June 1972

TECHNICAL INSTRUCTIONS

HANDBOOK FOR

O.B. MIXER MX1/501A

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- Line Pulse Clipper GE2/507
- Blanking Pulse Generator GE2/525*
- Two-channel Video Switch UN9/514 or UN9/514A

*Modified for colour separation overlay working

Additional Units required for Colour Separation Overlay Working
Video Distribution Amplifier AM4/517
E.M.I. Camera Overlay Matrix AM23/507
Caption Pulse Generator GE2/526
Switch Routing Unit UN1/639
Video Switch and Delay Unit UN1/640
Switch Unit UN21/511
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PREFACE

The MX1/501A is, basically, an O.B. mixer type MX1/501 which has been modified for colour working. The original MX1/501 is described in Designs Department Technical Memorandum No. 8.129 (62) and the modifications required for colour working are dealt with in Designs Department Technical Memorandum No. 8.240 (67).

This handbook contains an Instruction on the MX1/501A which deals with the mixer as a system; it also contains individual Instructions (see Contents) on the coded units which comprise the MX1/501A. Alignment procedures for individual coded units are contained in the Instruction on the appropriate parent unit; e.g. the alignment procedure for the AM18/520 is contained in the Instruction on the AM18/503A. Separate Instructions are not provided for the PA6/507A, the UN3/502 or the CT3/4A as these units are described in the master Instruction on the MX1/501A.

A number of inter-unit circuits are given at the end of this handbook to clarify certain control functions.

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TELEVISION O.B. MIXER MX1/501A

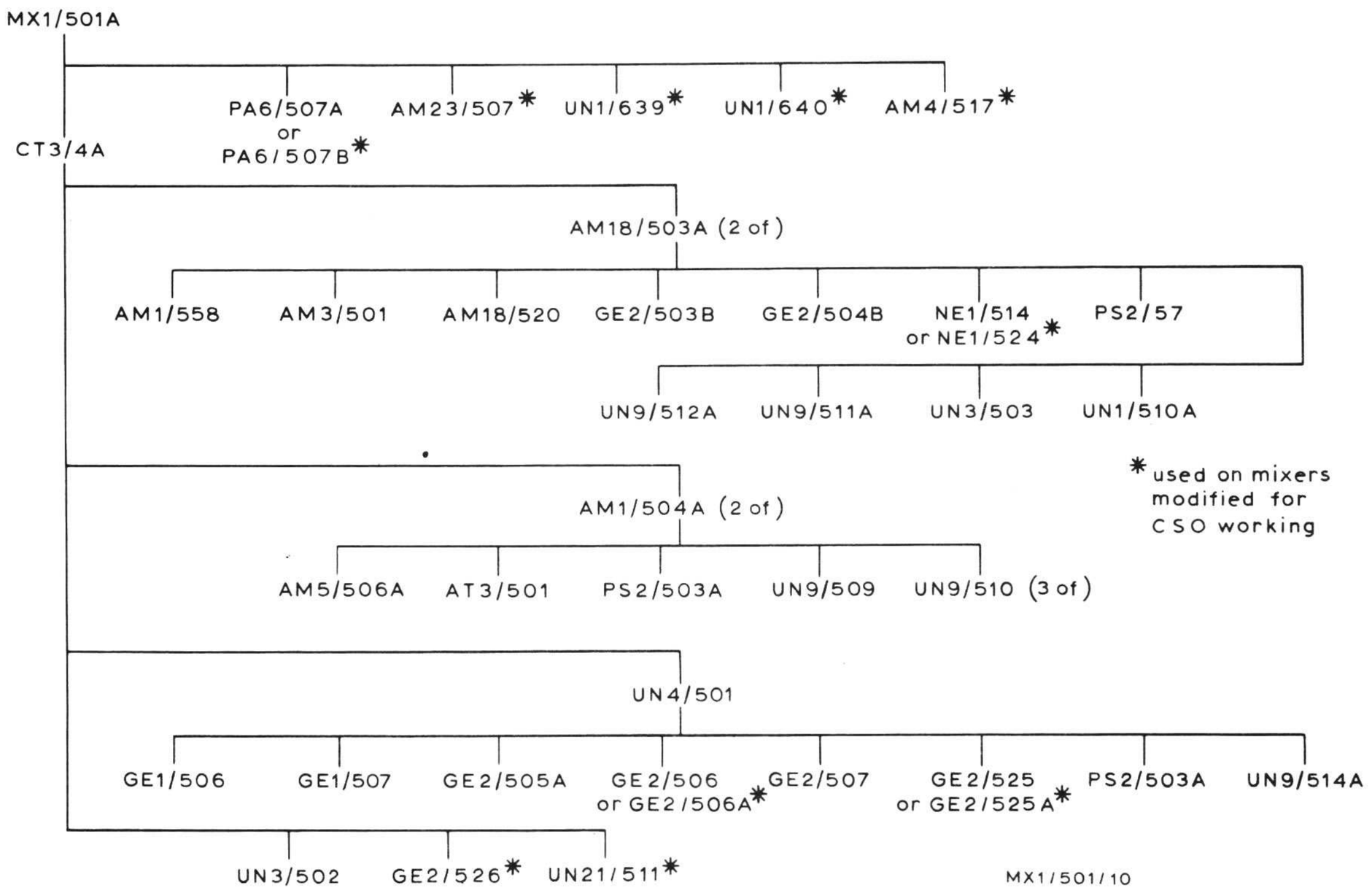


Fig. 1 Family Tree

List of Units

PA6/507A	Producers Control Panel
CT3/4A	Cabinet
UN3/502	Control Unit
UN4/501	Split-screen Effects Unit
	GE1/506 Field Sawtooth Generator
	GE1/507 Line Sawtooth Generator
	GE2/505A Clamp Pulse Generator
	GE2/506 Switch Pulse Generator
	GE2/507 Line Pulse Clipper
	GE2/525 Blanking Pulse Generator
	UN9/514A Two-channel Video Switch
	PS2/503A Stabilised Power Supplier
AM1/504A	Cut/Fade Amplifier (2 of)
	AM5/506A Two-channel Amplifier
	AT3/501 Remotely-controlled Fader
	UN9/509 Single-channel Switch Unit
	UN9/510 Three-channel Switch Unit (3 of)
	PS2/503A Stabilised Power Supplier
AM18/503A	Sync Pulse Stabilising Amplifier (2 of)
	AM18/520 Stabilising Amplifier
	AM1/558 Burst Error Amplifier
	AM3/501 Error Signal Amplifier
	UN3/503 Auto Time-constant Controller
	GE2/503B Gating Pulse Generator
	GE2/504B Sync Pulse Generator
	UN1/510A Sync Pulse Separator
	UN9/511A Sync Source Switch
	UN9/512A Video Source Switch
	PS2/57 Stabilised Power Supplier
	NE1/514 Relay Network

INTRODUCTION

The MX1/501A is a two-bank colour-working video mixer; it is intended for use in mobile control rooms and so is built in two sections. The first section is a Producers Control Panel PA6/507A on which are mounted all the operational controls; the second section is a Cabinet CT3/4A which houses all the electronic units. The two sections are connected electrically by three camera cables and may be separated by up to 300 feet. (Camera-cable circuits are shown in Table 1.)

