STUDIO VIDEO MIXING EQUIPMENT EP5/502

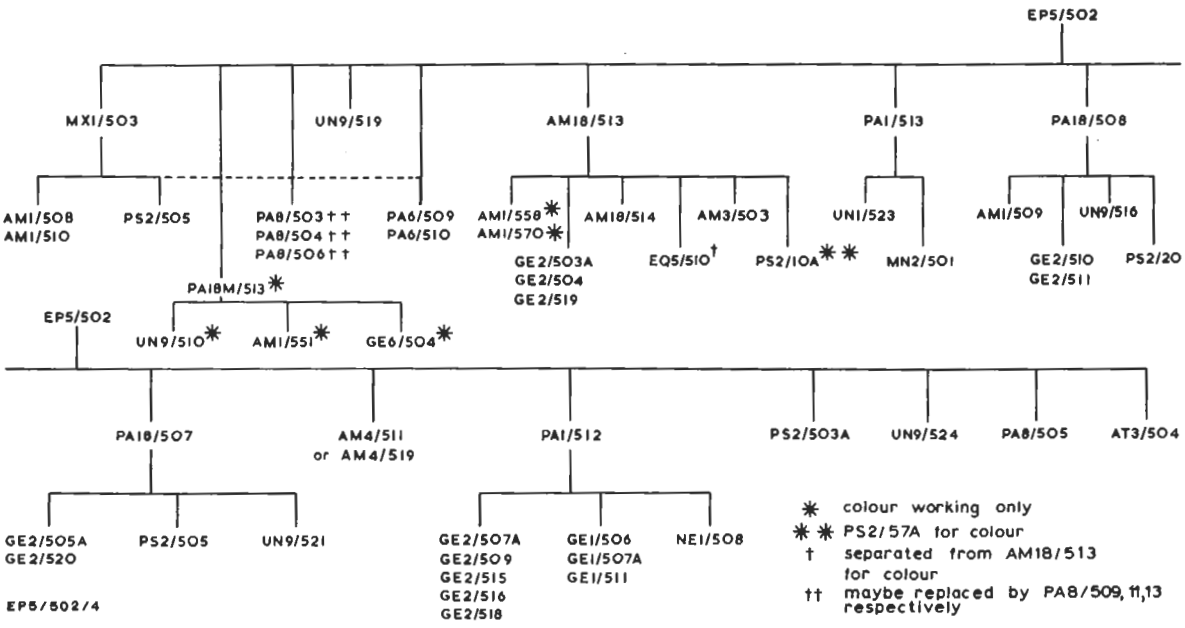


Fig. 1 EP5/502 Family Tree

A list of the relevant Instructions is given below.

AM1/508
AM1/509
AM1/510
AM1/551
AM1/558
AM1/570
AM3/503
AM4/511
AM4/519
AM18/513
AM18/514
AT3/504
EQ5/510
GE1/506
GE1/507A
GE1/511
GE2/503A
GE2/504
GE2/505A
GE2/507A
GE2/509
GE2/510
GE2/511
GE2/515
GE2/516
GE2/518
GE2/519
GE2/520
GE6/504
MN2/501
MX1/503
NE1/508
PA1/512
PA1/513
PA6/509
PA6/510
PA8/503
PA8/504
PA8/505
PA8/506
PA8/509
PA8/511
PA8/513
PA18/507
PA18/508
PA18M/513
PS2/10A
PS2/20
PS2/57A
PS2/503A
PS2/505
UN1/523
UN9/510
UN9/516
UN9/519
UN9/521
UN9/524

SECTION 2

STUDIO VIDEO MIXING EQUIPMENT EP5/502

Introduction

The EP5/502 is an eight-channel two-bank video mixer for use in television studios. It accepts a feed of station syncs and up to eight composite-video input signals. The video signals are applied to duplicate eight-channel MX1/503 mixers; one of these mixers provides a transmission signal and the other a preview signal. The outputs of both mixers may be combined in a split-screen switch to produce any one of 12 different wipes. Switching is provided to allow the group mixers in the MX1/503 units to be interchanged in the event of a breakdown.

The manner in which video input signals are treated by the mixer is determined by the settings of eight *Sync/Auto/Non-sync* keys which are mounted on the PA8/505 Sync and Pattern Selection Panel. When a channel is operated in the *Sync* mode any source applied to that channel is treated as synchronous and mixing is permitted with any other channel declared as *Sync*. When a channel is operated in the *Non-sync* mode any source applied to that channel is treated as non-synchronous and mixing is not permitted. However, when a channel is operated in the *Auto* mode the mixer itself decides whether the input source is synchronous or not.

Fig. 2.1 shows the way in which the various units comprising an EP5/502 are grouped. With the exception of the desk panels all the units are bay mounted.

This Instruction deals with the EP5/502 as a system and the only details given apply to the equipment as a whole. Detailed descriptions of all other units are given in the relevant Instructions; see the list under Fig. 2.1.

Signal Circuits

A block diagram showing the video and sync interconnections between the various units of an EP5/502 is given in Fig. 2.2.

The video input signals to the mixer are fed via the eight inputs of the Sync Pulse Separation and Monitoring Panel to eight UN9/519 Video Switch Units. Each UN9/519 provides two outputs and these feed the A and B channel mixer sections of the MX1/503 Studio Mixers. The channel mixers each contain 8 cut/fade amplifiers and the outputs of these feed a common mixing amplifier. The outputs from the Channel A and Channel B mixing amplifiers are fed to the A and B inputs of the PA18/507 Split Screen Switch and also, via a delay cable, to the A and B inputs of an AT3/504 attenuator. The C input of the AT3/504 is fed from the output of the split-screen switch. The AT3/504 contains three two-way splitters and so has two outputs for each input. Outputs 1A, 1B and 1C feed Group Mixer 1 (this is part of MX1/503 (A)), the other three outputs feed Group Mixer 2. Each group mixer consists of three cut/fade amplifiers followed by a mixing amplifier.

The outputs from the group mixers are applied, via delay lines, to AM18/513 Sync Pulse Stabilising Amplifiers. In these the signal is clamped, the original syncs are removed and are replaced by re-shaped syncs. The outputs from the stabilising amplifiers are fed to the two inputs of a UN9/524 Video Switch Unit. This unit functions as a video changeover switch for the group mixers and determines which is used for preview and which for transmission; it also switches a line-up signal. The UN9/524 has two transmission outputs and one preview output. Each output is applied to an AM4/511 Distribution Amplifier and so the mixer as a whole has six transmission outputs and three preview outputs.

The eight inputs to the Sync Separation and Monitoring Panel PA1/513 feed eight UN1/523 Sync Pulse Separator Units. These derive feeds of separated sync pulses for use in the PA18/508 Sync Switch Panel. Associated with each sync pulse separator is a sync pulses monitor unit; this compares the separated sync pulses with a reference waveform, derived from station syncs, to determine whether or not they are synchronous. Information regarding the condition of the sync pulses is then fed to the control panels where, if the associated channel is in the *Auto* condition, it is used to determine the mode of operation of the mixer.

The PA18/508 Sync Switch Panel is fed with the separated sync outputs of the PA1/513 unit and also with a feed of station sync pulses. If a signal passing through the mixer is synchronous, the associated switching circuits are non-conductive and station syncs are fed to the associated stabilising amplifier. If the signal is not synchronous the

switching circuits are conductive and the stabilising amplifier is fed with separated sync pulses derived from the incoming signal. If the signal is absent (no-sync condition) the associated switching circuits are non-conductive and station syncs are used to replace the missing sync feed.

Note. The sync pulses appearing at the outputs of the channel sync-switches (see Fig. 2.2) are not necessarily the same as those appearing at the outputs of the group sync switches. The syncs present at different points in the sync-switch chain for different sync input conditions are shown in Table 1.

TABLE 1

Signal Input	*Output of Channel Sync-switch*	*Output of Group Sync-switch*
Sync	Station syncs	Station syncs (fresh feed)
Non-sync	Separated syncs	Separated syncs
None	Station syncs	Station syncs (from channel sync switch)

The sync switch panel also generates a once-per-picture pulse which is fed to the group and channel control panels, for interlock purposes, and is then routed back to the trigger circuits of the sync switch panel.

Control Circuits

General

Control interconnections between the various units of an EP5/502 are shown in Fig. 2.3. Some of the control signals are steady potentials and some are triggering pulses. The control circuits incorporate a PA6/510 Group Control Panel and two PA6/509 8-channel Mixer Control Panels.

The operation of a fader or a cut-button on any of the desk panels of the mixer actuates fade or cut switching circuits in the associated control panel and also de-mutes the cut/fade amplifier of the associated mixer channel. When a channel is selected as *Non-sync*, relay interlock circuits in the control panels prevent it being mixed with any other channel and the associated *Non-sync* (cannot mix) lamp on the control desk is illuminated. When a channel is selected as *Sync* the interlock circuits permit it to be mixed with other synchronous inputs and the associated *Sync* lamp is illuminated. When a channel is selected as *Auto* the associated MN2/501 sync monitor unit determines whether or not the input signal to the channel can be mixed. If the sync pulses of the input signal are not coincident in time with station syncs then the signal is treated as non-synchronous, mixing is not permitted and the *Non-sync* lamp is illuminated. If the syncs of the input signal are coincident with station syncs the *Sync* lamp is illuminated but the interlock and routing circuits remain in the non-sync condition until a mix with another channel is effected; when this happens the routing and interlock circuits change to the synchronous condition for the duration of the mix.

