R.G.B. THREE-CHANNEL DISTRIBUTION AMPLIFIER AM4/522

Introduction

The AM4/522 is a three-channel R.G.B. video amplifier. Each channel has a high input impedance and accepts video at a level of −6 dB. There are three outputs per channel and each output is at standard level when terminated in 75 ohms. The amplifier and its power supply are constructed on a CH1/12A chassis with index-peg position 39. Connections to the chassis are via two 15-pole Painton plugs.

Use of the Amplifier

The AM4/522 is primarily designed to operate with the Termination and R.G.B. Matrix Unit UN1/624 to enable gated R.G.B. field-interval test signals to be inserted into any standard-level R.G.B. signal. The UN1/624 serves as the back connector for the AM4/522. The 6-dB gain provided by the AM4/522 compensates for the 6-dB loss in the mixing pad incorporated in the UN1/624.

The AM4/522 may also be used as an ordinary distribution amplifier with the back connector type PN3A/32A. Each channel then provides three normal -level R, G or B outputs with a gain of 6 dB. The AM4/522 can carry dissimilar studio pulses on each channel but dissimilar coded video signals should not be carried because of the low inter-channel isolation of the amplifier.

The channel inputs can be connected in parallel to provide nine outputs. The three channels can also be connected in cascade to give a gain of 18 dB with normal-level output.

Unused inputs and outputs should be terminated in 75 ohms except for the 18-dB connection when unused outputs should be left unterminated.

General Specification

Voltage Gain per Channel	6dB ± 0·05 dB
Number of Outputs	3 per channel
Normal Output Level	1 volt p-p video
Pulse Output Level	2 volts p-p
Pulse Overload Point	+3 dB
Input Impedance	11 kilohms in parallel with 20 pf
Isolation Between Two Outputs of One Channel	
at 5 MHz	greater than 40 dB
at 10 kHz	greater than 70 dB
Isolation Between Channels at 5 MHz (i.e. one channel operating at normal output level and the isolation measured at the output of an unused channel with all unused inputs and outputs terminated in 75 ohms)	greater than 54 dB
Differential Phase Distortion	
Normal output level	0·1° (worst case)
+3 dB output level	0·3° (worst case)
Per channel of three channels in cascade each providing normal output level	0·07° (typical)
Differential Gain Distortion	
Per channel of three channels in series each providing normal output level	0·08% (typical)
L.F. Tilt	
With three channels in cascade measured on a 50-Hz squarewave	less than 1%
Amplitude-Frequency Response	±0·15 dB, 2 Hz to 7 MHz
Pulse Response	
Three channels in cascade, each providing normal output level	change in IT pulse height less than 4 mV Change in IT pre-shoot less than 12 mV
Unweighted Noise	
Relative to 0·7 volts (single channel)	amplitude less than −83 dB
Relative to 0·7 volts (three channels in cascade)	amplitude less than −70 dB
Propagation Time Per Channel	16 ns ± 1 ns
Chrominance-luminance Delay Inequality	
Three channels in cascade	1 ns (typical)

Chrominance-luminance Gain Inequality

Three channels in cascade	±0·1 dB (typical)
Maximum Non-useful d.c. Component at Input	not to exceed ±6 volts
Maximum d.c. Output Voltage with Zero Input Signal	+150 mV
Operating Temperature Range	0°C to 45°C
Mains Voltage Range	210 to 260 volts r.m.s., 50 Hz
Power Consumption	18VA at 240V r.m.s.
Construction	CH1/12A with two 15-way plugs
Weight	0·94 kg (2lb 1oz.)

Circuit Description

The circuit of this amplifier is given in Fig. 1. The input circuit consists of a double emitter follower 1TR1 and 1TR2 which drives one side of a long-tailed pair amplifier 1IC1. 1IC1 and 1TR5 form an amplifier with a voltage gain of about 200. 1TR5 output drives a feedback pair output stage 1TR6 and 1TR7.