The mixer is capable of handling up to 10 sources of which 6 must be synchronous sources and the remaining 4 can be either synchronous or non-synchronous. A Sync/Remote/Non-sync switch is provided on the mixer cabinet for each of the 4 sync/non-sync sources to enable sync or non-sync working to be selected either locally or remote from the mixer.

A split-screen unit incorporated in the mixer allows a choice of 12 different shapes of cross-wipe between synchronous sources.

The A and B banks of the mixer are independent. Each has its own power supply and its own interconnecting cable so that, in the event of a failure on one bank, cutting facilities remain on the other. Two stabilising amplifiers are provided, the second one acts as an operating reserve.

Each MX1/501A consists of the units listed on page 2. A family tree which shows the way in which these units are related to each other is given in Fig. 1.

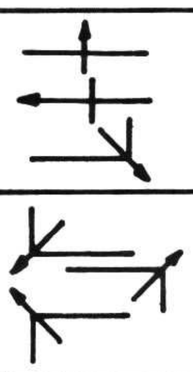
GENERAL SPECIFICATION

Number of Video Inputs	10
Pulse Inputs	mixed-syncs, field-drive, syncs-and-burst (two feeds)
Outputs	No. 1 output, No. 2 output, wipe-preview output
Input and Output Impedances	75 ohms
2T Pulse-to-bar Ratio	+1%, -2%
10T Pulse-to-bar Ratio	+1%, -2%
Differential-phase Distortion	$1{\cdot}5^{o}$ worst case
Differential-gain Distortion	not more than 6%
Chrominance-luminance Timing Error	not more than 8 ns
Crosstalk Isolation	34 dB worst case

TABLE 1

CAMERA CABLE CIRCUITS

TAG NO.	CAMERA CABLE A	CAMERA CABLE B	CAMERA CABLE W
1	-A	-B	-W
2	+A	+B	+W
3	A FADE	B FADE	-W
4	A FADE	B FADE	+W
5	COAX (MON) 4	COAX (MON) 7	COAX (MON) 1
5E	COAX (MON) 4	COAX (MON) 7	COAX (MON) 1
6	CH1A SELECT/IND	CH1B SELECT/IND	LINE WIPE D.C. SUPPLY
7	CH2A SELECT/IND	CH2B SELECT/IND	INSERT/WIPE FIELD CONTROL
8	CH3A SELECT/IND	CH3B/SELECT/IND	LINE WIPE D.C. SUPPLY
9	CH4A SELECT/IND	CH4B SELECT/IND	NOT USED
10	COAX (MON) 5	COAX (MON) 8	COAX (MON) 2
10E	COAX (MON) 5	COAX (MON) 8	COAX (MON) 2
11	CH5A SELECT/IND	CH5B SELECT/IND	FIELD WIPE D.C. SUPPLY
12	CH6A SELECT/IND	CH6B SELECT/IND	INSERT/WIPE LINE CONTROL
13	CH7A SELECT/IND	CH7B SELECT/IND	FIELD WIPE D.C. SUPPLY
14	CH8A SELECT/IND	CH8B SELECT/IND	NOT USED
15	COAX (MON) 6	COAX (MON) 9	COAX (MON) 3
15E	COAX (MON) 6	COAX (MON) 9	COAX (MON) 3
16	CH9A SELECT/IND	CH9B SELECT/IND	FUNCT SEL
17	CH10A SELECT/IND	CH10B SELECT/IND	FUNCT SEL
18	CH1A HOLD COIL	CH1B HOLD COIL	FUNCT SEL
19	CH2A HOLD COIL	CH2B HOLD COIL	FUNCT SEL
20	CH3A HOLD COIL	CH3B HOLD COIL	FUNCT SEL
21	CH4A HOLD COIL	CH4B HOLD COIL	FUNCT SEL
22	CH5A HOLD COIL	CH5B HOLD COIL	FUNCT SEL
23	CH6A HOLD COIL	CH6B HOLD COIL	FUNCT SEL
24	CH7A HOLD COIL	CH7B HOLD COIL	NOT USED
25	CH8A HOLD COIL	CH8B HOLD COIL	NOT USED
26	CH9A HOLD COIL	CH9B HOLD COIL	NOT USED
27	CH10A HOLD COIL	CH10B HOLD COIL	NOT USED
28	CH7 SYNC IND A BANK	CH7 SYNC IND B BANK	
29	CH8 SYNC IND A BANK	CH8 SYNC IND B BANK	
30	CH9 SYNC IND A BANK	CH9 SYNC IND B BANK	
31	CH10 SYNC IND A BANK	CH10 SYNC IND B BANK	FADE/WIPE VID SELECT A BANK
32			FADE/WIPE VID SELECT B BANK
33			
34	EARTH	EARTH	EARTH



GENERAL DESCRIPTION

Video Circuits

The video block diagram for the mixer is shown in Fig. 2. The ten mixer inputs are connected from the front panel of the CT3/4A cabinet to the corresponding inputs of the two AM1/504A Cut/Fade Amplifiers in parallel, via a coaxial jackfield on the back of the cabinet. If a video source is (or is likely to become) non-synchronous, it must be connected to one of the last four inputs (i.e. inputs 7 to 10). The impedance of each input of a Cut/Fade Amplifier is 300 ohms; therefore a 150-ohm resistor is connected across each pair of parallel inputs to ensure that the incoming circuits are terminated in 75 ohms.