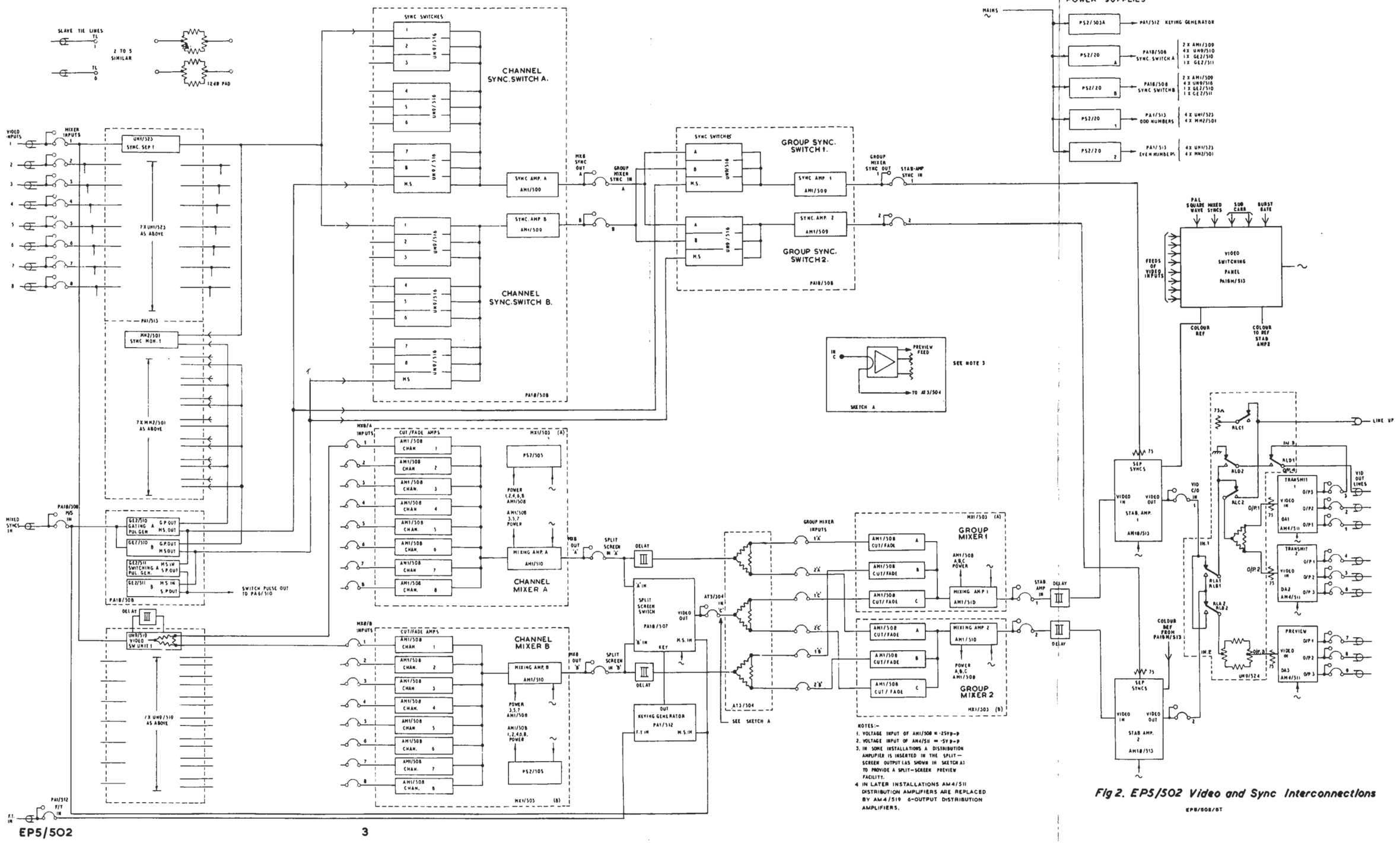
If, during such a mix, the input signal to the channel working in the *Auto* mode becomes non-synchronous then the sync-pulse monitor produces a fast-acting d.c. signal. This is applied, via the relay panel, to the *Off* circuit of the associated cut/fade amplifier until the slower acting relay interlock circuit operates. The sync-pulse monitor unit also feeds sync-failure information to the control panel if the separated-sync input in use fails. This information is routed to the sync-switch panel in such a way that station syncs replace the lost sync feed.

PA6/510: Functions

1. Routes switching pulses and 50 volts to the transmission and preview 3-channel mixers in the MX1/503 units and to the two 8-channel PA6/509 mixer control panels, in accordance with information received from the desk panels and the PA6/509 panels.
2. Provides relay and pulse interlock circuits to prevent the mixing or wiping of sync and non-sync sources or of two non-sync sources.
3. Routes switching pulses to the transmission and preview 3-channel sync switches in the PA18/508 in accordance with information received from the desk panels and the PA6/509 panels.
4. Provides transmission/preview changeover switching.
5. Provides group-cut, fade, wipe and interlock lamp outputs to the desk.
6. Combines synchronism information for the two PA6/509 panels.
7. Provides output indications of the state of the mixer.

PA6/510: Relays

The circuit of a PA6/510 control panel is shown



NOTES:-
1. VOLTAGE INPUT OF AM1/508 = -2.5V p-p
2. VOLTAGE INPUT OF AM4/511 = -5V p-p
3. IN SOME INSTALLATIONS A DISTRIBUTION AMPLIFIER IS INSERTED IN THE SPLIT-SCREEN OUTPUT (AS SHOWN IN SKETCH A) TO PROVIDE A SPLIT-SCREEN PREVIEW FACILITY.
4. IN LATER INSTALLATIONS AM4/511 DISTRIBUTION AMPLIFIERS ARE REPLACED BY AM4/519 6-OUTPUT DISTRIBUTION AMPLIFIERS.

Fig 2. EP5/502 Video and Sync Interconnections

EP5/502/BT

Previously issued as Fig.2.3, page 31 of V15, Part 5, Section 2

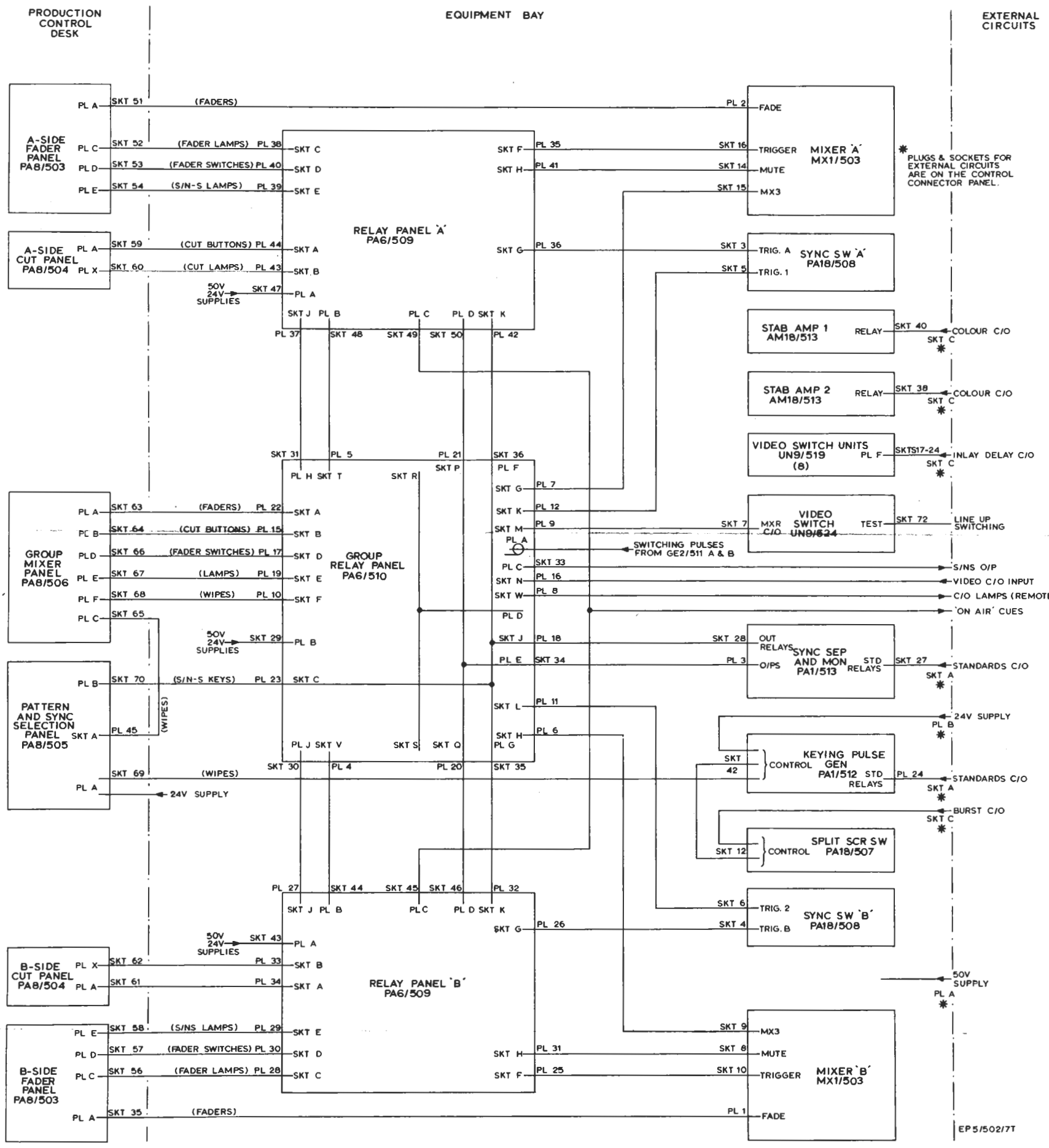


Fig 3 EP5/502 Control Interconnections

in Figs. 2.4 and 2.5 and is described in terms of relay functions in Table 2. Where there are a series of relays, each of which performs the same functions for a channel or bank, only the first relay of the series is detailed. For further description of those parts of the circuit which cannot be fully described in tabular form see under *PA6/510: Circuit Details.* The mute circuit and channel synchronism circuits are described under *PA6/509: Circuit Details.*

PA6/510: Circuit Details

(*a*) *Group Changeover*

Switching between the transmission and preview sections of the EP5/502 is done by interchanging the routing outputs from the PA6/510 to the No. 1 group mixer and sync switch with those from the PA6/510 to the No. 2 group mixer and sync switch. This interchanging takes place whenever an external short-circuit is applied between pins 1 and 2 of socket N.

The changeover is carried out by relays DA to DF; contacts DA-1 to DA-3 and DB-1 to DB-3 change over the mute relay circuits and the contacts of relays DE and DF, together with DC-6 and DD-6, change over the switch pulse routing. When relays DA to DF are de-energised the No. 1 group is on transmission and the No. 2 group is on preview; when the relays are energised the No. 1 group is on preview and the No. 2 group on transmission. However, if DB, DD and DF are energised before DA, DC and DE then both groups will be switched to transmission.

