV}$ position. A pulse of about $0.7\text{ V}$ p-p should be present at MP2. A low-amplitude pulse indicates low gain in the amplifier circuits. Set S1 to <i>OV</i> .
		RV3, monitor at MP1 in AM1/514	Use a high-impedance probe at MP1 and adjust RV3 to make the potential at this point zero volts.
(17) Feedback Clamp: Operaton Checks	AM3/503	RV1	Set S1 to <i>Normal</i> and restore the video input to the AM18/514. Check that a correctly-clamped video signal appears at monitor point MP1 on the AM18/514 unit. Set the display to show the field-blanking period and adjust RV1 for minimum distortion. Check RV2 and re-adjust if necessary.

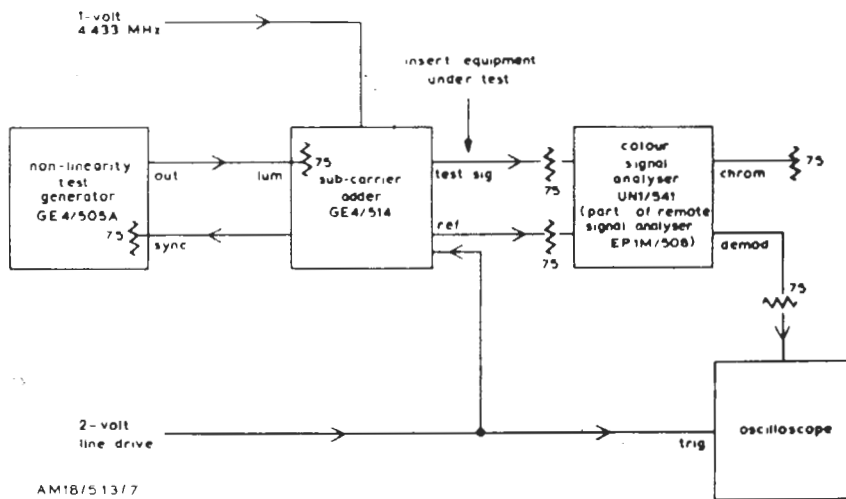


Fig.7 Differential-phase Distortion Test Arrangement for the AM18/514

References to Typical Associated Equipment

1. Video Mixing Equipment EP5/502
2. Video Mixing Equipment EP5/503

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