To maintain the correct value of termination when one of the Cut/Fade Amplifiers is removed, an additional 300 ohms is connected by means of relay contacts across each of the 150-ohm resistors; in these circumstances the mixer still offers the facilities of the remaining bank. The relays that operate when an amplifier is removed are controlled by micro-switches which have their operating blades depressed by the amplifier cases when these are fully inserted into the CT3/4A cabinet.

The Cut/Fade Amplifiers contain solid-state switches which are remotely controlled from the PA6/507A panel. One Cut/Fade Amplifier handles signals selected on the A-bank of the mixer, the other handles signals selected on the B-bank. Each Cut/Fade Amplifier has two outputs, a No. 1 (Unfaded) Output and a No. 2 (Faded) Output.

The unfaded outputs connect the selected signals to the A and B inputs of the UN4/501 Split Screen Effects Unit via a co-axial jackfield and also to the Non-sync inputs of the two stabilising amplifiers, again via the co-axial jackfield. The unfaded outputs always supply a signal of the same amplitude as the selected input signal and so permit each stablising amplifier to obtain a supply of synchronising pulses from non-synchronous sources.

The faded output of the Cut/Fade Amplifiers have an amplitude which is determined by the setting of the A and B faders; these outputs are connected to the Fade inputs of the stabilising amplifiers through a co-axial jackfield and a frequency-dependent mixing network, shown in a broken-line box at the top of Fig. 2. The source impedance of the mixing network is 36 ohms and so 39-ohm resistors are fitted in the feeds to the two stabilising amplifiers to ensure that the stabilising amplifier inputs are fed from a 75-ohm source. By correctly terminating the co-axial cables which connect the mixer networks to the stabilising amplifier inputs, these resistors prevent instability due to reflections in the cable. Inductor L2 is used to boost the high-frequency response. If one AM1/504A unit is removed from the equipment cabinet, the micro-switch connection described earlier connects a dummy load of 82 ohms across the output of the mixing network.

The Main output of the Split-screen Effects Unit is fed to the Wipe inputs of the stabilising amplifiers via a splitting network (shown in Fig. 2) which is arranged to give the same effect as the network provided for the Fade input.

The video outputs from the stabilising amplifiers appear on the CT3/4A cabinet and are labelled Out 1 and Out 2; grouped with them is the Wipe Preview output from the effects unit. Also on the front panel of the cabinet are the input sockets for the pulse feeds required by the mixer: mixed-syncs, field-drive and two feeds of syncs-and-colour-burst (labelled Black Level).

Nine co-axial circuits are provided via the three interconnecting camera cables (see Table 1) between the front panel of the cabinet and the producer's control panel, these circuits provide video monitoring facilities when the control panel is remote from the cabinet.

Mixer Timing

The lengths of the co-axial cable links used on the co-axial cable jackfields on the rear panel of the mixer cabinet CT3/4A are carefully selected to give correctly-timed signals at the output of the mixer. The following is a summary of the timing effected by each set of jackfield links:

Links A — Ensure that the delay through the Cut/Fade Amplifiers is identical for each of the 10 channels.

Links B — Ensure that the delays through the A Faded and B Faded paths are identical. These lengths will depend upon the delay settings of the No. 2 Faded Outputs of the AM1/504A units (controlled by L8 in the appropriate AM5/506A).

Links C — Ensure that the delays through the A Unfaded and B Unfaded paths to the output of the Split Screen Effects Unit UN4/501 are identical and ensure also that the delays through the Fade and Wipe paths to the output of the Stabilising Amplifier AM18/503A are identical. The lengths of these links depend upon the delay settings in the No. 1 Unfaded Outputs of the AM1/504A units (controlled by L5 in the appropriate AM5/506A).

Links D — Ensure that the non-synchronous reference paths are time-coincident with the Fade/Wipe Signals at the input to the AM1/558 Burst Error Amplifier which is contained in each of the stabilising amplifiers.

There are no timing links in the two syncs-and-colour-burst feeds to the stabilising amplifiers. Any adjustment needed to ensure time-coincidence between the sync reference signal and the signal at the inputs to the Burst Error Amplifiers must be made external to the mixer.

Control Circuits

A simplified block diagram of the mixer control circuits is shown in Fig. 3.

The control circuits of the mixer can be broadly sub-divided into three groups.

(a) Those that carry d.c. for relay operation.

(b) Those that carry varying d.c. for fader and split-screen effects control.