Relays DA to DF are driven by a sequencing circuit which is controlled by relays DG and DH. When the equipment is first switched on the changeover relays are all de-energised (group 1 on transmission). If a short-circuit is then applied between pins 1 and 2 of socket N relay DG is energised, and is held on by contact DG-2 when the short is removed. Relay DH is not initially energised because it is short-circuited by DH-1. The closing of contact DG-1 energises relays DB, DD and DF and the subsequent closing of DB-6 energises relay DJ. (Capacitors C6 and C7 delay the operation of DJ by about 100 ms and so ensure that transmission switching pulses are routed to the mixer previously on preview before DJ operates.) Contact DJ-1 applies the common 50-volt line, via pin 1 of socket M, to the first video-changeover relay in the UN9/524 and so connects both chains of video equipment to the transmission output of the mixer. This contact also energises slugged relay DK and so, after a further delay, the common 50-volt line is applied, via pin 2 of socket M, to the second video-changeover relay in the UN9/524. The operation of the second video-changeover relay connects group 1 to preview and so completes the lapped video changeover. Contact DK-2 energises relays DA, DC and DE and the contacts of these relays route preview switching pulses to group 1. Contact DK-1 breaks the original energising circuit for relays DB, DD and DF and provides a new holding circuit for them; contact DJ-2 prevents these relays from momentarily releasing while relay DK operates.

Relay DH energises either when the external short-circuit is broken or when contacts DG-2, DB-5 and DA-5 are operated, whichever is the later. When operated, DH-1 prepares a release circuit for relays DH and DG.

An external short-circuit between pins 1 and 2 of socket N, applied when all the relays are energised (group 2 on transmission), short-circuits relay DG via operated contact DH-1. Relay DG then de-energises and contact DG-1 breaks the operating circuit for relays DA, DC and DE. When DA de-energises the subsequent release of contact DA-4 de-energises, after 200 ms, relay DJ. Contact DJ-1 releases the first video-changeover relay in the UN9/524 and, after a delay due to the discharge of C8, de-energises relay DK. When DK is de-energised the second video-changeover relay in the UN9/524 releases and the changeover sequence is complete.

Contacts DC-5 and DD-5 provide lamp indications for the UN9/524, and for external circuits, to indicate which group is on transmission and which on preview.

(*b*) *Preview*

Except for split-screen purposes, switching pulses are applied, via D88, to PA6/509(A) when the A-bank is in the preview condition and, via D86, to PA6/509(B) when the B-bank is in the preview condition. For split-screen preview the switching pulses are applied to the appropriate PA6/509 panel either via D89 or via D87.

(*c*) *Split-screen Circuit*

The output of the split-screen switch is only transmitted when wipe is selected, the mixer is in the mix condition and both inputs are synchronous.

(*text continued on page* 2.17)

TABLE 2

Relay Code and Function		*Contact Function* (when operated unless otherwise stated)
1A (Auto)	1A-1	Routes non-sync (+12 volt) information, derived from the PA1/513 sync-sep and monitor panel, to the two PA6/509 control panels.
	1A-2	Energises relays 1E and 1J on the two PA6/509 control panels.
AA (Cut A)	AA-1	Lights the group-A *Cut* lamp on the desk panel.
	AA-2	Energises relay BH. Forms a series circuit with contacts CA-2 and BA-2 which ensures that relay P is de-energised when either of the group *Cut* buttons or the *Censor* button is pressed.
	AA-3	Energises relay CC.
	AA-4	Energises the transmission relays M and T on the PA6/509 panel which is in the transmission condition.
AB (Fader A)	AB-1 and AB-2	Part of a fader interlock circuit. Provides energising path for fade relays AF, BK and X.
	AB-3	Forms, with BB-4, AC-1 and BC-1, a series circuit which controls the operation of relay N.
AC (A-channel cannot mix)	AC-1	See AB-3.
	AC-2	Energises relay AD.
AD (A-channel cannot mix)	AD-1	Lights A-side *Non-sync* lamp.
	AD-2	Provides a momentary hold circuit for the fade relays when they are going from the non-sync condition to the sync condition.
	AD-3	De-energises relay V.
AE (A-channel separated sync)	AE-1	Disconnects the fade relays from the synchronous 50-volt common line.
	AE-2	Energises non-sync relay S and de-energises sync relay R.

Relay Code and Function	*Contact Function* (when operated unless otherwise stated)	
AF (Fade A)	AF-1	Forms part of an interlock circuit which prevents more than one group being faded up at a time if the sources are non-sync.
	AF-2	Provides a 50-volt common connection either for relay R or for relay S, depending on the position of AE-2.
AG (A-group up, B-group down)	AG-1	Part of the energising circuit for relay CC. See description of split-screen memory in circuit details.
	AG-2	Energises relay CG.
AH (A-bank off) This relay is operated when the *Censor* button is pressed or when the mixer is clear.	AH-1	Routes a switching pulse to the *Bank Off* connection of MX1/503 (A), if DC-8 is unoperated, and to the *Bank Off* connection of MX1/503(B), if DD-8 is operated. Also triggers on the mixed-syncs switch in the group-1 section of the PA18/508 if DE-4 is unoperated and in the group-2 section if DF-4 is operated.
AJ (Energised in mix)	AJ-1	Connects switching pulses to the pulse routing circuits when the panel is handling a non-sync fade.
	AJ-2	Connects switching pulses to the pulse routing circuits when the channel is handling a synchronous fade.
AK (Split-screen changeover-2 relay)	AK-1	Routes switching pulses to the *Cut C* connection of MX1/503 (A), if DE-1 not operated, and to the *Cut C* connection of MX1/503 (B) if DF-1 operated. Also, via diodes D78, D80, routes switching pulses to both the A and B PA6/509 control panels.
BH (Cut A)	BH-1	Connects switching pulses to the pulse routing circuits when the panel is handling a non-sync cut. Also, via D77, routes switching pulses to PA6/509 (A).
	BH-2	Connects switching pulses to the pulse routing circuits when the channel is handling a synchronous cut. Also via D72, routes switching pulses to PA6/509 (A).
BJ (A-channels separated sync)	BJ-1	Connects switching pulses to the pulse routing circuits when the panel is handling a separated-sync cut.

Relay Code and Function	*Contact Function* (when operated unless otherwise stated)
	BJ-2 Connects switching pulses to the pulse routing circuits when the panel is handling a separated-sync fade.
BK (Fade A)	BK-1 Forms part of the pulse routing circuit when the panel is handling a non-sync fade. Also via D85, routes switching pulses to PA6/509 (A).
	BK-2 Forms part of the pulse routing circuit when the panel is handling a synchronous fade. Also via D79, routes switching pulses to PA6/509 (A).
CA (Censor)	CA-1 Lights the *Censor* lamp on the desk panel.
	CA-2 Energises relay AH.
CB (Split-screen hold)	CB-1 and CB-2 Part of the energising circuit for relay CC. See description of split-screen memory circuit.
	CB-3 Provides a holding circuit for relay AB.
	CB-4 Provides a holding circuit for relay BB.
CC (Split-screen memory)	CC-1 Forms part of the energising circuit for relay CC. See description of split-screen memory in *Circuit Details*.
	CC-2 Switches +24-volts on the PA8/505 sync and pattern selection panel, via the PA8/506 desk panel.
CD (Split-screen changeover)	CD-1 Energises relay AK.
CF (Split-screen lamp relay)	CF-1 and CF-2 Illuminate the *Wipe* lamps on the desk panel.
CG (One fader up, one fader down)	CG-1 Breaks energising circuit to relay CD. See also V-1.
	CG-2 Forms part of the operating circuit of relay L. See also L-1 and P-1.

Relay Code and Function	*Contact Function* (when operated unless otherwise stated)	
DA (Mutes 1 changeover)	DA-1 to DA-5	
DC (Faders 1 changeover)	DC-1 to DC-6	
DE (Routing 1 changeover)	DE-1 to DE-8	
DG and DH (Changeover drive relays)	DG-1, DG-2, DH-1	See *Circuit Details* (group changeover circuit)
DJ (Video 1 sequence relay)	DJ-1, DJ-2	
DK (Video 2 sequence relay)	DK-1, DK-2	
L (Faders O lockout)	L-1	Provides a holding circuit for relay L if contact CG-2 is operated.
M (Mixer takeover)	M-1	Provides a holding circuit for relay M when P-1 is not operated.
	M-2	Operates, in conjunction with Q-5, the cut-button release circuit.
N (Two-up)	N-1	Interrupts the short-circuit between pins 1 and 6 of PLH and so releases the N (two-up) relay in the PA6/509 (A) control panel.
	N-2	Interrupts the short-circuit between pins 1 and 6 of PLJ and so releases the N (two-up) relay in the PA6/509 (B) control panel.
P (Cut buttons)	P-1	Forms part of the energising circuit for relay L.
	P-2	Provides, in conjunction with Q-1, a holding circuit for relays AJ, Q and W.
Q (Mix)	Q-1	See P-2 above.

Relay Code and Function		*Contact Function* (when operated unless otherwise stated)
Q (Mix) continued	Q-2	Provides a holding circuit for relays CD and CB when CG-1 is unoperated and V-1 is operated.
	Q-3	Energises relay AB via a fader microswitch on the desk panel.
	Q-4	Energises relay BB via a fader microswitch on the desk panel.
	Q-5	See M-2.
	Q-6	Changes lamp supplies from cut to mix.
R (Panel sync)	R-1	Provides a 50-volt common connection for the fade relays when the panel is synchronous.
	R-2	Breaks the circuit to the remote non-sync indicators.
	R-3	Connects switching pulses to the synchronous routing system.
	R-4	Disconnects switching pulses from the non-synchronous routing system.
S (Panel non-sync)	S-1	Provider a 50-volt common feed for the fade relays when the panel is non-synchronous.
	S-2	Operates the remote non-sync indicators.
	S-3	Disconnects switching pulses from the synchronous routing system.
	S-4	Connects switching pulses to the non-synchronous routing system.
T (Cut A)	T-1	Routes switching pulses to PA6/509 (B), via SKT V pin 5, when operated and to PA6/509 (A), via SKT T pin 5, when unoperated.
V (Split-screen)	V-1	Forms part of the operating circuit of relay CD.
	V-2	Provides a preview route for the switching pulses when wipe is selected.
W (Mix)	W-1	Connects switching pulses to the pulse routing circuits and to the PA6/509 panels when the panel is in the fade condition.
X (Fade A)	X-1	Forms part of the pulse routing circuit when the A-side fader is up.

