DISTRIBUTION AMPLIFIERS AM4/519 AND AM4/520

Introduction

The AM4/519 has a gain of 6 dB and provides six outputs for the distribution of 625-line monochrome or colour signals. Except in its original version, the amplifier is fitted with an internal control by which the propagation time between input and output is set at 13 ns. The unit contains its own power supply.

The AM4/520 is a similar 6 dB amplifier, without a means of propagation time adjustment. Originally it differed by giving closer uniformity between the amplitudes at the six outputs, making it suitable for the distribution of colour signals in R, G and B form. Later versions of the AM4/519 have provided this uniformity of output, rendering the AM4/520 obsolescent.

AM4/519A amplifiers are AM4/520 units which have been redesignated and modified to correspond to later AM4/519 amplifiers.

Installation

In normal practice these amplifiers work from source impedances of 75 ohms and in these circumstances should have matching terminations of 75 ohms connected across their inputs. The internal input impedance of the amplifiers is high and they may be operated with paralleled inputs (using one 75-ohm termination). However, if more than twelve outputs are required, it is preferable to operate amplifiers in tandem. All outputs must be terminated with 75 ohms at all times. The input signal must not include a d.c. component exceeding 10 volts.

On the multi-way connector of each amplifier the output pins are separated by intermediate earthed pins, and the unit is designed to be plugged into a termination block PN3A/18 or PN3A/40 (preferred).

The amplifiers are constructed on CH1/12A chassis. AM4/520 units have index pegs at positions 18 and 37. AM4/519 units have pegs at positions 17 and 37, but on later units position 18 is also drilled so that these amplifiers can be modified for use in positions originally intended for AM4/520 amplifiers.

General Specification

Input Return Loss (when input terminated in 75 ohms ±1%)	
10 kHz	>40 dB
4·5 MHz	>30 dB
Output Return Loss (50 Hz to 5 MHz)	>40 dB
Nominal Output	1 V p-p video across 75 ohms
Overload Point	
10 kHz sine wave	>3·5 V p-p
5 MHz sine wave	>2·9 V p-p
Differential Phase Distortion (at 4·43 MHz)	<0·1°
Differential Gain Distortion (at 4·43 MHz)	<0·1%
Picture Distortion Factor	<0·2%
Amplitude/Frequency Response	±0·1 dB, 2 Hz to 7 MHz
Chrominance/Luminance Gain Inequality (AM4/519 Serial Nos. 3909 to 5608, 5645 on)	< ±0·05 dB
1T Pulse and Bar Response	
k_{pb}	<0·5%
k_{1T}	<0·25%
L.F. Tilt (50 Hz square wave)	<0·1% per ms
Step Response	
D.C. step via CR circuit	<14% overshoot
D.C. step direct	No overshoot
Isolation Between Outputs	
100 kHz	>70 dB
5 MHz	>46 dB
Difference Between Outputs (with matched loads)	
AM4/519 serial nos. 101 to 3908X	<0·1 dB
AM4/519 serial nos. 3909 and above; AM4/519A; AM4/520	<0·01 dB
Propagation Time (AM4/519 and AM4/519A, Except Unmodified Serial Nos. 101 to 3837)	13 ±0·5 ns
Maximum D.C. Component in Input Signal	±10 V
Maximum D.C. Output (no signal input)	±100 mV
Supply Input	210 to 260 V, 50 Hz
Operating Ambient Temperature	0 to 45°C
Weight	0·9 kg (2 lb)

Maintenance

The amplifiers do not require regular maintenance, but their performance should be checked occasionally, and if necessary adjusted, as described in this section.