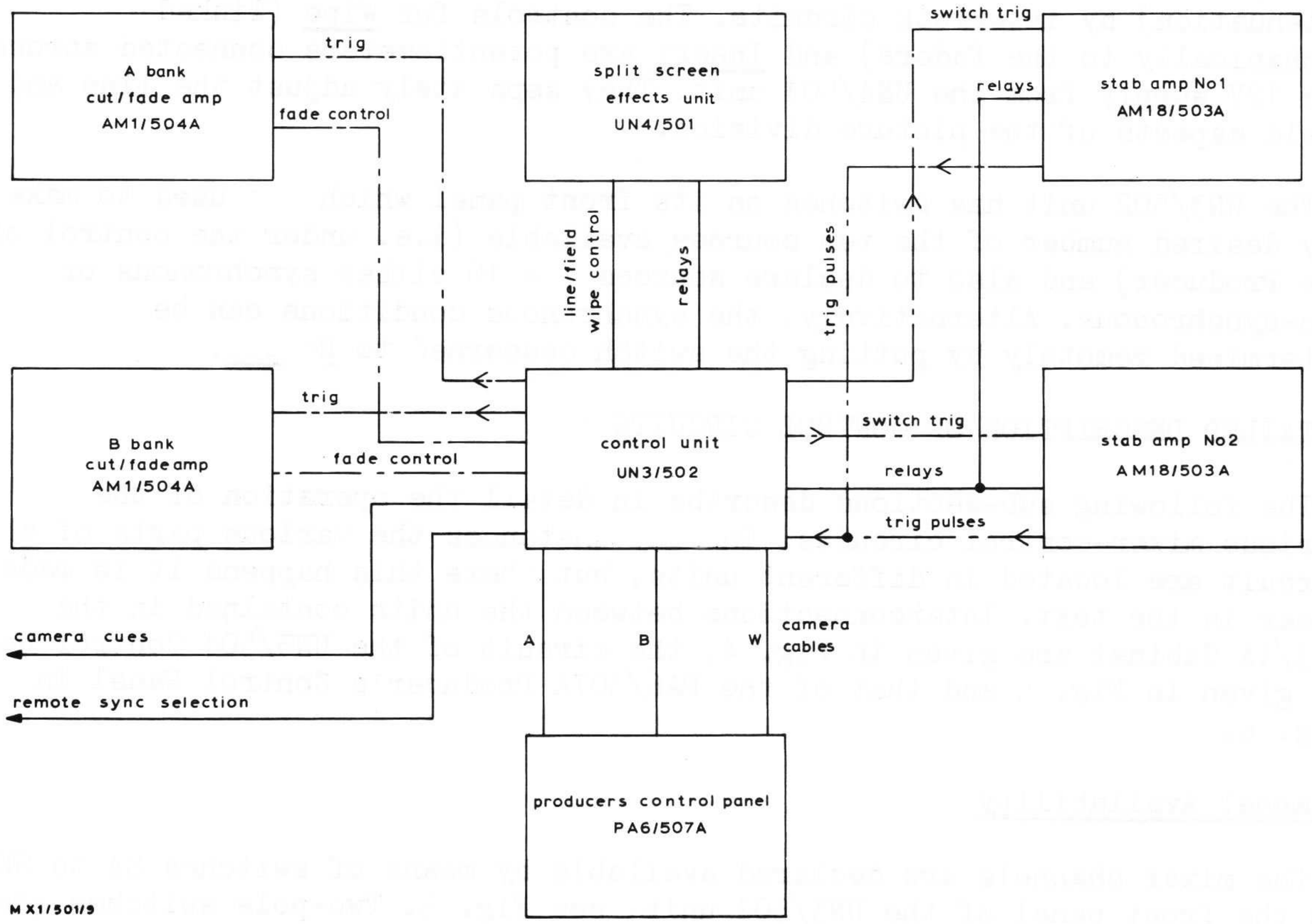


Fig. 3 Control Circuit Interconnections

(c) Those that carry switching pulses derived from field-drive pulses for operating diode switches in the AM1/504A and AM18/503A units.

The producer's control panel PA6/507A is entirely d.c. operated and supplies voltages (a and b groups) through the three camera cables (see Table 1) that connect the producer's panel to the mixer cabinet CT3/4A.

The PA6/507A contains the mixer operating controls and the relay circuits for the hold coils of the cut-buttons. The channel cut-buttons operate relays in the UN3/502 unit and these relays establish the switching-pulse routes. The field-phased switching pulses are generated in the AM18/503A units and are fed to the UN3/502 whose circuits form three bus-bars. One bus-bar system controls the syncs-and-colour-burst switch in the AM18/503A and all cutting of synchronous sources; another bus-bar controls the A-side non-sync switch in the AM18/503A and cutting of A-side non-sync sources; the third bus-bar controls the B-side non-sync switch in the AM18/503A and cutting of B-side non-sync sources. These three bus-bars are interlocked and thus establish the correct sync information in the AM18/503A units. They prevent the simultaneous transmission of a non-sync source on one side of the mixer with a sync or non-sync source on the other.

The PA6/507A also contains the Mixer Mode switch (Fade, Wipe or Insert), the relay interlocks associated with the split-screen effect and the two quadrant fader controls. Each quadrant fader contains a printed card for

a stud attenuator but it is wired as a variable resistor and connects directly into the circuits of the AM1/504A units via the camera cables. It may be short-circuited at the PA6/507A or UN3/502 units (to give maximum attenuation) by interlock circuits. The controls for Wipe (linked mechanically to the faders) and Insert are potentiometers connected across the 12V supply from the UN4/501 unit. They separately adjust the line and field aspects of the picture division.

The UN3/502 unit has switches on its front panel which are used to make any desired number of the ten sources available (i.e. under the control of the Producer) and also to declare sources 7 - 10 either synchronous or non-synchronous. Alternatively, the synchronous conditions can be determined remotely by putting the switch concerned to Remote.

DETAILED DESCRIPTION OF CONTROL CIRCUITS

The following sub-sections describe in detail the operation of the various mixer-control circuits. In many instances the various parts of a circuit are located in different units, but where this happens it is made clear in the text. Interconnections between the units contained in the CT3/4A Cabinet are given in Fig. 4, the circuit of the UN3/504 Control Unit is given in Fig. 5 and that of the PA6/507A Producer's Control Panel in Fig. 6.

Channel Availability

The mixer channels are declared available by means of switches SA to SK on the front panel of the UN3/502 unit, see Fig. 5. Two-pole switches are used to enable the A and B circuits to be kept separate. In the Available position the positive supply is connected through the A and B camera cables (pins 6-9, 11-14, 16 and 17) and appears on the microswitch contacts (SD and SE) of the channel push-buttons. The availability lights (ILP-D or ILP A on the PA6/507A, as shown in Fig. 6) are green (sync) or yellow (non-sync). For channels 1-6 the green light circuit is completed by a direct connection to -24V. For channels 7-10, a yellow lamp is connected in series with a green lamp and the junction of the two lamps is returned via the A and B camera cable connectors (pins 28-31) to contact 2 of relays A7M - A10M (B7M - B10M contact 22). When the relays are operated -24V is applied to this junction and the green lamp lights. When the relays are not operated the positive rail is connected to the junction and the yellow light shows. As this connection is taken from the switched side of the availability key of each channel, a lamp can only be powered when the channel is declared available by this key.

Channel Cutting

Suppose Channel 1 is made available. When channel 1 button (A1H) is depressed, microswitch contact SD applies + A to relay A1P. The contacts of this relay form part of a "bailing" circuit (so-called because it only releases a button when another is secured) which consists of one relay for each channel and the magnetic-hold coils of the channel push-button. It can be seen from Fig. 6 that the operation of A1P removes either the -A or +A supply rail from the hold coils of all other A buttons. The microswitch contact SD of the previously selected channel then opens and releases its associated P relay. The A1H hold coil is then energised to provide a holding circuit.

If a button is not depressed the bailing circuit energises ZA (or ZB for the B side) which short-circuits the fader control resistance (contacts 2,3) and therefore fades to blanking level. It also extinguishes the fader light (contacts 21, 22).

Contact SD also connects the +A supply through the camera-cable (pins 18-27) and operates the A bank relay A1X (UN3/502). This allows switch pulses to be routed via contacts 2 and 3 to trigger up channel 1 of the AM1/504A Unit. Where a channel is non-synchronous, say channel 8, contact SD of the channel push-button also operates relay A8N (or B8N for the B side) and thus feeds switch pulses to channel 8 of the AM1/504A (through A38) via A8M.