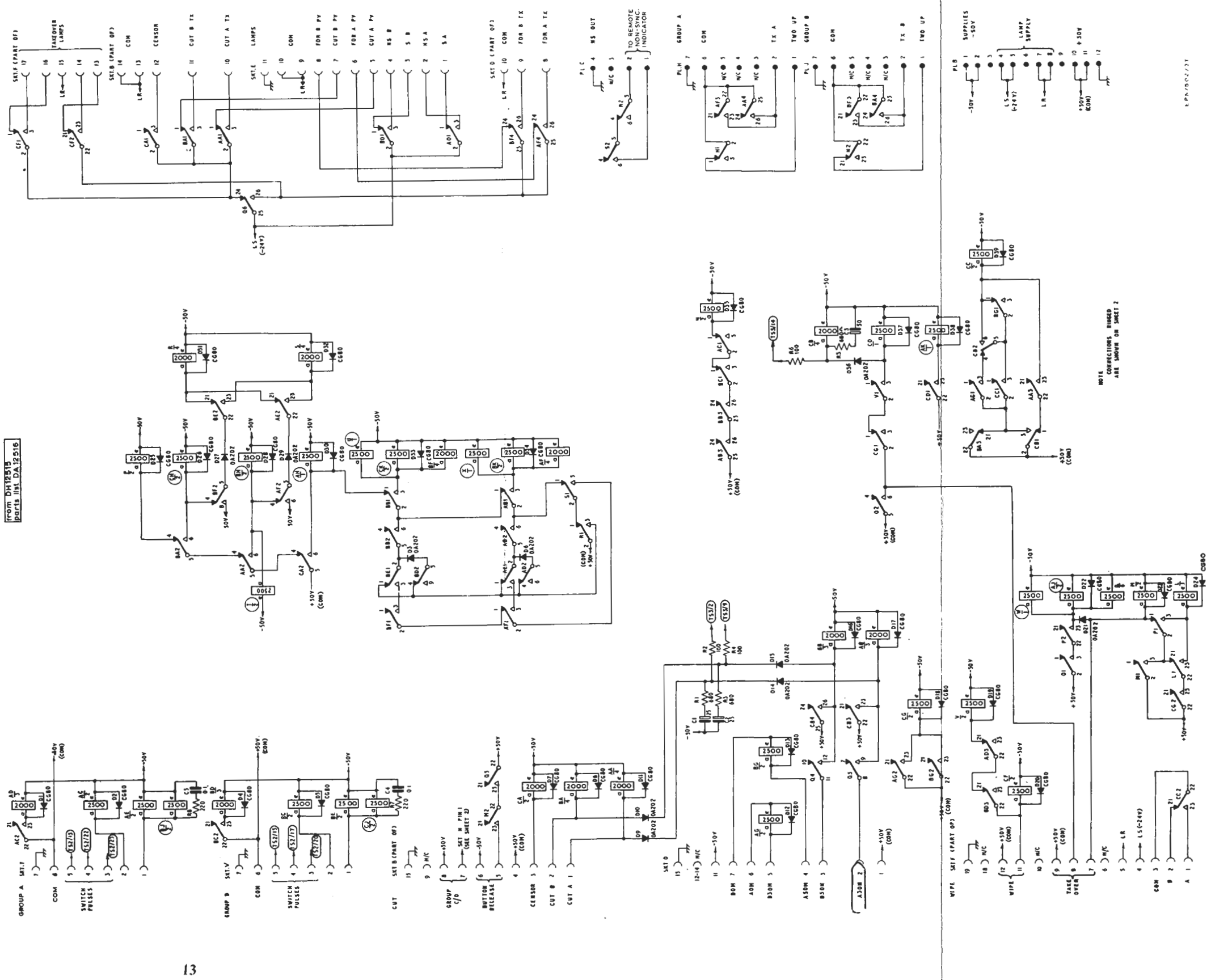


Fig.4 Group Mixer Control Panel PA6/510: Circuit Diagram Sheet 1

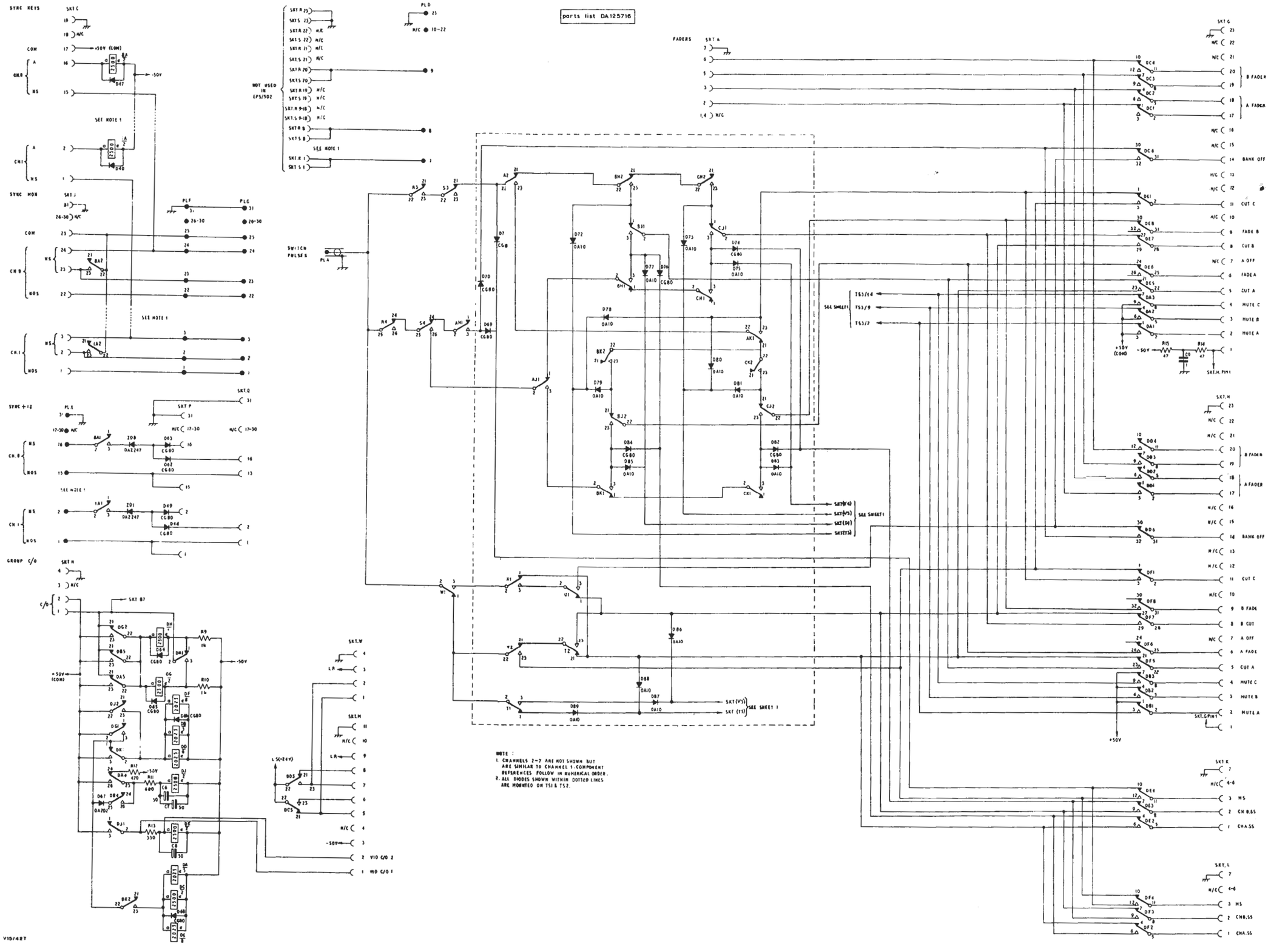


Fig. 2.5 *Group Mixer Control Panel PA6/510: Circuit Diagram Sheet 2*

When these conditions apply relay CF is energised, the *Wipe* legend is illuminated red and contact Q-6 is operated. The wipe-selection switch also energises relay V. Contact V-1 is in the operating circuit of relay CD and contact V-2 provides an appropriate preview route.

The slow-to-operate relay CB and the mute relay for channel-C (located in the MX1/503 unit) are effectively in parallel with relay CD via diode D36. The split-screen changeover relay AK is energised by contact CD-1; thus CB and the mute relay are energised before the split-screen routing circuit is made and remain energised until after relay AK releases.

During a wipe the fade circuits still operate and provide transmission and sync cues. They also provide the correct circuit conditions in the event of the selection switch being moved from *Wipe* to *Mix* during the wipe. It is necessary to ensure that the fader circuits are not released if one or both faders are moved to *30* before the wipe is completed. This is done by contacts CB-3 and CB-4 which hold relays AB and BB during the wipe. Contacts CB-1 and CB-2 provide split-screen holding information for the split-screen memory circuit.

(d) Split-screen Memory Circuit

The split-screen circuits must know which group is on transmission before a wipe starts and must retain this information until the wipe is completed. This is the function of relay CC, which is energised when the A group is on transmission and de-energised when the B group is on transmission. In the cut-A condition CC is energised via operated contact AA-3 and de-operated contact CB1. In the fade-A (A at *0* B at *30*) condition, CC is energised via BG-1, CB-2, AG-1 and BA-3. A hold circuit is provided through BG-1, CC-1 and BA-3 so that when the faders are moved from their respective end-stops, and relay AG releases, CC remains energised until the positions of the faders are reversed. Relay BG then energises and the changeover of contact BG-1 breaks the hold circuit. CC is not energised again until the faders are returned to their original positions.

In the wipe condition, when the faders are one up and one down, CB is not energised and the CC circuit operates as detailed above. As soon as a fader is moved relay CB operates and contacts CB-1 and CB-2 hold relay CC in its existing state until relay CB again releases.

PA6/509: Functions

1. Routes switching pulses and 50 volts to the MX1/503 mixer units in accordance with information received from the desk panels.
2. Provides relay and pulse interlock circuits to prevent the mixing of sync and non-sync sources, or two non-sync sources.
3. Routes switching pulses to the PA18/508 sync switch panel in accordance with information received from the desk panels.
4. Provides cut, fade and interlock lamp outputs, for the desk panels and the transmission cue circuits.
5. Provides interconnections with the PA6/510 group control panel to ensure the necessary integrated action.

