

STUDIO VIDEO MIXING EQUIPMENT EP5/503

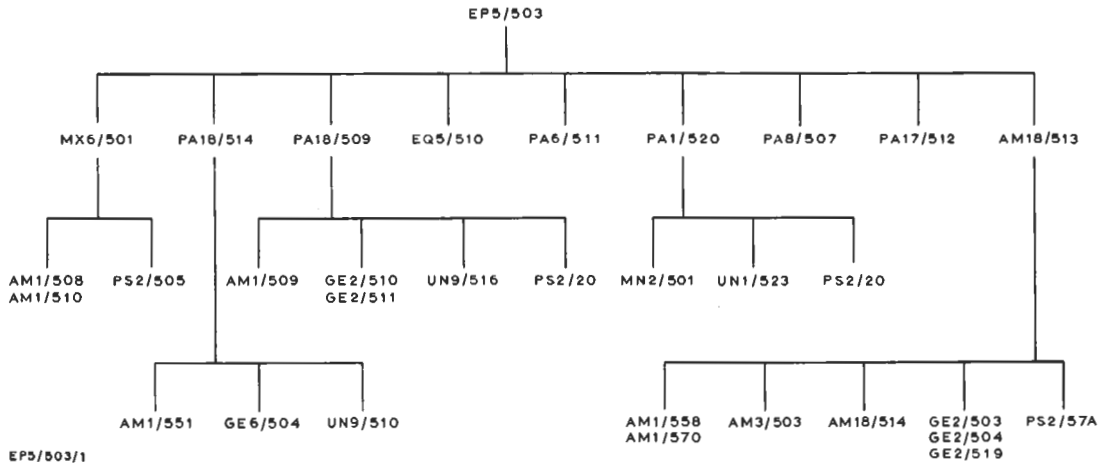


Fig. 1 EP5/503 Family Tree

A list of the various units and sub-units which comprise an EP5/503 is given below:

AM1/508	AM18/514	MN2/501	PS2/10A
AM1/509	EQ5/510	MX6/501	PS2/20
AM1/510	GE2/503A	PA1/520	PS2/57A
AM1/551	GE2/504	PA6/511	PS2/505
AM1/558	GE2/510	PA8/507	UN1/523
AM1/570	GE2/511	PA17/512	UN9/510
AM3/503	GE2/519	PA18/509	UN9/516
AM18/513A	GE6/504	PA18M/514	

STUDIO VIDEO MIXING EQUIPMENT EP5/503

Introduction

The EP5/503 is, basically, a six-channel video mixer for use in Television Continuity Rooms. It accepts up to six video signals and provides a composite video output. The desk panel of the equipment also provides mixing facilities for up to 10 sound channels.

The faders on the desk panel can be arranged to provide two or three independent video channels, four or three combined channels (sound and video faders adjacent) and up to six independent sound channels. *Sync/Non-sync* (Mix/Cannot-mix) lamps are provided for each of the video channels. *Cut* buttons are provided for the independent video channels only. Pre-hear circuits are provided for the sound channels. Remote cue and control facilities are provided for the input sources to all channels.

The manner in which video input signals are treated by the mixer is determined by the settings of *Sync/Auto/Non-sync* keys which are mounted on a PA6/511 control panel. When a channel is operating in the *Auto* mode the mixer itself decides whether the input source is synchronous or not.

Fig.1 shows the way in which the various units comprising an EP5/503 are grouped. This Instruction deals with the EP5/503 as a system and the only component units described are those that cannot be described in isolation; these are the control panel and the relay panel. Detailed descriptions of all other units are given in the relevant Instructions.

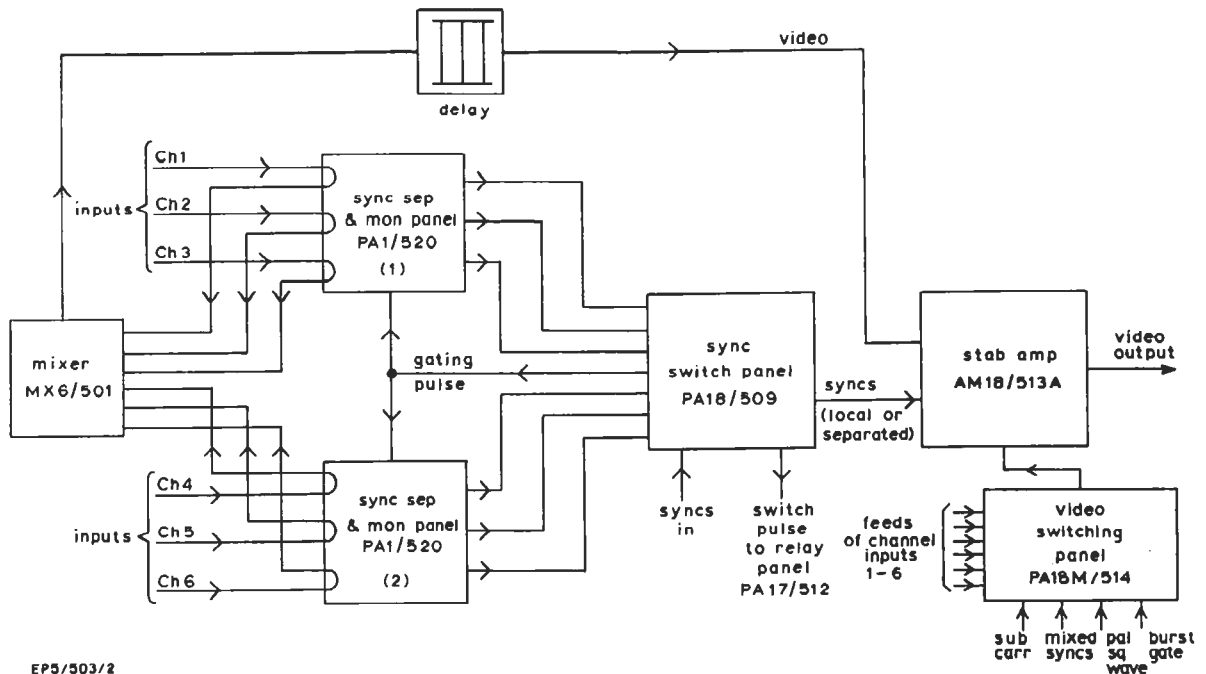
General Description

Signal Interconnections

The video and sync interconnections between the various units of an EP5/503 mixer are shown in Fig.2.