This relay feeds switch pulses from the sync bus-bar starting at A1X for sync working, or the non-sync bus-bar starting at A7N for non-sync working. Thus while the relays A7M - A10M (B7M - B10M) are operated switch pulses can be supplied from the sync bus-bar (channels 1 - 10) by means of the circuit through contacts 1 and 2 of the relays A1X to A10X (contacts 21 and 22 of B1X - B10X) and pins A31 - 40 (B31 - 40) of the UN3/502. The series circuit ensures a break-before-make action so that two channels cannot be triggered together. When A7M - A10M (B7M - B10M) are not operated the channel (or channels) concerned obtains switch pulses from the non-sync bus-bar which starts at contact 23 of A3 (B3).

The other set of contacts on the relays A1X - A10X (B1X - B10X) provide camera cueing outputs on pins C11 - C20 (UN3/502) from a common supply appearing on C37. Relay AE (BE) prevents this cue if a channel is selected but not in use; i.e. faded down.

Microswitch contact SE of the channel push-button applies +A (or +B) from the availability circuit to the red and blue lights (ILP B and ILP C). Relay ZCY (ZDY for a B side) is energised provided that the bank is on-air, and changes the blue light to red. The rectifiers in series with the lights prevent the -24V supply from finding a series path through the lights and relays of other channels to the positive supply.

Fader Control

The contact-stud assembly of the quadrant fader used on the PA6/507A (fader type PZ/9Q/1S) is set to give 60 discrete steps to the fader resistance, even though the scale reads 0-30. When the fader control is at 30; the fader resistance is zero and this represents full attenuation in the video attenuator of the Cut/Fade Amplifier AM1/504A. The fader control circuits are taken from the PA6/507A units (pins 3 and 4 of the A and B camera cable connectors) to the UN3/502 and thence to the AM1/504A. Relays ZA (ZB) and A1Z (B1Z) contacts 2 and 3 can cut the AM1/504 output by short-circuiting the fader control circuits irrespective of the position of the fader control knob. A1Z and B1Z are in the UN3/502.

Supply volts are applied to the 30-microswitch common contact via SKT.1A (SKT.1B) pin 11 and are routed by the normally-closed contact (i.e. when the fader is off the 30 end-stop) via connectors A32 (B32) in the camera cables and pin A27 (B27) of the UN3/502 connectors to B1Y contact 22 (A1Y contact 2) in the UN3/502. When the channels selected are synchronous, B1Y and A1Y are not energised and the supply voltage is returned to both fader circuits on camera-cables A33 (B33) via A28 (B28) of the UN3/502. The fader light indications and the relays (ZCY and ZDY) selecting <u>On Air</u> (red) or <u>Channel Selected</u> (blue) cut-button indications

for the A and B sides can now be operated together, provided that CY and CZ (see Insert condition) and ZA and ZB are not operated. When a non-synchronous channel is selected these conditions can be broken by B1Y or A1Y (see Synchronous and Non-synchronous Operation) and the lights indicate which bank is being used.

Contacts 21 and 22 of relay ZA (21 and 22 of ZB) ensure that the fader lights are out when a channel is not selected. This condition always exists when the mains supply to the mixer is first switched on.

Contacts 1 and 2 of CY and CZ cause the fader lamps to flash on and off when the faders are not on the correct end-stops in the Insert mode.

The contacts of relay CL which are across the normally closed contacts of the 30-microswitches are used to imitate the movement of the fader from the 30 end-stops when the mixer is switched to Insert mode.

Mixer Mode Indication

The three windows which are to the left of the wipe pattern selector on the PA6/507A are inscribed Insert, Fade and Wipe. Each window is illuminated white when the inscribed mode is not selected and changes to red when the inscribed mode is selected. The illumination circuits for each mode of operation are selected by means of the Mixer Mode switch (KA) and are detailed below.

(a) Fade

ILP 35, ILP 38 and ILP 40 are illuminated.

ILP 35 is connected to the positive supply via KA contacts 28 and 29 and 25, ILP 38 uses the same circuit with MR82 also in series.

ILP 40 is connected to the positive supply via KA contacts 21 and 22.

(b) Wipe

ILP 36, ILP 37 and ILP 40 are illuminated, ILP 37 receives a positive supply through KA contacts 27 and 28, 24 and 25.

ILP 36 has this same connection with the addition of MR83 in series.

ILP 40 is connected as for Fade.

(c) Insert

ILP 36, ILP 38 and ILP 39 are illuminated.

ILP 39 is paralleled with the B fader hold-coil and both are energised in this psotion.

ILP 36 is connected to the positive supply via KA contacts 22 and 23 and MR85.

ILP 38 is connected via MR84 and the same switch contacts as ILP 36.

Synchronous and Non-synchronous Modes of Operation

By means of key switches SL to SP which are located on the front panel of the UN3/502 unit, channels 7 to 10 of the mixer can be declared Synchronous, Non-synchronous or Remote. By means of these switches, or the control circuits (pins C7 - C10 on the UN3/502) which are extended to the remote position, relays A7B to A10B can be operated by the shared 24V supply. (Pins C7 - C10 in the UN3/502 are connected to the Sync Selection plug.)

When the channels are declared synchronous, relays A7B - A10B are operated. Consider the situation when channel 8 is declared synchronous. Contacts 2 and 3 of A8B cause A8M to be operated and contacts 22 and 23 similarly operate B8M. This ensures that switching pulses from the synchronous bus-bar can be routed via A38 (B38) to the Channel-8 switch in the AM1/504A. Contacts 1, 2 and 3 on A8M (21, 22 and 23 B8M) are used for channel indication (see Channel Availability). In the non-synchronous condition A8B is not operated. A8M and B8M now isolate the eighth channel on each Cut/Fade Amplifier from the "synchronous bus-bar" and switch pulses can only be obtained through contacts 2 and 3 of A8N (B8N) from a "non-synchronous bus-bar" (one for each side) starting at relay A3 (B3) tag 23 in the UN3/502.

The switch pulses from the AM18/503A appear on C21 (UN3/502) and are applied to the synchronous bus-bar connected to C22, or the A non-sync bus-bar connected to A29 or the B non-sync bus-bar connected to B29. The switch pulses are fed back to the sync-selection circuits of the AM18/503A unit from the appropriate bus-bar. For example, switch pulses on A29 (A-side non-sync bus-bar) operate the diode-switch circuits in the AM18/503A unit so that syncs are obtained from the unfaded output of the A-side Cut/Fade Amplifier.