Voltage feedback is applied from 1TR7 collector to the other side of the long-tailed pair via the double emitter follower 1TR3 and 1TR4. This feedback reduces the overall gain to 6 dB and reduces the output impedance of the circuit to a value negligible compared with the 75-ohm output resistors.

The gain of the amplifier is set by the ± 0·1% tolerance feedback resistors 1R15 and 1R19 which act as a potential divider on the output signal and hence set the amount of feedback applied. There is no provision for gain adjustment. Indentical double emitter followers are used to drive the long-tailed pair to prevent loading of the potential divider by the long-tailed pair input and to ensure roughly equal voltage drifts at 1TR2 and 1TR3 collectors as the temperature changes.

1C7, 1R14, 1C9 and 1R20 are used to shape the out-of-band frequency response to maintain stability under all operating conditions.

The Power Supply provides stabilised outputs of +12V and −6V relative to earth. The circuit is conventional except for the earth rail stabiliser which operates as follows:

R56, TR54 and R57, TR55 form a potential divider across the regulated 18V supply. The mid point of this divider is connected to chassis.

An increase in load current between chassis and *negative* rail causes a slight *increase* in the potentials of both supply rails and hence of the base of TR54. Thus TR54 becomes more conductive and its collector voltage decreases. This decrease in TR54 collector voltage is passed on to the base of TR55 by D56 and D57 causing TR55 to become less conductive.

The effect of making TR54 more conductive and TR55 less conductive is to adjust their potential division ratio so that the supply rail potentials are lowerd toward their original values relative to earth.

On the other hand an increase in load current between chassis and *positive* rail results in a slight *decrease* in the potentials of the supply rails relative to earth. This causes TR54 to become less conductive and TR55 to become more conductive which adjusts their potential division ratio so that the supply rail potentials are raised toward their original values.

In the event of a short-circuit between chassis and the negative or positive rail, the current is limited by R56 or R57.

Maintenance

Listed below are typical voltages relative to chassis measured with an AVO Model 8 under zero input signal conditions with all inputs and outputs correctly terminated

Measured at				*Volts*
Pin 1	1IC1	2IC1	3IC1	+1·3
Pin 4	1IC1	2IC1	3IC1	−4·1
Pin 5	1IC1	2IC1	3IC1	+1·3
Pin 8	1IC1	2IC1	3IC1	+10·6
Collector	1TR5	2TR5	3TR5	−0·6
Collector	1TR7	2TR7	3TR7	+0·1

Test Apparatus Required

Termination bracket PN3A/32A wired for AM4/522 as shown on DSK 12620 A4.
Oscilloscope (5mV/cm d.c. to 15 MHz).
Wayne Kerr video oscillator type 022B.
H.F. changeover box.
Eleven terminations 75-ohm ± 1%
Oscilloscope termination 75-ohm + 0·1%
Decibel Meter type E3238 75-ohm or UN1/511 Signal Measuring Set
Two push-button attenuators 75-ohm 1-dB step STC 74600
Fixed attenuator 6 dB + 0·01 dB
Fixed attenuator 3-dB