Video input signals are fed to the studio mixer type MX6/501 via the sync separation and monitoring panels type PA1/520. The MX6/501 consists of six cut/fade amplifiers type AM1/508 followed by a mixing amplifier type AM1/510. The output of the mixing amplifier is fed, via a delay cable, to the sync pulse stabilising amplifier type AM18/513A.

The EP5/503 contains two PA1/520 units, each of which contains three sync pulse separator sub-



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units type UN1/523 and three sync pulse monitor sub-units type MN2/501. The sync pulse separators derive feeds of separated sync pulses from the composite input signals. The sync pulse monitors compare the sync pulses so obtained with a reference waveform, derived from a feed of local sync pulses in the sync switch panel, and so determine whether or not they are synchronous. Information regarding the condition of the sync pulses is then fed, via the control panel, to the relay panel where, if the associated channel sync key is in the *Auto* position, it is used to determine the mode of operation of the mixer.

The sync switch panel type PA18/509 is fed with the separated-sync outputs of the two PA1/520 units and also with a feed of station syncs. The semi-conductor switching circuits in the sync switch panel are operated by trigger pulses from the relay panel. If the sync key of a selected channel is set to *Non-sync* the switching circuit associated with that channel is triggered on and feeds separated sync pulses, derived from the incoming signal, to the stabilising amplifier. If the key is set to *Sync* the switching circuit associated with station syncs is triggered on and station syncs are fed to the amplifier. If the key is set to *Auto* the sync feed selected will depend on the information fed from the channel sync-pulse monitor to the relay panel, and on whether that channel is being used alone or in conjunction with other channels.

The stabilising amplifier is fed with the output from the MX6/501 studio mixer and with sync pulses from the sync-switch panel. The video signal is equalised, amplified, clamped and clipped at white-level. The original sync pulses are then removed and replaced by reconstituted sync pulses of the correct shape and amplitude. The output of this unit, a 1-volt composite signal, is the output of the EP5/503 as a whole. The output impedance is 75 ohms.

Control Interconnections

Control interconnections between the various units which comprise an EP5/503 are shown in Fig. 3. Some of the control signals are steady d.c. potentials and some are pulses which are used to trigger a circuit into a particular condition.

The operation of a video fader, or a cut button, on the desk panel actuates relays in the control and relay panels. These relays, if the channel interlocks permit, set up a route for trigger pulses to the appropriate cut/fade amplifier and sync

switch unit. A relay in the MX6/501 unit, which de-mutes the associated cut/fade amplifier, is also operated by the fader or cut button.

The mode of operation of the channels, whether sync, automatic or non-sync, is determined by the setting of the channel sync keys on the front plate of the control panel. When a channel is selected as non-sync, relay interlock circuits prevent it being mixed with any other channel and the associated *Non-sync* lamp on the desk panel is illuminated. An attempt to mix results in the second signal being rejected. When a channel is synchronous the interlock circuits permit it to be mixed with any other synchronous inputs and the *Non-sync* lamp on the desk panel is extinguished. When a channel is selected as automatic the associated sync monitor determines whether or not the signal can be mixed. If the signal cannot be mixed it is treated as non-sync and the desk lamp is illuminated. If the signal can be mixed the *Non-sync* lamp is not 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 a mix when working in the automatic mode, the input signal becomes non-synchronous 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 relay 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 feed.

When a cut/fade amplifier is in the fade condition the gain of the amplifier is directly controlled by the position of the fader on the desk panel.

Operation

A drawing of the desk panel installed in Continuity 1 at Television Centre is shown in Fig. 4.

Video signals can be routed through the mixer either by cutting or fading on the independent channels, or by fading only on the remaining video channels. Cuts can be made from a sync to a non-sync channel, but cross-fades and superimpositions can only be made between synchronous channels. If it is required to fade from a sync to a non-sync channel, or from one non-sync channel to another, the first channel must be faded out before the