Whenever a fresh source is selected, if a change of sync is necessary, the switch pulses are first disconnected from the signal path, (by A3, B3, A2Z or B2Z) then the relays select the correct syncs and, finally, the sync and video changeovers are accomplished together as the last relay in the sequence is made, and the next pulse arrives. It should be remembered that each of the three diode-switch systems (A Cut/Fade, B Cut/Fade, Stabilising Amplifier Sync Source Selection) remains in its original condition even though switch pulses are removed from it, because bistable multivibrators are used. Changeover occurs only when switch pulses are applied ti a fresh input of each diode-switch system.

Consider the position where channel 8 is declared non-synchronous.

Relay A8B now provides a positive supply to contact 22 of A8N (B8N) so that when the non-synchronous channel is selected, relay A3 (for the A side) and B3 (for the B side) are operated. One of these two relays is always operated by the selection of a non-synchronous channel.

The operation of A3 (or B3) by the selection of a non-synchronous channel on the A (or B) side results in A2Y (or B2Y) being operated through contacts 2 and 3 of A3 (or B3). The 22 and 23 contacts of relays A2Y and B2Y ensure that if either is operated, both are operated. A2Z and B2Z are also operated. These four relays are connected to the Shared Supply and their operation is thus ensured should either the A or B supplies fail.

When a non-synchronous channel is selected on either side of the mixer, relay interlock circuits ensure that the AM18/503A supplies the correct sync pulses with the video waveform and guard against the possibility of two channels which are not synchronous being mixed. The operation of these interlocks is described below.

When a fader is moved from its 30 end-stop the 30-microswitch operates and the positive supply is routed through the A or B camera cable (pins A32, B32) to the UN3/502 unit (pins A27, B27). When a non-synchronous channel is selected, A2Y and B2Y are energised and this positive potential operates either relay A1Y (through B1Y contacts 21 and 22) or relay B1Y (through A1Y contacts 2 and 3) but not both, as the relays contacts mutually cancel their operating circuits. One fader must therefore gain control of this circuit depending on which is away from the 30 stop first, and whether A3 (and hence A2Y) is operated before B3 and B2Y. The other fader can gain control only when the first fader is returned to the 30 stop. Because A1Z (B1Z) relay is operared in parallel with A1Y (B1Y), contacts 2 and 3 apply a short-circuit to the fader-control resistance via UN3/502 connectors B25 and B26 (A25 and A26) and so ensure that the output from the side of the mixer controlled by the operative fader is fully attenuated, irrespective of that fader's control setting. Contacts 22 and 23 allow the charge on C2 and C4 (obtained through R2 and R4 before the relay is operated) to leak away through A1Z (B1Z) giving a slow-to-release action whenever the Y relay is released. Rectifiers MR20 and MR40 prevent this charge holding the Y relay operated.

Suppose the A bank has a non-synchronous channel selected and its fader is at 0 (i.e. faded up) and the B bank fader is at 30. Then, if a cross-fade to the B bank is attempted, A1Z contacts 2 and 3 hold the B bank at blanking level but the A bank fades out. When the A fader reaches stop 30, its 30 microswitch releases A1Y (via camera cable A32 and pin A27 in the UN3/502). This allows B1Y and B1Z to operate (thus changing over syncs and fading A fully to black). Due to the action of C2 however, the B bank output is not released by A1Z for about 1/4 sec thus allowing the video chain to settle down before the new (i.e. B-bank) picture is rapidly faded up (there is a CR circuit in the electronic fader of the Cut/Fade Amplifier, which smoothes the fader-control voltage).

Suppose that a synchronous channel is selected on both sides of the mixer and that both faders are away from the 30 stop (i.e. a mix). If a non-sync channel is then selected on the A side, relay A3 operates causing A2Y to operate. B2Y also operates through contacts 22 and 23 of A2Y, but contacts 2 and 3 of A2Y have established the setting of A1Y and hence B2Y contacts 2 and 3 cannot establish the B side of the fader circuit by operating B1Y and B1Z as A1Y 2 and 3 have already broken this circuit. The A side therefore takes precendence and the non-sync channel only is transmitted. Conversely selecting a B side non-synchronous channel would establish the B side in preference to the A.

When the synchronous channel is selected on both banks, A2Z and B2Z are not operated (therefore A1Y and B1Y are not operated) and pulses appear only on the sync bus-bar. (A29 and B29). Therefore the stabilising amplifier uses station syncs for the sync chain.

When a non-sync channel is selected on either bank, the synchronous bus-bar is disconnected by A2Z and B2Z. Relays A1Y and B1Y decide which bank has priority and is on the air. A3 and B3 (contacts 21 - 23) which are operated when their respective banks are non-sync, decide whether the sync or the appropriate non-sync bus-bar shall have pulses on it.

Because only one of the three trigger bus-bars can have trigger pulses, it is not possible to trigger up a channel in a Cut/Fade amplifier until pulses appear on its bus-bar (and therefore change over stabilising amplifier syncs). This condition does not effect the operation of the mixer since when the cut-buttons are dperessed they stay down and act as a "memory", but it does mean that the cut-buttons do not always indicate which channel is passing through the Cut/Fade Amplifier.

When a non-synchronous channel is selected on either bank, A2Z and B2Z are both operated. Contact 2 and 3 of A2Z and 22 and 23 of B2Z wired in series remove the positive supply from C1 (UN3/502) and therefore from W33 (PA6/507A) to prevent a wipe or insert being transmitted (see Wipe Control Circuits and Selection of Wipe Mode).

Wipe Pattern Selection

Push-button switch SC (PA6/507A) is used to select the twelve patterns available in the Wipe or Insert condition. Contacts on row (a) of the switch supply eight circuits (W16 to W23) to the UN4/501. Depending on which button is pressed, a diode matrix in the split screen unit (UN4/501) routes these voltages to the appropriate relays in order to produce the desired pattern. On patterns 1, 3, 5 and 8; row (b) of the switch operates relay CT which interchanges the A and B pictures of the split screen unit. Row (c) operates relays CW and CX, but the common contact on each contact set is supplied from one of two bus-bars supplying a positive voltage in either the Insert (and Fade) or Wipe condition as determined by contacts 7, 8 and 9 on the Mixer Mode switch KA. Row (d) connects a white light in circuit when not selected and switches to a red light when the button is pressed. These lights appear in the windows at the top of the Producer's Panel and illuminate a diagram showing the split-screen patterns that are available to the operator.