Apparatus Required

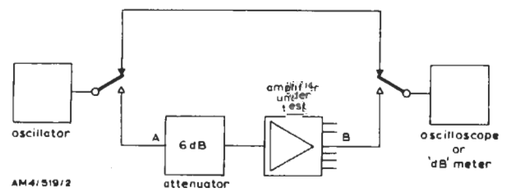
Video oscillator
H.F. double-pole changeover box
75-ohm 6-dB fixed attenuator
Tektronix type 515 oscilloscope or equivalent
75-ohm wide-band decibel meter
Measuring vectorscope, Tektronix type 521A
Avometer model 8

Test Procedure

1. Connect the apparatus as shown in the Test Arrangement diagram and ensure that all outputs of the amplifier are terminated with 75 ohms.
2. With the Avometer measure the voltages across C16 and C17. Set both to 12 volts by adjustment of R49 and R52.
3. With the oscilloscope as an indicator and the video oscillator, switched off, as a zero reference, switch between the direct path of the test arrangement and the path including the amplifier, and adjust R3 to obtain zero d.c. at the amplifier output.
4. Replace the oscilloscope by the decibel meter and, using the direct path of the test arrangement, adjust the output of the video oscillator to obtain a reading of 0 dB at 10 kHz on the decibel meter. Change over to the amplifier path and adjust R16 to obtain an output of 0 dB and hence a gain of 6 dB.
5. Alter the oscillator frequency to 4·5 MHz and check that the gain has remained at 6 dB within ±0·05 dB. If necessary, adjust the values of C6 and C7, which should have the same nominal value (not over 33 pF). If L2 has been changed, it may also be necessary to add 1 or 2 pF in parallel with it.
6. Check that the gain of the amplifier at 10 MHz lies between 6·0 dB and 6·4 dB (See note).
7. Check the d.c. output level as in (3) above and readjust as necessary.
8. Replace the decibel meter with the oscilloscope. Set the oscillator to 10 kHz and increase the input to the amplifier to 3·5 volts p-p. Limiting should not occur.
9. When checking amplifiers fitted with a propagation time adjustment capacitor, C19, apply subcarrier to a measuring vectorscope alternately (a) directly and (b) via the amplifier, using the same lengths of cable, and check that the amplifier introduces a propagation delay angle of 20·75 ±0·8 degrees. If necessary, adjust C19 to obtain this result. If C19 is adjusted, recheck and reset the gain at 4·5 MHz.

Notes: For tests 5 and 6 it is essential to check the zero of the test circuit by comparing the two branches when the amplifier under test and the 6 dB pad are replaced by a short link (between points A and B on the Test Arrangement diagram).

If the amplifier fails tests 5 and 6, a possible cause is TR4 which should be replaced. If it fails test 8, transistors TR5, TR6 and diode D2 should be checked.



Test Arrangement

AIB 4/68
DPEB 10/75

Features of the Different Versions

Amplifier Type	*Serial Nos.*	*Propagation Time Control*	*Uniformity of Outputs*	*Suitable to Distribute RGB*
AM4/519 (original version)	101 to 3837	Only on units modified. Then set at 13 ns.	Within ±0·1 dB	No
AM4/519 (converted AM4/517)	3838X to 3908X	Yes. Set to 13 ns.	Within ±0·1 dB	No
AM4/519A (converted AM4/520)	5609 to 5644	Yes. Set to 13 ns.	Within ±0·01 dB	Yes
AM4/519 (current version)	3909 to 5608, & 5645 on	Yes. Set to 13 ns.	Within ±0·01 dB	Yes
AM4/520		No.	Within ±0·01 dB	Yes

Notes:
1. These amplifiers have a mains neon lamp and two 4-mm monitoring sockets on the front panel, except the current AM4/519, which has an l.e.d. power-on indicator and two 1·27-mm sockets.
2. The AM4/519A and current AM4/519 have RGB and 13 nSECS marked on their front panels. The AM4/520 is marked RGB.
3. Some components in the AM4/519 amplifiers with serial numbers 3838X to 3908X, which are converted AM4/517 units, have circuit reference numbers that differ from corresponding components in other AM4/519 amplifiers.

Circuit Description

This description applies to all versions of the amplifiers, except that the units which were originally type AM4/517 have some differing component reference numbers as noted on the circuit diagram.

C1, at the input, is a reversible electrolytic capacitor blocking d.c., up to the maximum specified d.c. component in the applied signal. TR1 and TR2 form a feedback pair with high input impedance and low output impedance. C2 and C19 modify the phase response to maintain stability. C19 (omitted on AM4/520 and early AM4/519 units) serves also as a means of adjusting the propagation time through the amplifier.