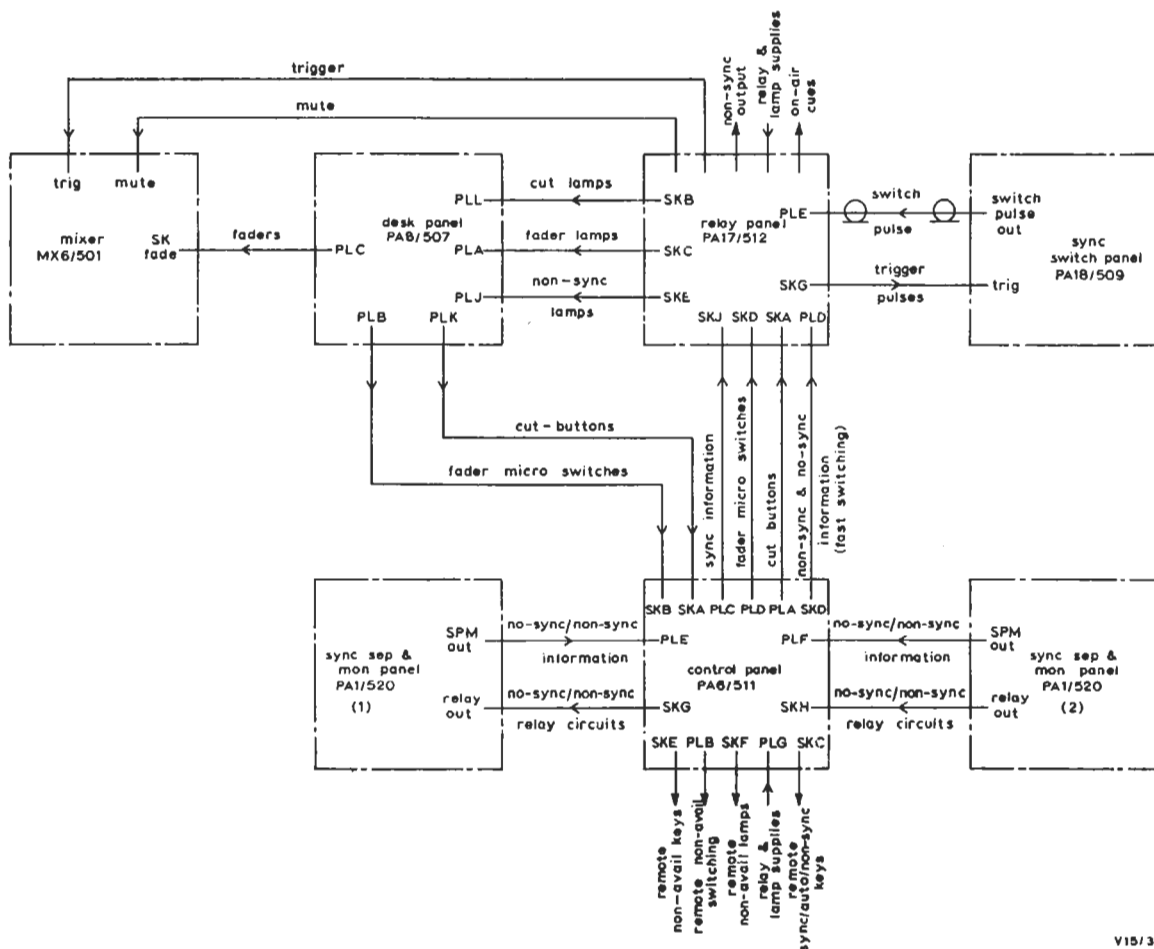


Fig. 3.3 Control Interconnections between Units of an EP5/503

second channel can be faded up. In normal practice the *Sync/Auto/Non-sync* keys of the independent channels are kept in the *Sync* position and the keys of the other video channels are kept in the *Auto* position. When a channel is switched to *Auto* it will normally operate non-synchronously; i.e. output syncs will be derived from the video input signal. However, if a mix is attempted, and the associated MN2/501 sync pulse monitor units declare the pulses of both sources to be coincident with station syncs, then the channels are declared synchronous for the duration of the mix. If, however, the monitor units declare either set of pulses to be non-synchronous interlock circuits in the relay and control panels prevent the mix from taking place.

Control Circuits

Functions

Control circuits for an EP5/503 are provided jointly by a PA6/511 Control Panel and a PA17/512 Relay Panel. The functions of these panels are summarised below.

(a) Control Panel

1. Converts the momentary action of the cut buttons on the desk panel into a holding signal to operate the cut relays on the relay panel.
2. Routes synchronising information to the relay panel from the local or remote sync keys and from the two PA1/520 Sync Separation and Monitoring Panels.

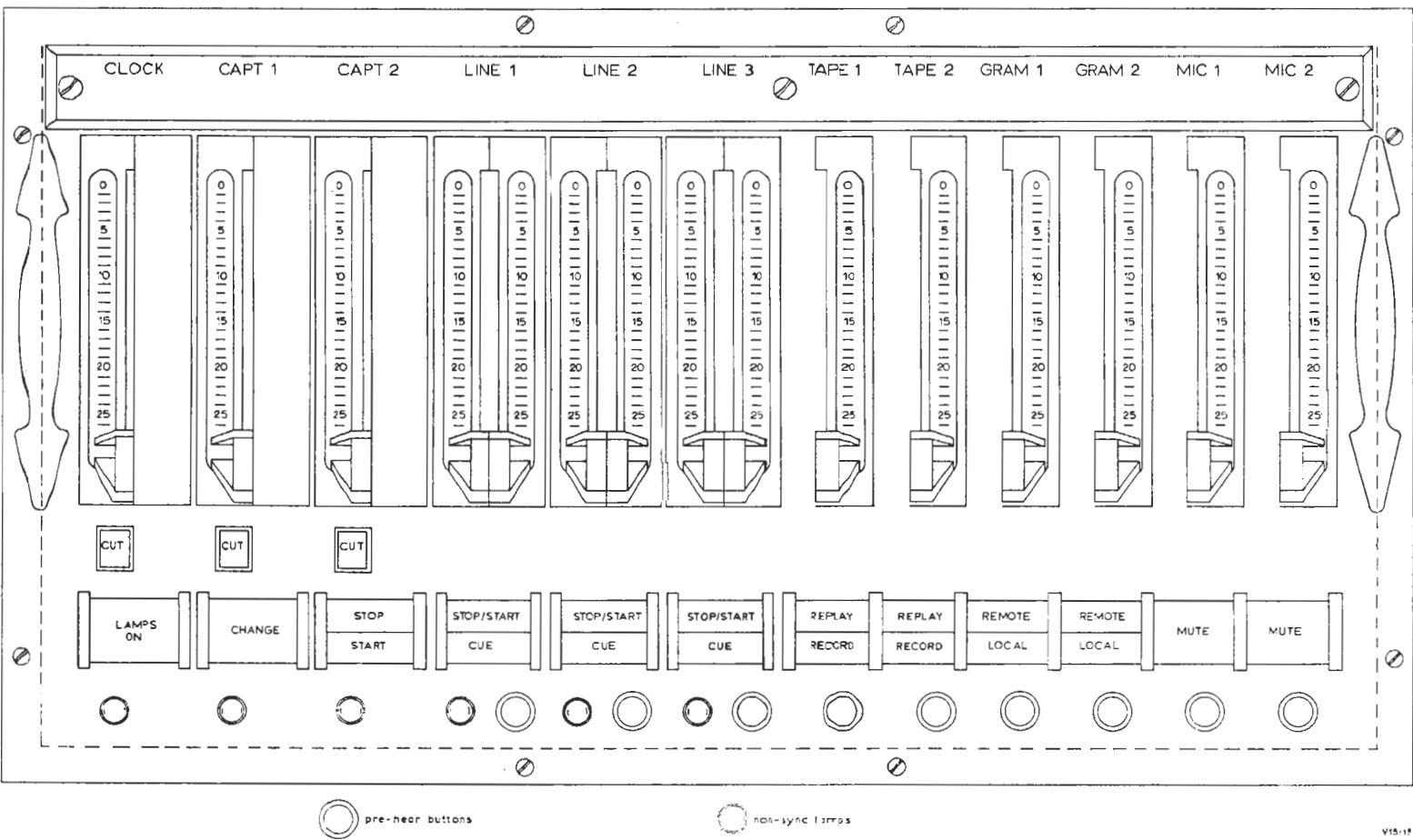


Fig. 3.4 Layout of the Desk Panel in Television Centre Continuity 1

3. Provides local or remote non-availability switches which interrupt the cut-button and fader circuits.
4. Provides external lamp and non-availability switching circuits.