PA6/509: Relays

The circuit of a PA6/509 panel is shown in Fig. 2.6 and is described in terms of relay functions in Table 3. Where there are a series of relays, each of which performs the same functions for a different channel, only the first relay of the series is detailed. For further description of those parts of the circuit which cannot be fully described in tabular form see, *PA6/509: Circuit Details.*

PA6/509: Circuit Details

(a) Channel Synchronism

Channel synchronising information is obtained either from the eight *Sync/Auto/Non-sync* keys on the desk panel type PA8/505 or from the eight sync pulse monitor units type MN2/501. The signals so derived are routed to the group relay panel where they are combined and distributed to the two 8-channel relay panels. When the keys on the desk panel are in the *Sync* or *Non-sync* positions the relay circuits are held in the appropriate condition and the information derived from the sync monitor units has no effect on the operation of the mixer (unless a signal input fails when the mixer is in the non-sync condition). When the keys are in the *Auto* position the relay circuits are controlled by the sync pulse monitor units.

A simplified sync information circuit for a single channel (channel 1 on the A-side) is shown in Fig. 2.7 (a more detailed circuit is given in Television Centre Station Drawing No. TS/3.305K).

(text continued on page 2.22)

TABLE 3

Relay Code and Function	*Contact Function* (when operated unless otherwise stated)
1A (Channel 1 cut-button)	1A-1 In conjunction with 1E-2 routes no-sync information, derived from the associated MN2/501, to the sync switch panel.
	1A-2 Provides channel transmission cues.
	1A-3 Lights the channel-1 transmission cut lamp on the desk panel if relay M is energised. Lights the channel-1 preview cut lamp if relay M is de-energised.
	1A-4 Energises relays 1L, 1C and, via 1F-1 and 1E-4, either the panel sync relay P or the panel non-sync relay Q. This contact forms part of an interlock circuit, with all the other A-4 contacts, which ensures that only one L-series relay can be energised at a time. Also de-energises relay R.
1B (Channel 1 fader relay)	1B-1 and 1B-2 Provide the operating path for fade relays 1F, 1G and 1H, via operated contacts P-2 and Q-2. Contact 1B-2 also breaks the operating circuit of relay Y.
	1B-3 Provides a holding circuit for relay 1C.
1C (Channel two-up)	1C-1 and 1C-2 Form part of an interlock circuit, incorporating the contacts of all the C relays, which holds relay N energised when not more than one C-series relay is energised.
1D (Channel non-sync)	1D-1 Breaks operating circuit for relay 1C.
	1D-2 Feeds non-sync information to plug B, pin 2.
	1D-3 Lights the channel *Non-sync* lamp on the desk.
	1D-4 Has no function when operated. When unoperated provides a momentary hold circuit for the fade relays during the period in which the +50-volt common line is being transferred from the non-sync bus-bar to the sync bus-bar.

Relay Code and Function	*Contact Function* (when operated unless otherwise stated)	
1E (Auto)	1E-1	Prevents the passage of non-sync information through the control panel to the *Off* input of the channel-1 cut/fade amplifier.
	1E-2	See 1A-1 and 1G-1.
	1E-3	Provides, in conjunction with 1F-2, a 50-volt common circuit for the fade relays when the channel is in the non-sync condition.
	1E-4	See 1F-1.
1F (Channel 1 fade interlock)	1F-1	Provides an earthing circuit for relay P or for relay Q, depending on the position of 1E-4.
	1F-2	Forms part of an interlock circuit which prevents more than one channel being faded up at a time if the sources are non-sync. See also 1E-3.
1G (Channel fade-indicate)	1G-1	Routes no-sync information, derived from the associated MN2/501, to the sync switch panel in conjunction with 1E-2.
	1G-2	Provides channel transmission cues.
	IG-3	Lights channel-1 preview lamp when relay T de-energised.
	IG-4	Lights channel-1 transmission lamp when relay T energised.
1H (Fade switch pulse routing)	1H-1	Routes switching pulses, in conjunction with X-1 and 1J-1, to the *Fade* input of the channel 1 cut/fade amplifier when the source is non-sync. The same pulses are also routed to the sync switch panel, in conjunction with D91 and K-1.
	1H-2	Provides an alternative path to that given above when the source is synchronous.
1J (Auto)	1J-1	See 1H-1 above.
	1J-2	Routes switching pulses to the *Cut* input of the channel-1 cut/fade amplifier, in conjunction with X-1 and 1L-1, if the source is non-sync.

Relay Code and Function	*Contact Function* (when operated unless otherwise stated)
1K (Channel no-sync or no-signal.) *Note.* This relay is *de-energised* if the incoming source lacks sync pulses.	1K-1 Changes over to route the switching pulses applied to the sync switch panel from the channel-1 sync switch to the local-syncs sync switch, if the incoming source fails.
1L (Cut)	1L-1 Routes switching pulse to the *On* input of the channel-1 cut/fade amplifier if the source is non-sync. See also 1J-2. At the same time it routes a switching pulse to the channel-1 input of the sync switch panel via D111 and 1K-1.
	1L-2 In conjunction with unoperated contacts X-1 and 1J-2 routes a switching pulse to the *On* input of the channel-1 cut/fade amplifier, if the source is synchronous.
M (Transmission)	M-1 to M-8 These contacts prepare a path from the A-3 contacts of the channel cut-button relays to the transmission cut lamps on the desk panel.
N (Two-up)	N-1 to N-8 These contacts energise the E and J relays when the panel is working in the *Auto* condition.
P (Panel sync)	P-1 Breaks the short-circuit, established under non-sync conditions, between pins 1 and 6 of plug B.
	P-2 Provides a 50-volt common circuit for the fade relays when the panel is synchronous.
	P-3 Breaks the non-sync preview route for switching pulses.
	P-4 Makes the sync preview route for switching pulses.
Q (Panel non-sync)	Q-1 Short-circuits pins 1 and 6 of plug B when the panel is in the non-sync condition.
	Q-2 Provides a 50-volt common circuit for the fade relays when the panel is in the non-sync condition.
	Q-3 Makes the non-sync preview route for switching pulses.
	Q-4 Breaks the sync preview route for switching pulses.

Relay Code and Function	*Contact Function* (when operated unless otherwise stated)	
R (Panel cut-button)	R-1, R-2	See *Circuit Details* (Cut/mix changeover circuit)
S (Panel mix)	S-1	Provides an energising circuit for the B-series relays, via a microswitch on the selected channel fader.
	S-2, S-3	See *Circuit Details* (Cut/mix changeover circuit)
T (Transmission)	T-1	In conjunction with the individual G-4 contacts provides a circuit to light the transmission lamps in the channel faders.
	T-2	Completes the circuit for external transmission cues.
V (Faders ' O ' lockout)	V-1	See *Circuit Details* (Cut/mix changeover circuit)
W (Mix take-over)	W-1, W-2	See *Circuit Details* (Cut/mix changeover circuit)
X (Panel mix)	X-1	Connects transmission and preview switching pulses to the pulse-routing circuits when the panel is handling a non-sync fade.
	X-2	Connects transmission and preview switching pulses to the pulse routing circuits when the panel is handling a synchronous fade.
Y (Bank off)	Y-1	Routes a switching pulse from plug B to the *Bank-Off* connection of socket F when nothing is selected; i.e. the 8-channel cut and fade panels are cleared.

Relay conditions for the three positions of the *Sync/Auto/Non-sync* key are given in Table 4; *x* indicates that the relay is energised. Note that the MN2/501 does not give a sync output as such; for the purposes of this Table the MN2/501 has a sync output when the non-sync and no-sync outputs are absent.

TABLE 4

Key Position	*MN2/501 Output*	*No. of Channels Selected*	*Relays Energised* A D E J K
Sync	(Not used)	Any number	– – – – x
Auto	Sync	2 or more	x – – – x
Auto	Sync	0 or 1	x – x x x
Auto	Non-sync	0 or 1	x x x x x
Auto	No-sync	0 or 1	x x x x –
Non-sync	Sync or non-sync	0 or 1	– x x x x
Non-sync	No-sync	0 or 1	– x x x –

Relays E, J, D and K take several milli-seconds to operate and the trigger pulse, which normally determines the operating conditions of cut/fade amplifiers and sync switch units, occurs only once every 40 milli-seconds. Therefore, to obtain more rapid operation of the sync information circuits than the relays can provide, d.c. switching signals for the non-sync and no-sync conditions are derived from the MN2/501 units. These d.c. signals enable the cut/fade amplifiers and sync switch units to respond rapidly to any change of sync conditions.

When the channel is synchronous, trigger pulses applied via D99 to SKG pin 9 turn on the mixed-sync switch UN9/516 (9A) in the sync-switch panel. Trigger pulses are also applied, via unoperated relays contacts 1J-1 or 1J-2, to the control circuits of the channel-1 cut/fade amplifier.

When the channel is non-sync, trigger pulses are applied via diodes D91 or D111 and relay contact 1K-1 to SKG pin 1. These pulses turn on the channel 1 separated-sync switch, UN9/516 (1A). Trigger pulses are also applied, via operated relay contacts 1J-1 or 1J-2, to the control circuits of the cut/fade amplifier.

When the channel is automatic the trigger pulse routing is the same as for the non-sync condition, except when a mix is required between two sources which have been declared synchronous by their respective MN2/501 sync-pulse monitor units. When this happens relay N (which has one contact per channel) is de-energised, thus de-energising all the E and J relays. The mixer then operates in the synchronous mode while the mix is taking place. Should either of the channels selected for mixing go non-sync while the mix is taking place the D relay for that channel will be energised by an earth derived from the appropriate monitor unit and this earth will also re-energise (via D31 in the channel 1 instance) the E and J relays. Prior to the operation of the relays the cut/fade amplifier of the non-sync channel will have been turned off by a positive-going 12-volt signal, derived from the appropriate MN2/501 monitor unit.

If the incoming source fails the earth for relay 1K, which passes through the MN2/501, is interrupted and the relay de-energises. At the same time +12 volts is applied, via 1E-2 and SKG pin 9 to the mixed sync switch, UN9/516 (9A), in the sync-switch panel. Thus, if the incoming source fails, station syncs appear at the output of the A-side sync switch. If the video signal is also lost the output of the mixer will consist of station syncs only.

(*b*) *Mute Circuit*

The mute circuit described below is that associated with a PA6/509 panel, the mute circuit for a PA6/510 panel is similar.