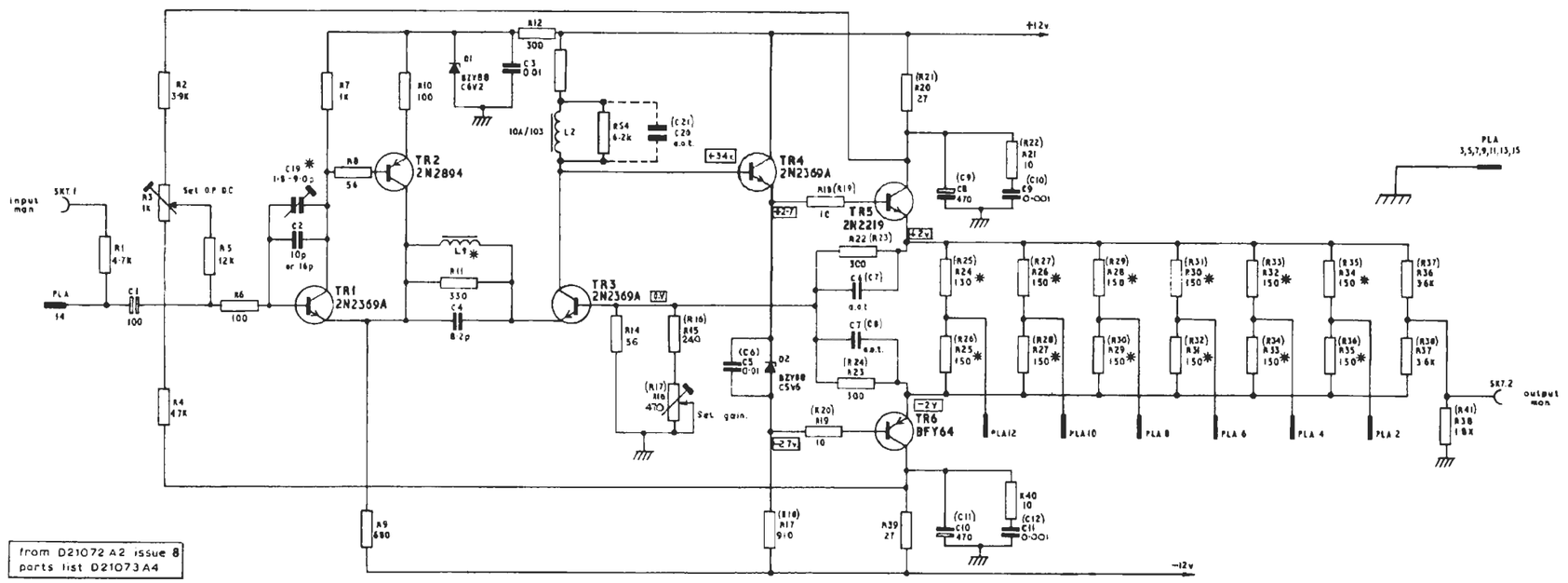
The main gain of the amplifier is provided by TR3 connected in the common base mode. The gain of such a stage varies inversely with source impedance and, using L1, C4 and R11, advantage is taken of this to determine the response at high frequencies. The inductive collector circuit assists this action. TR4 is an emitter-follower buffer stage for driving the output transistors.