(b) *Relay Panel*

1. Routes 50-volts and switching pulses to the Video Mixer MX6/501 and the Sync Switch Unit PA18/509, in accordance with information obtained from the desk and control panels.
2. Provides relay and pulse interlocks to prevent the mixing of sync and non-sync, or two non-sync, inputs.
3. Provides switched feeds of 24 volts to illuminate the *Cut*, *Fade* and *Non-sync* lamps on the mixer desk panel.

4. Provides channel-transmission and mixer non-sync cue outputs.

Relays

The circuits of the relay and control panels are largely described in tabular form. The only detailed descriptions given are for those parts of the control system which cannot be fully dealt with in this way.

The functions of the control panel relays, the circuit for which is shown in Fig. 3.5, are given in Table 1 and the functions of relay-panel relays, whose circuit is shown in Figs. 3.6 and 3.7, are given in Table 2. 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.

TABLE 1

<i>Relay Code and Function</i>	<i>Contact Function</i> (when operated unless otherwise stated)
<p>1A (Non-available)</p>	<p>1A-1 Prevents the operation of the channel-1 fade circuit when the channel is in the non-available condition.</p> <p>1A-2 Provides remote non-availability switching.</p> <p>1A-3 Operates remote non-available lamps.</p> <p>1A-4 Prevents the operation of the channel-1 cut circuit when the channel is in the non-available condition.</p>
<p>1B (Auto)</p>	<p>1B-1 Routes non-sync (+12 volt) information, derived from the sync-sep and monitor panel, through the relay panel to the MX6/501 video mixer. See also 1E-1 in Table 2.</p> <p>1B-2 Energises relays 1E and 1J on the relay panel.</p>
<p>1C (Cut)</p>	<p>1C-1 Provides a 50-V common connection for relay 1D.</p> <p>1C-2 Provides -50 volts for relay 1D.</p>
<p>1D (Cut hold)</p>	<p>1D-1 Provides a holding circuit for relay 1C.</p> <p>1D-2 Energises relay 1A on the relay panel and, via diode D141 on the relay panel, the mute relay in the channel-1 cut/fade amplifier.</p>
<p>E (Cut-to-fade)</p>	<p>E-1 De-energises any of the D series relays that may be operated.</p>

TABLE 2

<i>Relay Code and Function</i>	<i>Contact Function</i> (when operated unless otherwise stated)
1A (Cut)	1A-1 Routes no-sync (+12 volt) information, derived from the sync-sep and monitor panel via the control panel, to the sync switch panel in conjunction with contact 1E-2.
	1A-2 Provides channel on-air information.
	1A-3 Lights the <i>Cut</i> lamp on the desk panel.
	1A-4 Energises relays 1L, 1C (through 1B-3 and 1D-1) and P or N (through 1E-4). De-energises Q.
1B (Fader)	1B-1 and 1B-2 Energise relays 1F, 1G and 1H. Contact 1B-2 also breaks the 50-volt common circuit to relay W and channels 2 to 6.
	1B-3 Energises relay 1C and de-energises relay 1L.
	1C-1 and 1C-2 Form part of an interlock circuit, incorporating the contacts of all the C series relays, which applies +50-volts common to relay M when not more than one C relay is energised.
1D (Non-sync)	1D-1 Removes +50 volts common from relay 1C.
	1D-2 Feeds outgoing non-sync information to PL B pin 2.
	1D-3 Lights the <i>Non-sync</i> lamp on the desk panel.
	1D-4 When unoperated provides a momentary hold circuit for the fade relays while the +50 volt common circuit is being transferred from the non-sync bus-bar to the sync bus-bar.
1E (Auto)	1E-1 When unoperated routes non-sync (+12-volt) information from the control panel to the <i>Off</i> input of the channel-1 cut/fade amplifier. See also 1B-1 in Table 1.
	1E-2 Completes the circuit for no-sync (+12-volt) information from the control panel to the ninth (station syncs) input of the sync switch panel via SKT G, pin 9. See also 1A-1 and 1G-1.

Relay Code and Function

Contact Function

(when operated unless otherwise stated)

1F
(Fader interlock)

1E-3 In conjunction with 1F-2 provides an alternative +50 volt common circuit for relays 1F, 1G and 1H when the channel is in either the automatic or the non-sync conditions.

1E-4 Acts in conjunction with 1F-1 or 1A-4 to energise relay P and de-energise relay N.

1F-1 Energises relay P or relay N through 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. At the same time it provides an alternative +50 volt common circuit for relays 1F, 1G and 1H. See also 1E-3.

1G
(Fade indicate)

1G-1 Wired in parallel with 1A-1. See also 1A-1 and 1E-2.

1G-2 Provides channel On-Air information.

1G-3 Lights the transmission lamp in the channel-1 fader.

1H
(Fade pulse routing)

1H-1 Routes switching pulses, in conjunction with 1J-1 to the *Fade* input of the channel-1 cut/fade amplifier. Also routes switching pulses to the channel-1 input of the sync switch panel; via D91, 1K-1 and SK G pin 1.

1H-2 Provides an alternative path to that given above when 1J-1 is not operated (source synchronous).

1J
(Separated sync routing)

1J-1 See 1H-1 above.

1J-2 Routes switching pulses to the *On* input of the channel-1 cut/fade amplifier if the channel is working in the the auto or non-sync conditions.

1K
(No-sync or no-signal.)
Note. This relay is de-energised if the incoming source lacks sync pulses.

1K-1 Changes over, if the syncs of the incoming source fail, to route switching pulses away from the channel-1 sync switch and to the local-syncs sync switch.