When a video channel is either cut up or faded up the mute relay in the cut/fade amplifier associated with that channel is energised. For example, if channel 1 on the A-bank is faded up the common 50-volt feed present at SKT D, pin 1, is connected via D131 and R1 to the operating circuit of the channel 1 mute relay in the MX1/503 (A) unit. The operating sequence of the relays on the PA6/509 panel is such that the mute relay operates before switching pulses are applied to the channel. Capacitor C1 and resistor R11, are effectively connected across the channel-1 mute relay and provide it with a slow release time. This ensures that the channel is triggered *Off* before it is muted. Note that the channel is muted when the mute relay is in the *de-energised* condition.

(*c*) *Cut/Mix Changeover Circuit*

Cut-to-mix information is obtained either from the fader *O* switches or from the mix-takeover button. Mix-to-cut information is obtained when relay R, in the cut-button circuit, is de-energised.

Previously issued as Fig.2.6, page 2.23 of V15, part 5, section 2.

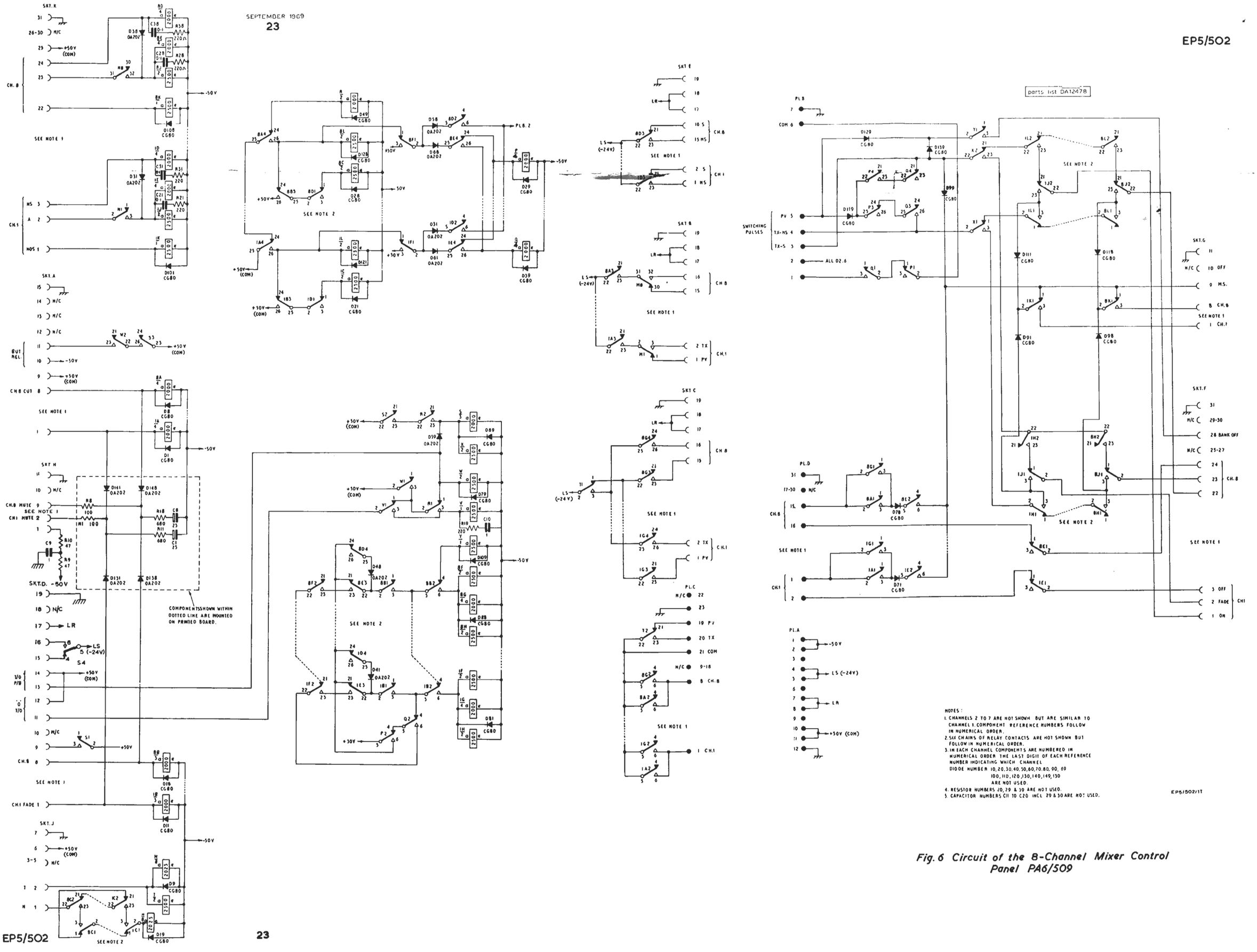


Fig. 6 Circuit of the 8-Channel Mixer Control Panel PA6/509

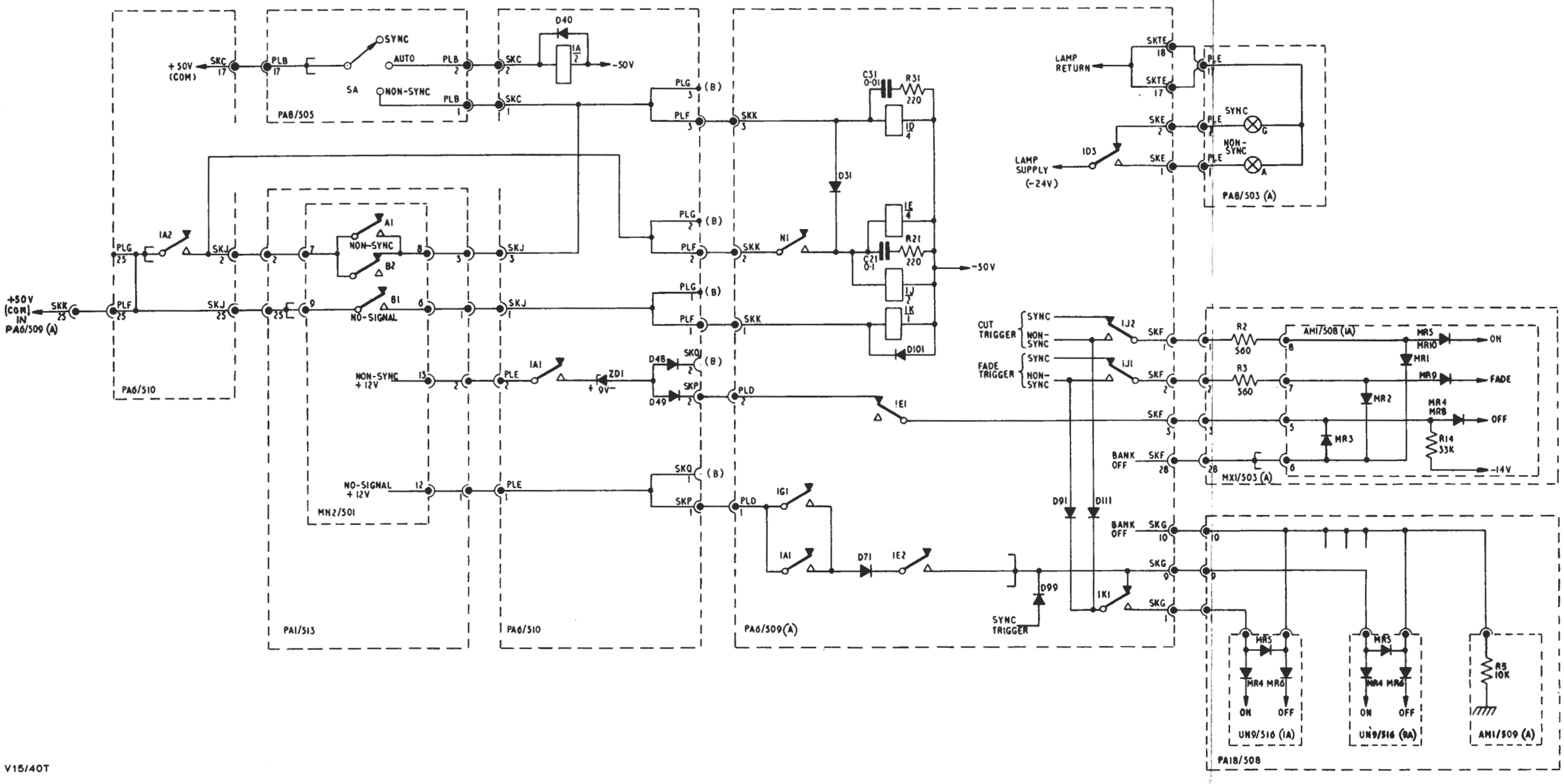


Fig. 2.7 Sync Information Circuit for Channel 1 on the A Side

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The fader *O* microswitches are connected in parallel between pins 11 and 12 of SKD. When the mixer is in the cut condition and a fader is moved to the fully-up position the *O* microswitch of that fader operates and a 50 volts (common) feed is connected to SKD pin 12 and is applied from there, through V-1 and R-1, to relay W and, via D59, to relays S and X. Contact W-1 provides a holding circuit for relay W and contacts W-2 and S-3 apply 50 volts (common) via SKA pin 11 to the button-release solenoid on the cut panel.

The release of the cut-button de-energises the associated A-series relay and relay R is energised through all the unoperated A-4 contacts in series. Contact R-1 breaks the holding circuit for relay W while contact R-2 provides an alternative holding circuit for relays S and X. The changeover of contact R-1 completes a circuit to relay V which is then held on by its own contact V-1 until the source is faded down. This prevents incorrect, or multiple, fader take-over occurring.

The mix-take-over button functions in a similar manner to that described above but, as the action is momentary, relay V does not need to be operated. The operation of the button short-circuits pins 13 and 14 of SKD and so connects the 50-volt common line to relays W, S and X.

A change from mix to cut occurs when any cut-button is pressed. The operation of the button releases relay R and so breaks the holding circuit for relays S and X.

Slave Working

Normally connected, the EP5/502 Video Mixing Equipment has eight video inputs which appear on corresponding channels on the A and B banks of the mixer. It is possible by re-arranging the plugging on the mixer bays to separate the A and B banks and use one of them for synchronous camera inputs from a slave studio, leaving the usual facilities of the mixer associated with the other bank. Split-screen facilities are restricted when working in this manner.