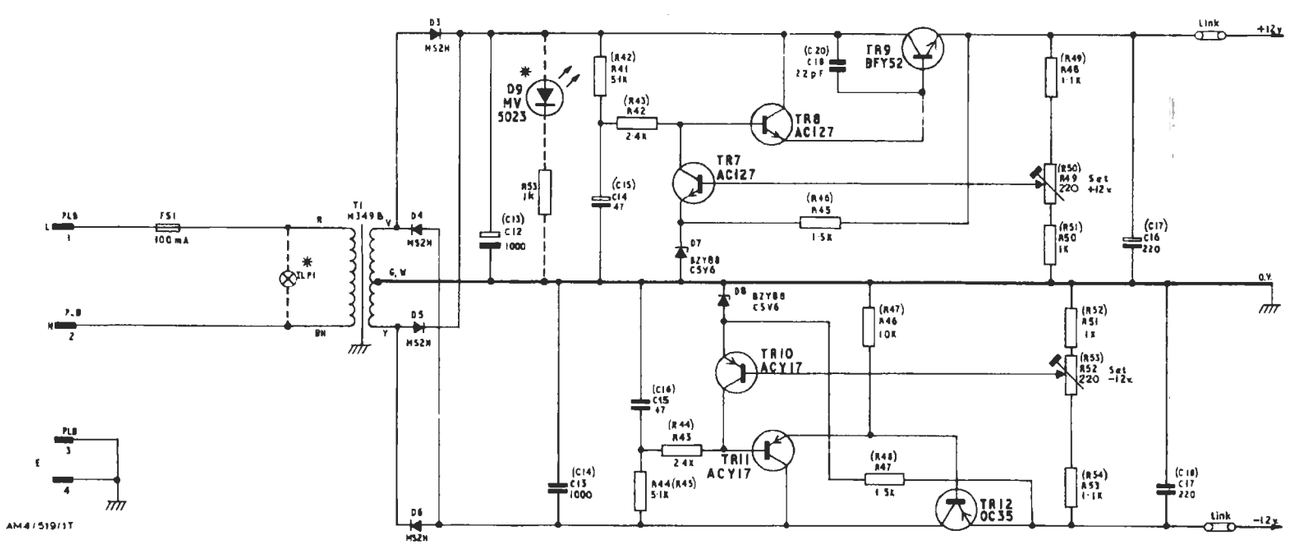
TR5 and TR6 are connected as a push-pull emitter-follower output stage. The transistors are complementary and are therefore fed in phase; the necessary d.c. bias between them is provided by the zener diode D2. Both transistors drive each output via a 150-ohm resistor, thus producing a 75-ohm output impedance. This arrangement reduces the effect of removing the output terminations and stabilises the operating point. Resistors R24 to R35 have a tolerance of 0·1 per cent (except on early versions of the AM4/519).

The gain from input to loaded output is 6 dB and this is controlled by feedback through R22 and R23 to the base of TR3; the preset resistor R16 provides a setting-up adjustment. Capacitors C6 and C7 introduce a phase lead which, together with the frequency shaping already mentioned, maintains stability under all load conditions likely to be met in operation.

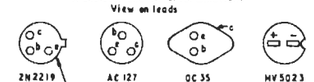
The d.c. conditions at the output are stabilised by feedback from the decoupled resistors R20 and R39; the actual voltage is set to zero by adjustment of R3. Adjustment of the gain by R16 does not affect this as both ends of R16 are nominally at earth potential.

The positive supply voltage is derived by D3, D5 and reservoir capacitor C12. The rectified d.c. is fed through TR9, and a sample of TR9 output is fed back from R49 to TR7. This amplifier controls the compound emitter follower consisting of TR8 coupled to TR9. R49 is adjusted for +12 volts output. The −12 volt supply circuit is similar and is adjusted by R52.





Transistor and l.e.d. terminations
View on leads



NOTES

Boxes indicate d.c. voltages to be expected with no signal input, measured on a model 8 Avometer.

Component reference numbers in brackets apply to units with serial numbers 3838X to 3908X.

* DIFFERING COMPONENTS

	AM4/520	AM4/519 Serial Nos. 101 - 3837	AM4/519 Serial Nos. 3838X - 3908X	AM4/519A Serial Nos. 3609 - 5044	AM4/519 Serial Nos. 3909 - 3608, 5045 on
R24 (R25) - R35 (R36)	± 0·1% tol.	± 1% tol.	± 1% tol.	± 0·1% tol.	± 0·1% tol.
C19	omitted	on some	fitted	fitted	fitted
Power-on indicator	ILP1 neon	ILP1 neon	ILP1 neon	ILP1 neon	D9, R55
L1	L/714	Nos. 101 - 3900, 3838X - 3908X: L/714 Nos. 3901 - 3837 3909 on: L/1554			

Circuit of AM4/519, AM4/519A and AM4/520