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Relay Code and Function

1L
(Cut routing)

M
(Two-up)

N
(Mixer sync)

P
(Mixer non-sync)

Q
(Panel cut)

Contact Function

(when operated unless otherwise stated)

- 1L-1 Routes switching information to the *On* input of the channel-1 cut/fade amplifier, in conjunction with operated contacts P-3 and 1J-2 and unoperated contacts N-3 and V-1. Also routes switching information to the channel-1 input of the sync switch panel via D111, 1K-1 and SKT G pin 1.
- 1L-2 Provides an alternative path to that given above when 1J-2 is unoperated.
- M-1 to M-6 These contacts energise the E and J relays of channels working in the automatic mode.
- N-1 Breaks the non-sync short-circuit between pins 1 and 6 of PL B.
- N-2 Provides a +50 volt common circuit for the F, G and H series relays, when the mixer is synchronous.
- N-3 Disconnects switching pulses from the non-synchronous routing circuit.
- N-4 Connects switching pulses to the synchronous routing circuit.
- P-1 Short-circuits, through unoperated contact N-1, pins 1 and 6 of PL B in the non-sync condition.
- P-2 Provides a +50-volt common circuit for the fade relays when the mixer is in the non-sync condition. When unoperated provides, in conjunction with unoperated N-2, an initial starting circuit for the fade relays.
- P-3 Connects switching pulses to the non-synchronous routing circuit and disconnects them from W-1.
- P-4 Disconnects switching pulses from the synchronous routing circuit.
- Q-1 Energise relay S.
- Q-2 Provides a holding circuit for relays R and V, in conjunction with R-2.

Relay Code and Function

R
(Panel mix)

S
(Earth holding)

V
(Panel mix)

W
(Bank off)

Contact Function
(when operated unless otherwise stated)

- R-1 Provides +50-volts common for the B series relays, via the control panel and a microswitch on the fader of the selected channel.
- R-2 See Q-2.
- R-3 Energises relay E on the control panel, in conjunction with contact S-2, and so prepares the circuit for the change from cut to fade.
- S-1 Provides a holding circuit for relay S.
- S-2 See R-3.
- V-1 Connects the non-synchronous switching pulses to the fade routing circuit.
- V-2 Connects the synchronous switching pulses to the fade routing circuit.
- W-1 Routes the switch pulse output to the *Bank Off* connection of the MX6/501 when the mixer is clear (i.e. no faders or cut buttons operated).

Circuit Details

(a) *Channel Synchronism*

Channel synchronising information is obtained either from the six *Sync/Auto/Non-sync* keys on the PA6/511 control panel or from the six MN2/501 sync pulse monitor units. When the keys on the control panel are in the *Sync* or *Non-sync* positions the relay circuits are held in the appropriate condition and information derived from the sync-pulse 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 channel 1 is shown in Fig. 3.8; channels 2 to 6 are similar. Relay conditions for the three positions of the *Sync/Auto/Non-sync* key are given in Table 3; 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.

Relays E, J, D and K take several milli-seconds to operate and the switching pulse, which normally determines the operating conditions of cut/fade amplifiers and sync switch units, occurs only once every field period. Therefore, to obtain more rapid operation of the cut/fade amplifier than the relays can provide, d.c. switching signals for the

TABLE 3

Key Position	MN2/501 Output	Number of Channels Selected	Relays Energised B 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 -

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non-sync and no-sync conditions are derived from the MN2/501 unit. These signals enable the cut/fade amplifiers and sync switch units to respond rapidly to any change of sync conditions.

When the channel is declared synchronous, switching pulses, applied via D87 to SK G pin 9, turn on the mixed-sync switch in the sync switch panel. Thus station syncs are added to the video signal at the output of the mixer. Switching pulses are also applied, via unoperated contacts 1J-1 or 1J-2, to the control circuits of the cut/fade amplifier.

When the channel is declared non-sync, switching pulses are applied, either via D91 or via D111, to SK G pin 1. These pulses turn on the channel-1 separated-sync switch; thus separated syncs are added to the video signal at the output of the mixer. Switching pulses are also applied, via operated contacts 1J-1 or 1J-2, to the control circuit of the cut/fade amplifier.

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

If the channel loses syncs (usually this means a loss of signal also) the earth for relay 1K, which passes through the MN2/501, is interrupted and the relay de-energises. At the same time a positive-going 12-volt signal is applied, via SKG pin 9, to the mixed-sync switch panel. Thus, when channel syncs fail, station syncs are added to the video signal at the output of the mixer. If the

incoming video signal is also lost, the output of the mixer will consist of station syncs only.

(b) Mute Circuit

When a video channel is selected on the mixer desk panel, either by cutting or fading, the mute relay in the cut/fade amplifier associated with that channel is energised. For example, when channel 1 is faded up, the +50-volt common connection present at SKD pin 1 is connected, via D131 and R1, to the operating circuit of the channel 1 mute relay. The operating sequence of the relays in the PA17/512 is such that the mute relay operates before switching pulses are applied to the channel. Capacitor C1 and resistor R11, which are effectively connected across the channel 1 mute relay, provide it with a slow release time. This ensures that channel 1 is triggered *Off* before it is muted. Note that the mute channel is muted when the relay is in the *de-energised* condition.

Modifications for Colour Working

When used for colour working the EP5/503 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. 3.9 on page 3.19.