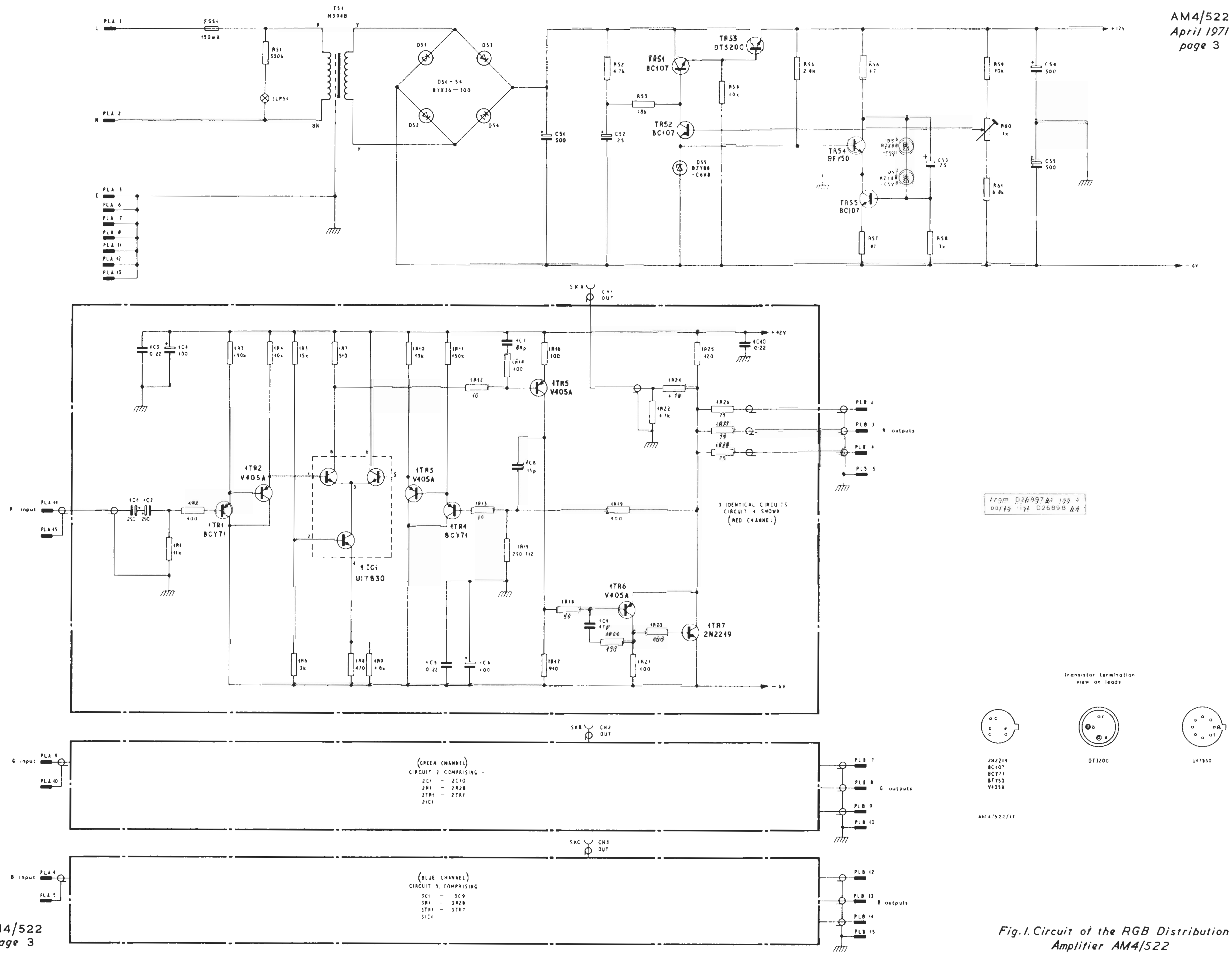

Fig. 1. Circuit of the RGB Distribution Amplifier AM4/522

625-lines pulse and bar generator.
ME1/504 Noise Measuring Set.
AVO Model 8 meter.
GE4/520 Non-linearity Test Signal Generator.
EP1/508 Remote Signal Analyser.

Test Procedure

1. Plug the amplifier into the PN3A/32A and switch on the mains supply. Connect the AVO 8 between the negative pole of C55 and the positive pole of C54. Adjust R60 to give 18V.
2. Transfer the positive lead of the AVO 8 to chassis and check that the voltage is 6V ±0·5V.
3. Terminate all the inputs and 2 outputs of each channel in 75 ohms. Monitor the remaining outputs in turn with the oscilloscope set to d.c. and terminate in 75 ohms. The d.c. on each channel output should not exceed ±150mV.
4. Connect the three channels in cascade and terminate all unused outputs. Monitor the output with the oscilloscope. There should be no sign of instability even when the intermediate terminations are removed.
5. Set up the GE4/520 to give a standard-level staircase with subcarrier on the steps.
   Use the EP1L/508 to measure the differential-phase distortion on the test signal direct from the GE4/520. This should be very much less than 0·1°. Now connect the test signal via a 6-dB attenuator to each channel of the AM4/522 in turn, and measure the differential phase at each channel output. All unused inputs should be terminated. If necessary adjust the value of 1R9, 2R9 or 3R9 as appropriate to reduce the differential phase to 0·1° or less.
6. To check the gain of each channel set up the circuit of Fig. 2. The 3-dB attenuator between the oscillator and the changeover box is used to improve matching between oscillator and amplifier.
   Switch the changeover box to A and use the Decibel Meter or UN1/511 and oscillosope to set the oscillator output to 0 dB at 10 kHz.