Wipe Control Circuits

The Split Screen Effects Unit (UN4/501) has relays in it which produce the pattern selected by the Producers Panel (W16 - W23 are the connections which do this). It has three other relays which can reverse the direction of wipes and effectively interchange the A bank and B bank contributions to the split-screen output. For example, if push button 1 is pushed a line wipe is selected. Moving both faders from the A position, the transition moves from left to right and the B picture appears on the left. When the fader knobs reach the B bank, the line potentiometer must be reversed (ready for the next wipe) as the faders will move in reverse direction, and yet the wipe direction must be preserved. Moreover the A picture must now appear on the left. There must, therefore, be circuits which co-relate the selection of a pattern and the bank from which a wipe is started. Relay CS defines the bank from which the faders started and relays CT, CW and CX work in conjunction with it to provide the correct direction of wipe. CS and CT (via W28) operate CP in the split-screen unit to determine which input (A or B) is the 'old' bank and which input the 'new' bank. CS and CW (via W29) operate CQ in the split screen unit to reverse the polarity of the line potentiometer and maintain the direction of wipe indicated by the illuminated pattern. CS and CX (via W30) operate CR to reverse the field potentiometer for the same reasons.

In the Wipe mode, the Mixer Mode Switch (KA) connects CS to CW and CX via MR80 and MR81 so that CS will always reverse the conditions set by CT, CW and CX if CS changes state.

Relays CN and CO are operated by the normally-open contacts of the fader microswitches. CN is wired to the 0 microswitch of the A fader assembly and the 30 microswitch of the B fader assembly. CO is wired in the reverse manner. -24V appears on the common contact of the 0-microswitches and +24V on common contacts of the 30-microswitches.

If the fader controls are operated together, the normal requirement, CN is operated when the faders are set fully to the A bank and CO is operated when the faders are both to the B bank.

CN (both faders to the A bank) operates CS which then holds itself operated until CO (both faders to the B bank) de-energises it. SB (contacts 2, 3, 21 and 22) ensure that CS cannot change state until SB is de-energised (i.e. until the mixer is not using the split-screen output).

The operation of the split-screen unit can be controlled either by the potentiometers which are ganged to each fader assembly (pins 4, 5 and 6 for wipes) or by means of the joystick control (for inserts). When relays CU and CV (PA6/507A) are de-energised, the joystick controls are operative. CU and CV are operated from the supply on W33 which is present only when the mixer is handling synchronous channels on both banks.

Selection of Wipe Mode

To operate the mixer in the Wipe mode, the Mixer Mode switch KA on the PA6/507A must be operated. This illuminates the Wipe window in red and operates relays CU and CV (KA pin 31), The contacts of these relays connect the wipe-control potentiometers, in the fader assemblies, to the control circuits of the Split Screen Effects Unit UN4/501 through the wipe camera-cable (W6, W8 and W12 for the line control and W7, W11 and W13 for the field control). The fader control knobs now control the split-screen unit.

Switch KA also operates relays SA and SB (from KA pin 31) and hence relays in the Video Switch Unit UN9/512A of the Stabilising Amplifier. The signal used by the Stabilising Amplifier is changed from the faded (No. 2 Output) of the Cut/Fade Amplifiers (AM1/504A) to the output of the Split Screen Effects Unit (UN4/501). The two following conditions, however, must be met:

(a) The channels selected on both sides of the mixer must be synchronous i.e. a positive supply must appear on pin 33 of the Wipe camera cable from the sync/non-sync interlock circuit of the UN3/502 and thence through contacts 30 and 31 of key switch KA.

(b) Relays AM and BM must be operated so that this supply is transferred via contacts 4 and 5 of key switch KA, to relay SA which then closes contacts 2 and 3 and operates SB.

The two relays in the AM18/503A are operated sequentially by SA and SB (contacts 22 and 23) through the Wipe camera cable connections (W31 and W32 respectively). When SA is released the AM18/503A relays are released in the same sequence, the action of SB is retarded by the discharge time of C1 through the relay coil resistance.

The significance of the AM and BM relay operation, the contacts of which are mentioned above, becomes apparent when it is realised that the mixer, although switched to the Wipe mode, remains in the Fade mode until the wipe action is actually initiated by the movement of both faders away from their end-stops.

Relays AM and BM are each connected to the 0 and 30 microswitches of their respective fader assemblies so that they operate in the following manner. A -24V connection is obtained from the normally-closed contacts of the 0 microswitch. The positive supply is obtained from A33 (or B33) camera-cable connection and is therefore only present when the 30 microswitch is normally closed and the channels selected are all synchronous (i.e. A1Y (B1Y) in the UN3/502 are not operated).

Selection of Insert Mode

When the mixer mode switch (KA) is moved to Insert, the Insert window glows red and pin 31 of the switch removes the positive voltage from CU and CV. The contacts of these relay thus connect the wipe control circuits of the Split Screen Unit (UN4/501) via connections W6, W8 and W12 for line, W7, W11 and W13 for field, to the potentiometers of the Insert control RV1 and RV2. Contacts 5 and 6 of key switch KA maintain SA (and hence SB) in the operated state so that the fade/wipe changeover relays of the AM18/503A route the split-screen signal to the mixer output for the duration of the insert. Contacts 22 and 23 on key switch KA operate relay CL. The contacts of CL short-circuit the normally-closed contacts of the 30 microswitches on the A and B faders. This imitates the condition of moving both faders from their 30 stops and allows the sync/non-sync circuits in the UN3/502 to operate and so prevent a non-synchronous insert by removing the positive supply from W33. Otherwise the mixer indicates as for a mix and ZCY and ZDY contacts give a 'non-air' indication on the buttons of the channel involved. Contacts 2 and 3 on KA connect CY to contact 22 of relay CO. Unless CO or CN is operated (both faders at the same end-stop) a circuit is formed between CY and CZ which causes them to oscillate at about 2 Hz and flash the fader lights to warn the operator that the faders are not together on an end-stop. This oscillatory action is produced in the following way. When neither CN or CO is operated, current flows through CY, and through contacts 21 and 22 of CO, CN and CZ to discharge capacitor C2. CY is operated by this current and opens contacts CY, 21 and 22. As the voltage across CY falls, CY releases due to the reduced current. CY-21 and 22 then energises CZ (low p.d. across C2) and CZ-21 and 22 are made, CY operates and the cycle is repeated. Contacts 1 and 2 of CY and CZ alternatively interrupt the positive supply to the fader lights in the A and B fader assemblies.