Feeds of the colour-video input signals to the mixer are applied to a PA18M/514 Video Switching Panel together with reference feeds of mixed-syncs, PAL square wave, colour subcarrier and burst-gate pulses. The PA18M/514 is controlled, in the same way as the PA18/509 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/514 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/514 is fed to the AM18/513A 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 3.11 for Fig. 3.5

See page 3.13 for Fig. 3.6

See page 3.15 for Fig. 3.7

See page 3.17 for Fig. 3.8

See page 3.19 for Fig. 3.9

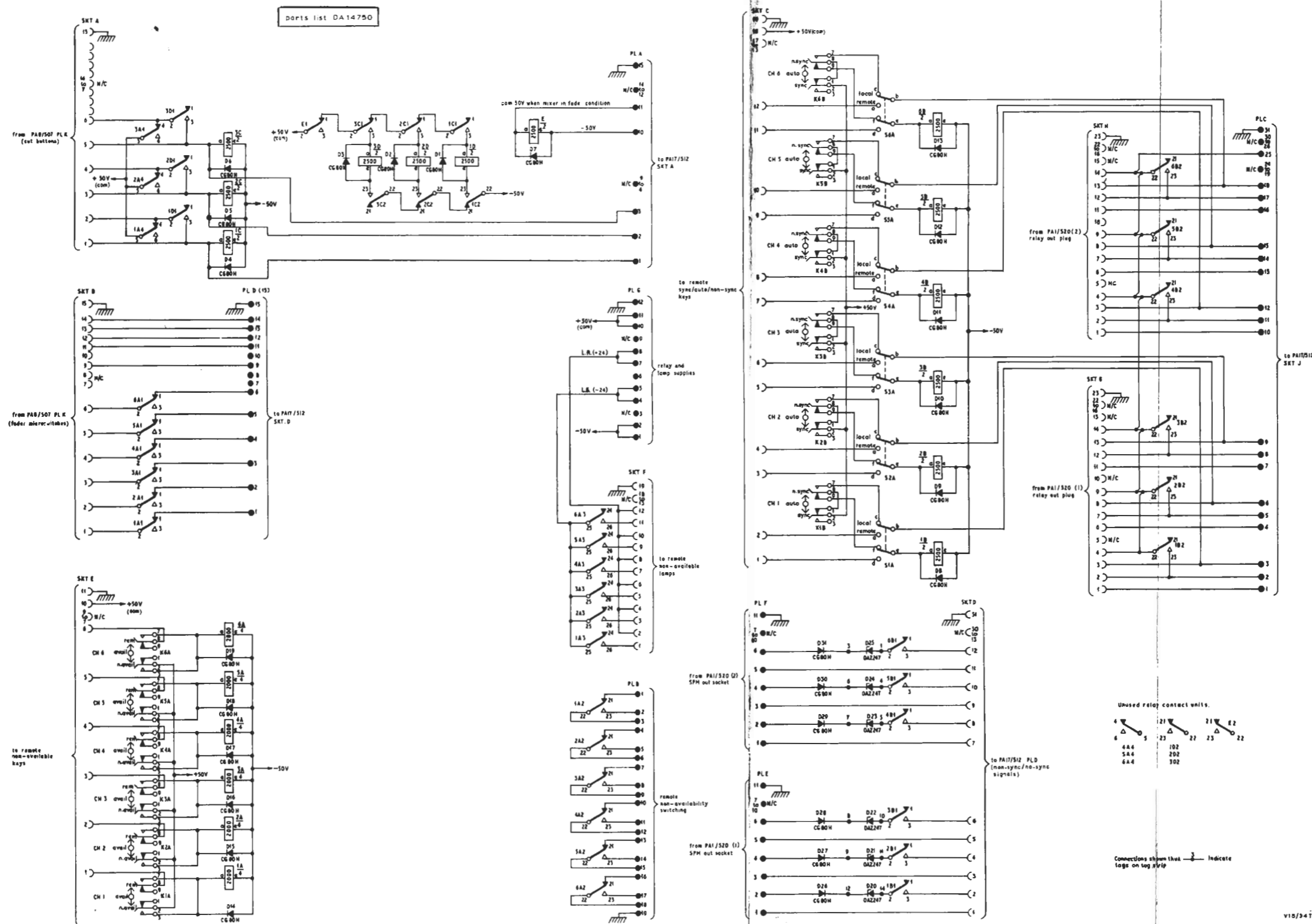


Fig. 3.5 Circuit of the Control Panel PA6/S11

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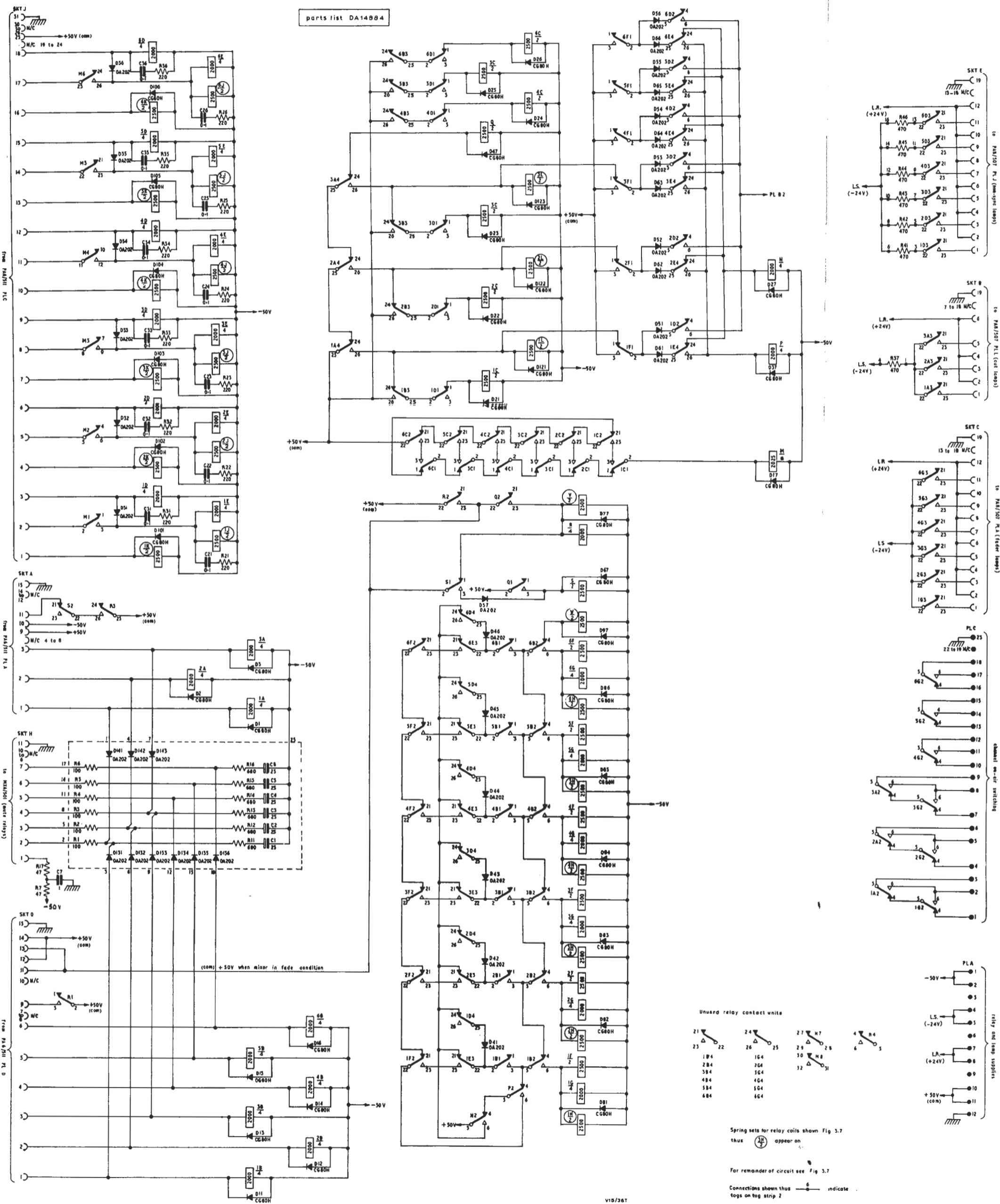