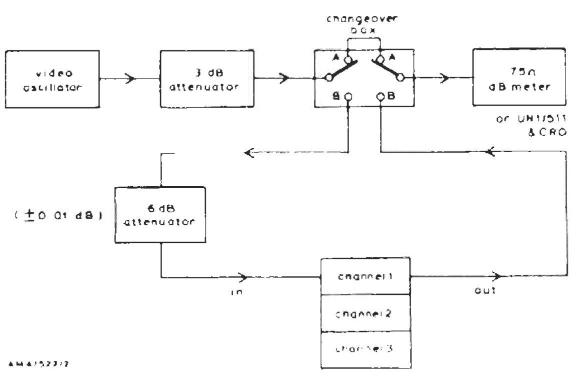

Fig. 2. Test Arrangement for Checking Gain

   Switch the changeover box to B. The Decibel Meter should read 0 dB ±0·05 dB. Repeat with the other channels. The relative gain between any two channels should not exceed 0·1 dB.
7. Set up the video oscillator to give 1V p-p across 75 ohms at 5 MHz as indicated on the terminated oscilloscope.
   Connect the oscillator output to one *output* of channel 1 on the AM4/522 and monitor with the terminated oscilloscope at one of the other channel 1 outputs. Terminate the third output. The signal displayed should be less than 10 mV p-p. Repeat for channels 2 and 3.
8. Reduce the oscillator output to 0·5V p-p and feed it to channel 1 input. Measure the signal with the terminated oscilloscope at channel 2 output and then channel 3 output. All unused inputs must be terminated. The signal indicated on the oscilloscope should be less than 2 mV p-p. Repeat this procedure with the oscillator feeding channel 2 and then channel 3.
9. Use the ME1/504 to measure the unweighted signal-to-noise ratio at the output of each channel with the inputs terminated in 75 ohms. This ratio should be greater than 83 dB.

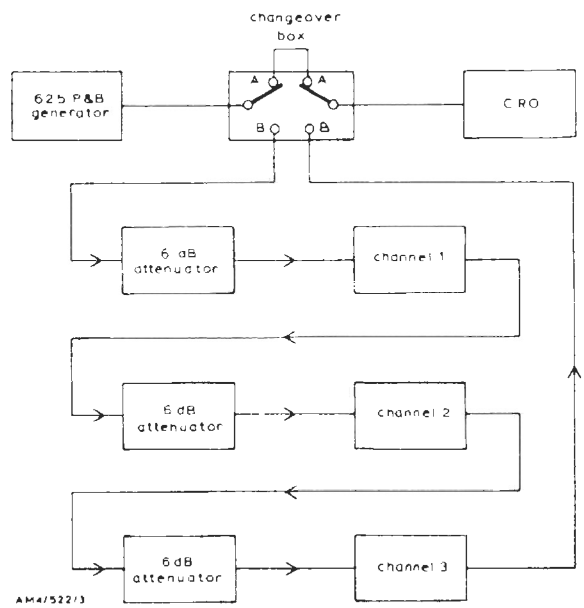

Fig. 3. Test Arrangement for Checking P-B Ratio

10. Set up the circuit of Fig. 3.
    Switch the changeover box to A to display the 1T pulse from the generator. Check for correct pulse-to-bar ratio.
    Switch the changeover box to B to display the pulse after passing through the amplifiers. The pulse height change should be less than 4 mV and the pulse pre-shoot change less than 12 mV.
11. Switch the pusle and bar generator to give the 50-Hz auxiliary waveform and check that the L.F. tilt is less than 1%

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