The necessary steps are as follows:

1. Decide which bank is to be the slave. The following assumes the A bank.
2. On the low level jackfield, JF1, remove the eight U-links feeding the A side of the mixer. Insert eight 75-ohm terminations in the apparatus jacks (centre row) to terminate the unused outputs of the UN9/519 units. Feed the slave 1V p-p equalised signals from the tielines to the 12-dB pads (top row) and thence to the appropriate channel inputs (bottom row) of the A side. Note: (Only six equalised tielines are available.)
3. At the PA6/510 group control panel, remove Plug F and socket P. This disconnects the synchronising information to the A relay panel so that it operates synchronously only.
4. At the A-side PA6/509 control panel, remove Plug C. This disconnects the on-air cue circuits. Connections may be made at Plug C, if required, to extend on-air cues to the slave sources.

Because the point of injection of the slave video signals is after the 0·5 μs inlay timing delays, the delay in the slave inputs is reduced by this amount. This delay can be incorporated into the slave timings to make them truly synchronous at the master mixer. The timing of the synchronous slave cameras should be checked at the output of the group mixer against the master synchronous inputs and adjusted as necessary to bring the mixed sync pulses into coincidence. This adjustment can be made in any of the following ways:

(a) by delay cables in the slave tielines.
(b) by delay cables in the mixed-sync feeds to the slave cameras.
(c) by an equalised delay cable in the output from the A channel mixer.

It should be noted that it is not possible to separate individual channels of a bank by the above steps. To do this it is necessary to provide appropriate wiring to PL.C, PL.F and SK.P.

16-channel Working

1. Separate the A and B banks of the mixer as for slave working.
2. Put all synchronous sources on the A-side of the mixer.
3. Use the B-side of the mixer (which still retains the sync/non-sync facility) for non-sync sources such as O.B. contributions.

Modifications

The standard EP5/502, as described in this Instruction, is installed in Studio 1 at Television Centre. Slightly modified versions have been installed in Studios 6, 7 and 8 at Television Centre (a d.c. interconnection diagram for Studio 6 is given in Fig. 2.8). A brief description of these modifications is given below.

(a) The *Sync/Auto/Non-sync* switches have been moved to a separate panel adjacent to the A-side fader panel (see PA8/513, Instruction V.13).
(b) The *Censor* button and the white preview

lamps have been removed from the group control panel.

(c) The *Mix/wipe* switch on the group control panel has been re-labelled *Mix/Effects*.

(d) The pattern-selection buttons now form part of an effects control panel. Twenty-four interchangeable modules are provided for the buttons; this allows the wipe facilities to be varied to suit programme requirements. See PA8/510, Instruction V.13.

(e) The pattern selection panel has been moved from the control desk to the equipment bays in the apparatus room.

(f) A split-screen preview output is provided by means of an additional distribution amplifier (shown as an inset sketch in Fig. 2.2).

Modified versions of the EP5/502 are installed also in television studios in the regions. Full details of these modified installations will be found in the relevant P.I.D. drawings.

Cue Circuits

A simplified diagram showing the on-air cue circuits of a studio equipped with an EP5/502 (Studio 1 at Television Centre) is given in Figs. 2.9 and 2.10. More detailed circuits of the On-air Cue Relay Panel and the Inlay Routing Matrix Panel are given in the relevant P.I.D. drawings. The Source Channel Control and Cue Relay Panel is described in Instruction V.13.

Modifications for Colour Working

When used for colour working the EP5/502 is modified to allow for colour-burst stabilising in addition to sync pulse stabilising. The extra units required are listed in the Family Tree at the front of this Instruction. A simplified block diagram of the video and sync interconnections for a modified equipment is given in Fig. 2.11 on page 2.35. (The diagram shows also the timing delays throughout the equipment.)

Feeds of the colour-video input signals to the mixer are applied to a PA18M/513 Video Switching Panel together with reference feeds of mixed-syncs, PAL square wave, colour subcarrier and burst-gate pulses. The PA18M/513 is controlled, in the same way as the PA18/508 Sync Switch Panel, by trigger pulses derived from the control circuits of the mixer. When a signal passing through the mixer is non-synchronous, the associated switch circuit in the PA18M/513 is completed and a feed of the input signal is routed to the output of the panel. When a signal passing through the mixer is synchronous, then a signal derived from the reference signals is routed to the output of the panel. The output of the PA18M/513 is fed to the AM18/513 stabilising amplifier where it is used for colour-burst stabilising. Note that this unit also must be modified for colour working.

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See page 2.29 *for Fig.* 2.8

See page 2.31 *for Fig.* 2.9

See page 2.33 *for Fig.* 2.10

See page 2.35 *for Fig.* 2.11

PRODUCTION CONTROL DESK

EQUIPMENT BAYS

EXTERNAL CIRCUITS

MIXER FADER PANEL 'A' (8)
PL.A (FADERS)
PL.C (FADER LAMPS)
PL.D (FADER SWITCHES)
PL.E (S/N-G LAMPS)

MIXER CUT PANEL 'A' (9)
PL.A (CUT BUTTONS)
PL.X (CUT LAMPS)

RELAY PANEL 'A' PA6/509
SKT.C, SKT.D, SKT.E
SKT.F, SKT.H
SKT.A, SKT.B, SKT.Q
50V / 24V PL.A
SKT.J PL.B PL.C PL.D SKT.K
PL.H SKT.T SKT.R SKT.P PL.F SKT.G SKT.K

FADE, TRIGGER, MUTE, MX3 — MIXER 'A' MX1/503

TRIG.A, TRIG.1 — SYNC.SW.'A' PA18/508

PL.A — REMOTE COLOUR BOX

SPECIAL EFFECTS PANEL (5)
PL.A (FADERS)
PL.B (CUT BUTTONS)
PL.D (FADER SWITCHES)
PL.E
PL.F
SKT.A
PL.G (COLOUR SYNTH)
PL.J (INFILL/EDGES)
PL.H (RIPPLE)
PL.C (WIPES)
PL.K 24V SUPPLY

GROUP RELAY PANEL PA6/510
SKT.A, SKT.B, SKT.D, SKT.E, SKT.F
50V / 24V PL.B
PL.A SWITCHING PULSES FROM GE2/511 A&B
SKT.M, PL.C, SKT.N, SKT.W, PL.D, SKT.J, PL.E, SKT.L, SKT.H, PL.G
PL.J SKT.V SKT.C SKT.S SKT.Q

VIDEO SWITCH UN9/524
MXR.C/O — LINE UP SWITCHING (STANDARDS RELAY PANEL)
TEST — S/NS. O/P (TO C.A.R.)

PLUG PANEL 'B'
PL.A SK.A
PL.B SK.B
— MIXER C/O (P.C.R.)
— MIXER C/O (V.A.R.)

— 'ON AIR' CUES.

OUT RLYS. SYNC.SEP. & MON PA1/513 STD. RLYS.
O/PS — STANDARDS C/O SKT.A *

KEYING PULSE GEN. PA1/512
CONTROL — STD. RLYS. — STANDARDS C/O SKT.A *
— BURST C/O SKT.E *

SYNC NON-SYNC PANEL
PL.A (SYNC/NON SYNC. KEYS)

PATTERN SELECTION PANEL
SKT.A SKT.C
SKT.B PL.A PL.B
50V 24V

CONTROL — SPLIT SCR.SW. PA18/507

MIXER CUT PANEL 'B' (11)
PL.K (CUT LAMPS)
PL.A (CUT BUTTONS)

RELAY PANEL 'B' PA6/5C9
50V / 24V PL.A
SKT.J PL.B PL.C PL.D SKT.K
SKT.B, SKT.A, SKT.G
SKT.E, SKT.D, SKT.C
SKT.H, SKT.F

TRIG.2, TRIG.B — SYNC. SW.'B' PA18/508

MIXER FADER PANEL 'B' (10)
PL.E (S/NS LAMPS)
PL.D (FADER SWITCHES)
PL.C (FADER LAMPS)
PL.A (FADERS)