Fig. 3.6 Circuit of the Relay Panel PA17/512: Sheet 1

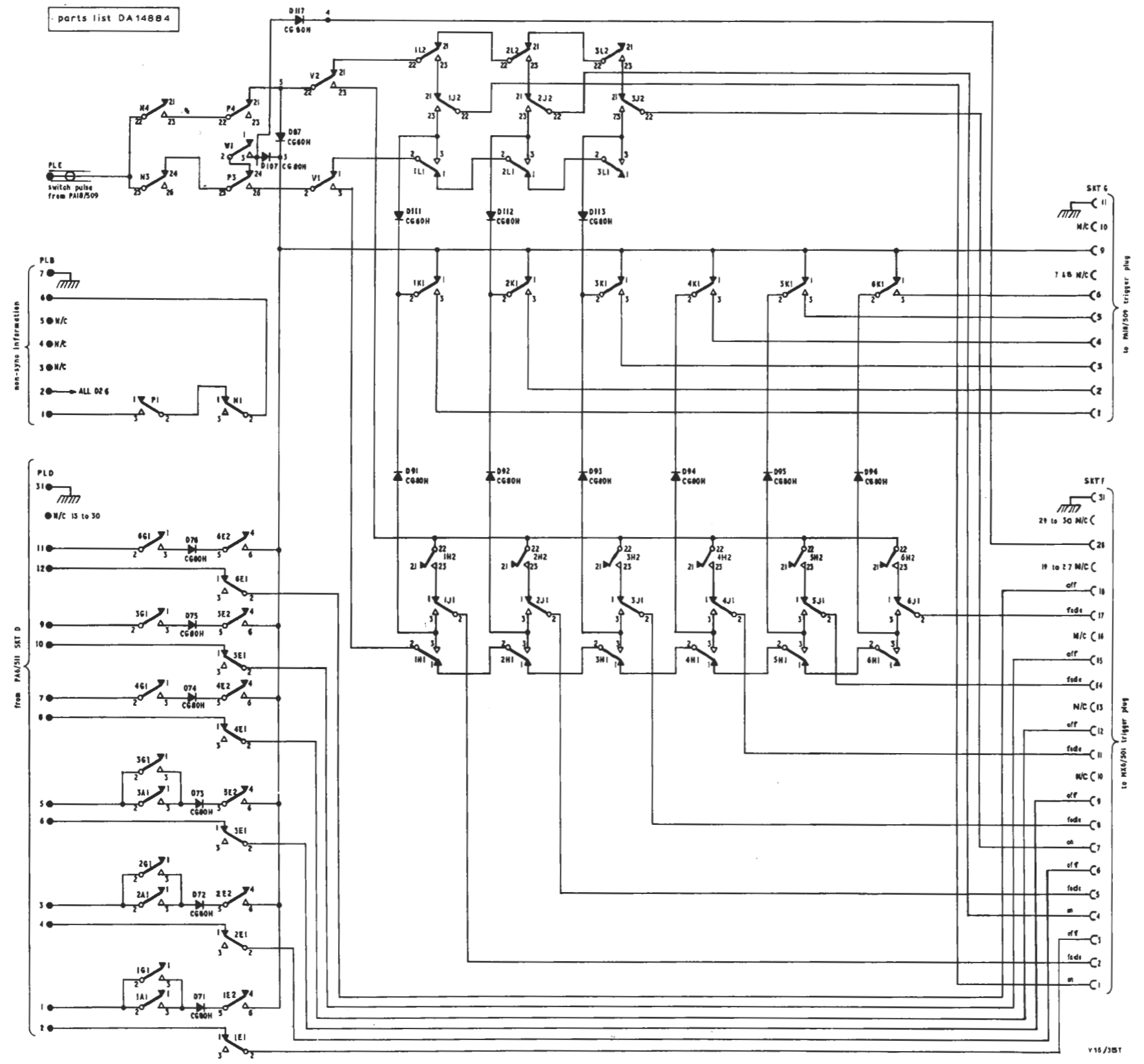
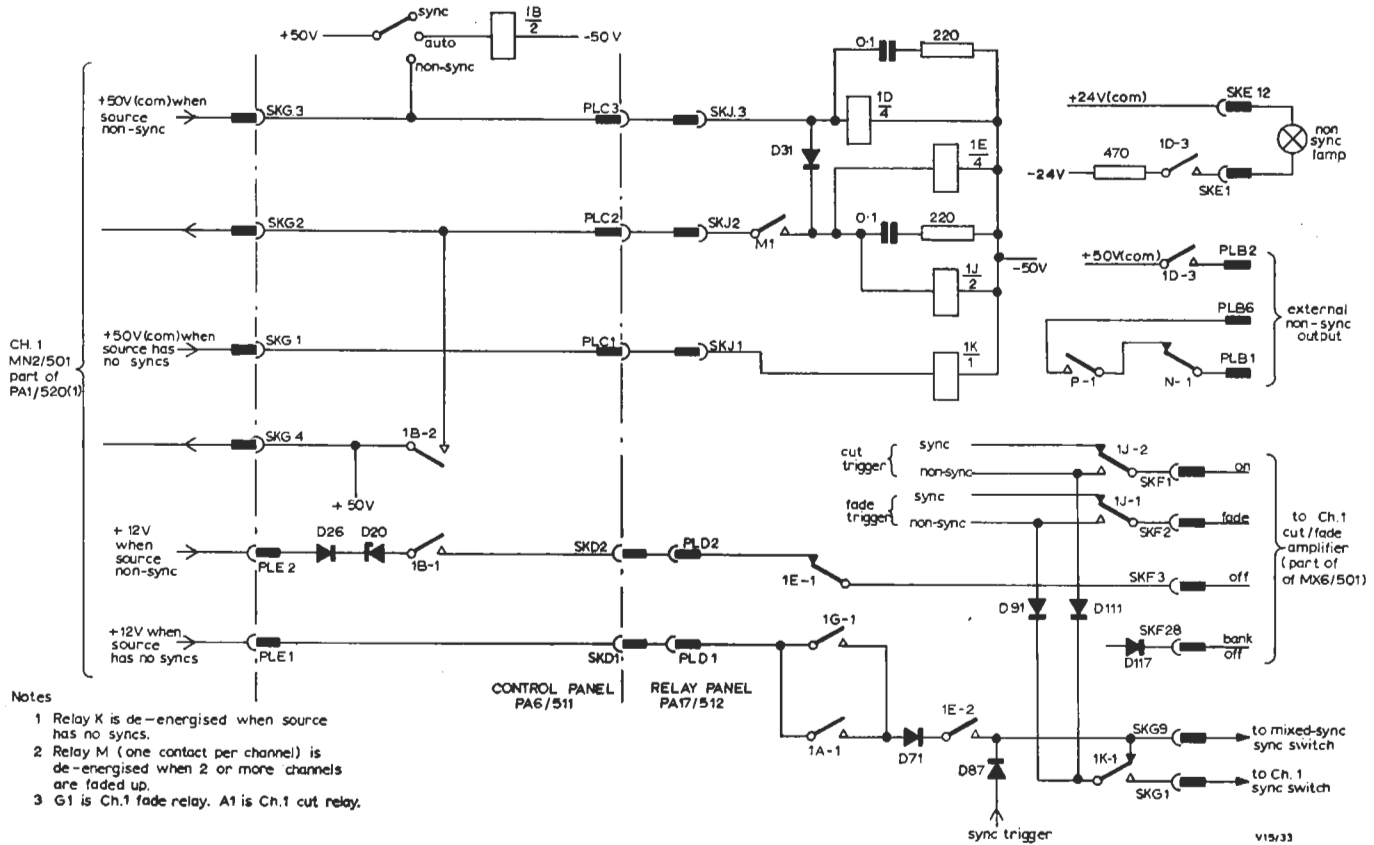