Contacts 22, 23, 25 and 26 of the Mixer Mode switch KA apply positive volts to the magnetic-hold coils of the A and B fader assemblies. These coils hold the armatures attached to the fader levers firmly and prevent them being moved inadvertently away from the end-stop while insert is selected. If they happen to be away from the end-stops when the hold coils are energised, the magentic field is too weak to pull them in but the fader lights flash.

Producers Preview Switching

Switch SG provides a routing for 14 circuits from a common supply (Preview pin 15) to operate remote relay circuits and switch the

Producer's preview monitor. A microswitch (SF) operated when the Insert joystick control is depressed breaks this common supply and applies it directly to the first of the fourteen outgoing circuits to give a preview of the split-screen output when the control is being adjusted (i.e. setting-up for an insert).

POWER SUPPLIES

Power supplies for the mixer control circuits are derived from the UN3/502 unit and are shown in Fig. 5. Three separate 24-volt supplies are provided and these are labelled A, B and C in Fig. 5. (Note that elsewhere in the mixer the C supply is called the W supply.) The A and B supplies are associated with the A-bank and B-bank circuits respectively, the C (or W) supply is associated with the Wipe and Insert functions of the Mixer.

A feed from both the A and B supplies (labelled A and B shared in Fig. 5) is provided for certain relays in the UN3/503 unit, for details see the Control Circuit text.

ADDITIONS TO FIG. 4

1. To save space in this diagram, two or more connector tags, components or leads are in some instances represented by a single symbol. Where two tags or components are involved, the numbers of both are shown, e.g. 25, 26. Where the relevant tag numbers form a consecutive series they are indicated thus 19-22. Where the higher number is placed first, e.g. 40-37, this denotes that the highest number in the series is associated with the lowest number in some other series, e.g. tag 40 connected to tag 19, tag 39 to tag 20, and so on. Where tag, etc numbers do not form a consecutive series, details of numbering are given in the accompanying tables and the number of the relevant table (T_1, T_2 etc) appears in the diagram. Details of earth connection numbering where several connector tags are paralleled are given in Table T5.

2. R24, R25, R51, R52, R53 and R54 each consists of a parallel combination of two resistors:

   R51, R52, R53, R54 = 186Ω = 2·7kΩ//200Ω
   R24 = 940Ω = 15kΩ//1kΩ. R25 = 250Ω = 430Ω//1·8k

3. Relay contact set RLF-1 is not used.

4. The leads connected to tags 29 of Skt.7 and Skt.8, tags 21, 22 of Skt.9 and tags 10, 14, 19, 20 of Skt.5 and Skt.10 form twisted pairs with other leads, not shown, which are earthed.

5. SA and SB are microswitches normally held in their operated condition by the presence of the 'B' and 'A' Cut/Fade Amplifiers respectively. Thus the operating circuit of relays RLA to RLF is closed only when one of these units is withdrawn from the cabinet.

T1: Monitor Lines to Producers' Panel

Monitor Line No.	Co-axial Connector No.	Camera-cable Connector Tag No.		Camera Cable
		Core	Screen	
1	27	5	5E	W
2	28	10	10E	W
3	29	15	15E	W
4	30	5	5E	A
5	31	10	10E	A
6	32	15	15E	A
7	33	5	5E	B
8	34	10	10E	B
9	35	15	15E	B

T2: Video Input Circuits

Input Channel No.	Co-axial Connector No.	SKT2 SKT3 Tag No.	SKT4 SKT1 Tag No.	Relay Contact Set	Load (150w)	Emergency Load (300w)
CH1	SKT11	23	23	RLD-1	R13	R14
CH2	SKT12	6	6	RLC-1	R9	R10
CH3	SKT13	39	39	RLE-1	R17	R18
CH4	SKT14	37	37	RLE-2	R19	R20
CH5	SKT15	35	35	RLD-2	R15	R16
CH6	SKT16	33	33	RLC-2	R11	R12
CH7	SKT17	39	39	RLA-1	R1	R2
CH8	SKT18	37	37	RLA-2	R3	R4
CH9	SKT19	35	35	RLB-1	R5	R6
CH10	SKT20	33	33	RLB-2	R7	R8

T5: Earth Connections

AM1/504 Cut/Fade/Amp		AM18/503 Stab/Amp	UN4/501 Split Screen	UN3/502 Control Unit	
PL1	PL2	PL1	PL1	PL No.	Tag No.
Tag No.	Tag No.	Tag No.	Tag No.		
3	2	3	3	PLA	30
5	4	5	5	PLB	30
7-14	7-14	7-9	7-9	PLC	24
24-32	24-32	11	13		25
34	34	13	16		30
36	36	24-31	22		31
38	38	33	24		34
40	40	35	31		38
		37	33		
		39	39		

T3: 'B' Bank Pilot-lamp and Relay-operating Circuits			T4: 'A' Bank Pilot-lamp and Relay-operating Circuits		
Circuit Details	SKT8 Tag No.	Camera-cable Connector 'B' Tag No.	Circuit Details	SKT7 Tag No.	Camera-cable Connector 'A' Tag No.
24-volt supplies (switched in Control Unit) to push-buttons 1-10 and associated pilot lamps	1	6	24-volt supplies (switched in Control Unit) to push-buttons 1-10 and associated pilot lamps	1	6
	2	7		2	7
	3	8		3	8
	4	9		4	9
	5	11		5	11
	6	12		6	12
	7	13		7	13
	8	14		8	14
	9	16		9	16
	10	17		10	17
Operating circuits of relays BNN (CH7-CH10 only) and BNX	11	18	Operating circuits of relays ANN (CH7-CH10 only) and ANX	11	18
	12	19		12	19
	13	20		13	20
	14	21		14	21
	15	22		15	22
	16	23		16	23
	17	24		17	24
	18	25		18	25
	19	26		19	26
	20	27		20	27
Sync. Status Identification 'OR' circuits (CH7-CH10 only)	21	28	Sync. Status Identification 'OR' circuits (CH7-CH10 only)	21	28
	22	29		22	29
	23	30		23	30
	24	31		24	31
Relay circuits associated with 'B' fader	27	32	Relay circuits associated with 'A' fader	27	32
	28	33		28	33