MX.3, MUTE, TRIGGER, FADE — MIXER 'B' MX1/503

RIPPLE GENERATOR
SKT.A

COLOUR CONTROL SYNTH

STAB. AMP. 1 AM18/513 RELAY — COLOUR C/O SKT.C *

STAB. AMP. 2 AM18/513 RELAY — COLOUR C/O SKT.C *

VIDEO SWITCH UNIT UN9/519 (8 OFF) PL.F — INLAY DELAY C/O (SOURCE/CHAN.SEL.RP.) SKT.B *

PL.A * — 50V SUPPLY

Connectors shown * are on the control connector panel

V1S/27T

Fig. 2.8 Control Interconnection Diagram for Studio TC6

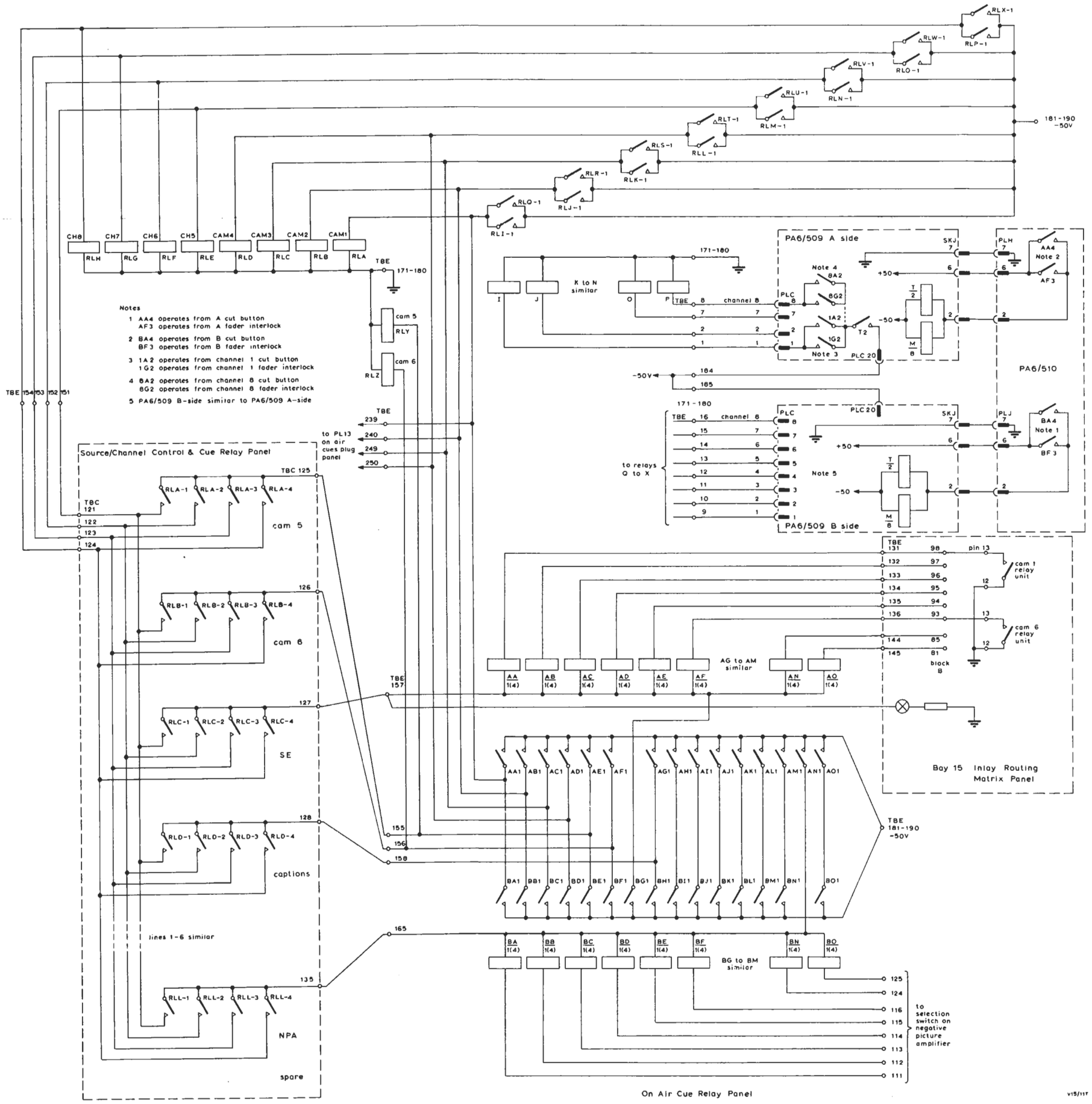


Fig. 2.9 Simplified On-air Cue Circuits of a Television Studio Equipped with an EP5/502

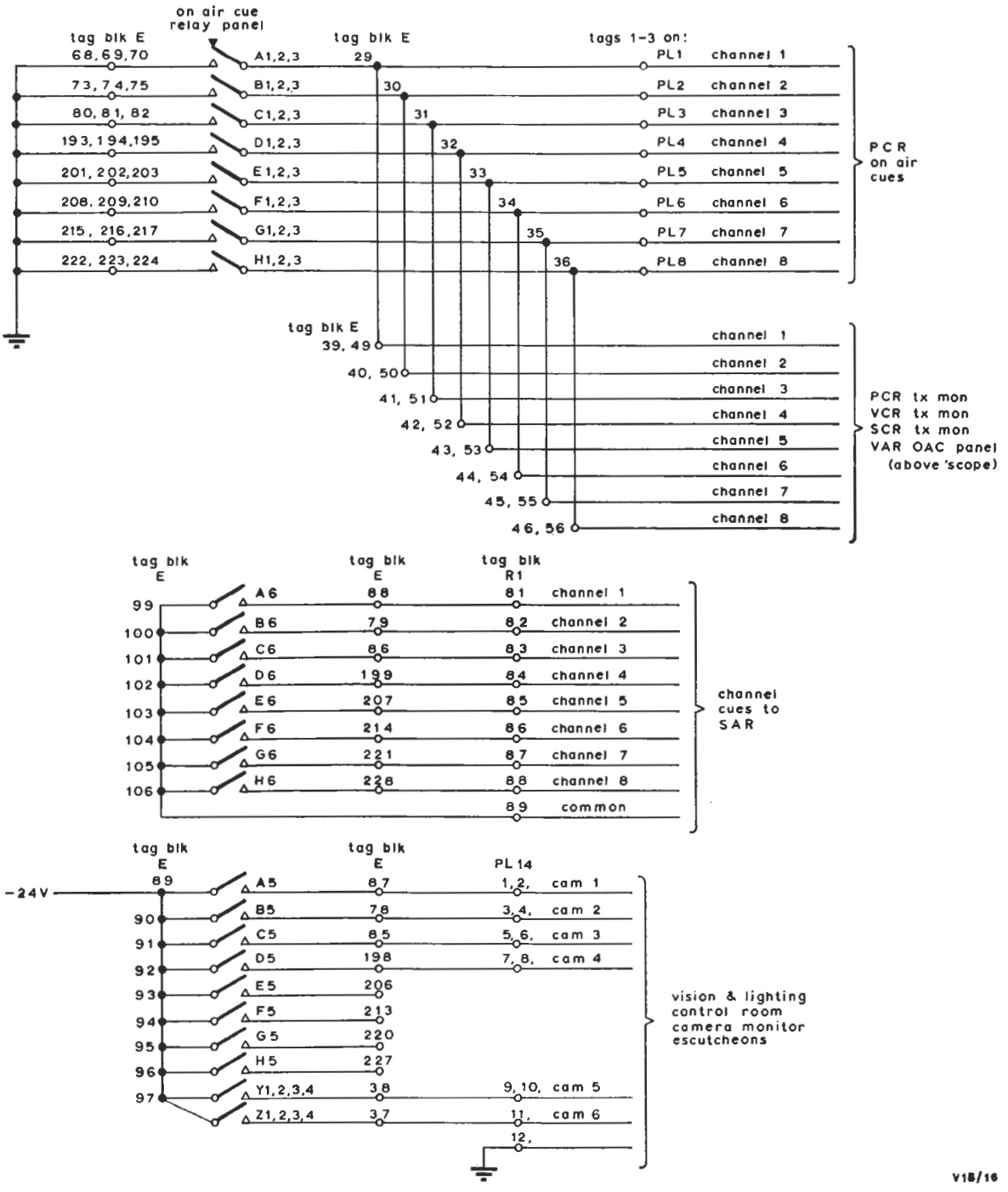
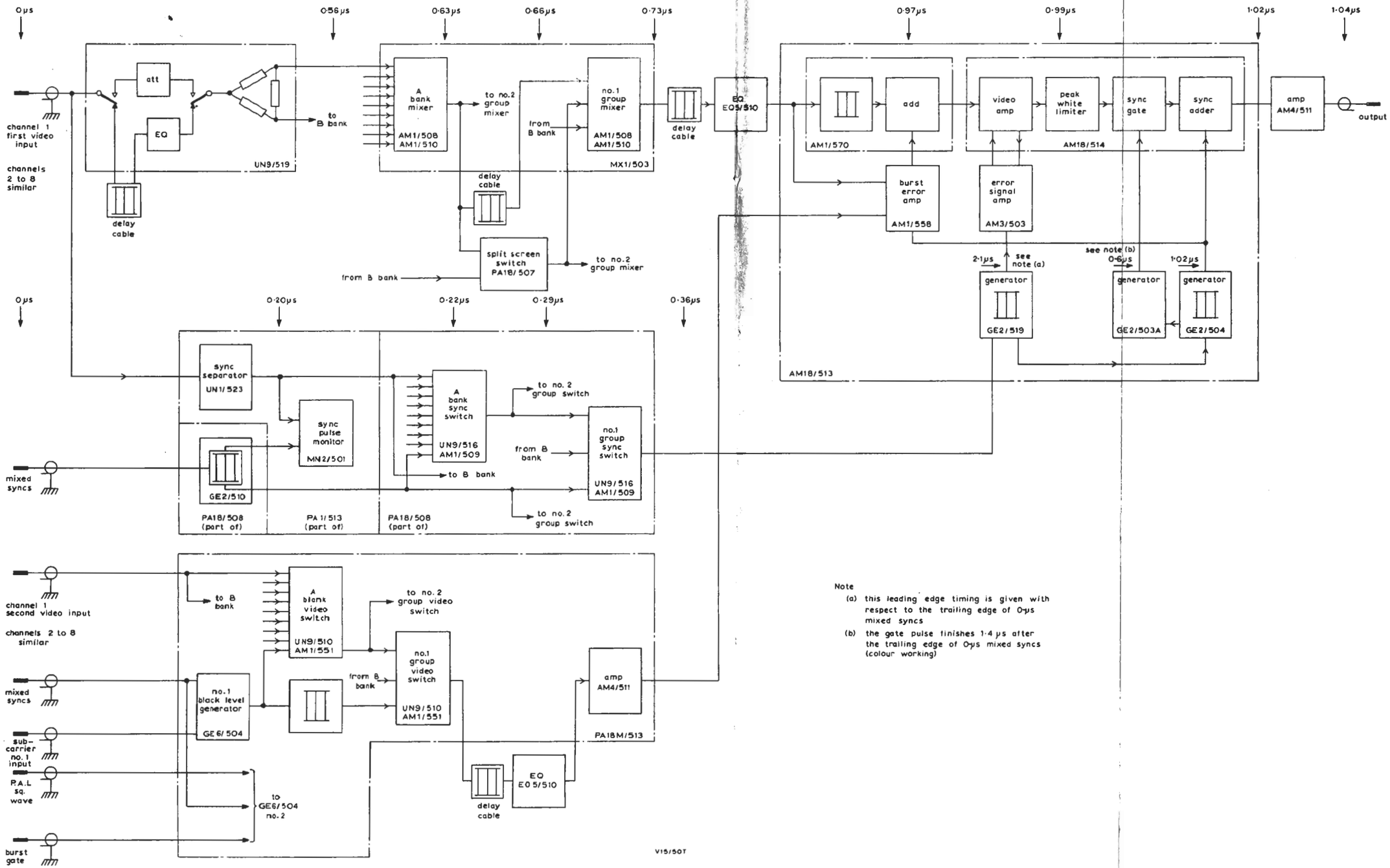


Fig. 2.10 On-air Cues Provided by Channel On-air Relays



Note

(a) this leading edge timing is given with respect to the trailing edge of 0-μs mixed syncs

(b) the gate pulse finishes 1·4 μs after the trailing edge of 0-μs mixed syncs (colour working)

Fig. 2.11
Simplified Block Diagram of EP5/502 Modified for Colour