Fig. 3.7 Circuit of the Relay Panel PA17/512: Sheet 2

Fig. 3.8 Simplified Sync-information Circuit for Channel 1



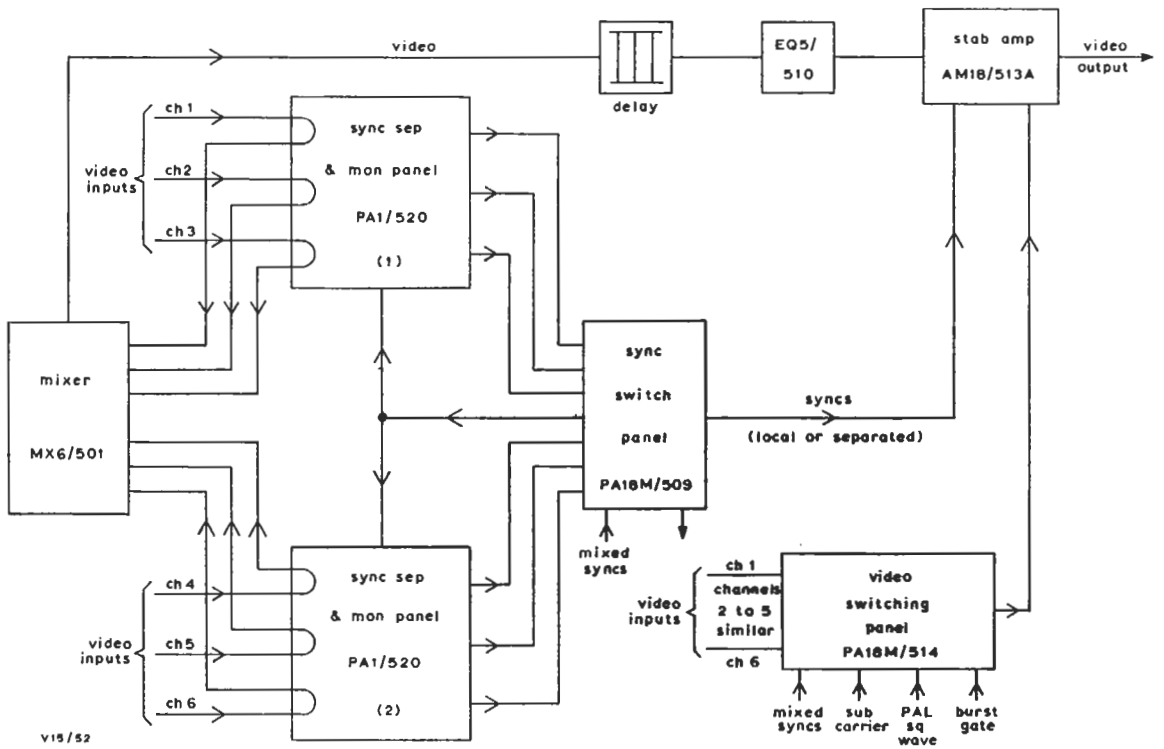


Fig. 3.9 Simplified Block Diagram of EP5/503 Modified for Colour