AMPLIFIER AM5/507

General Description

The AM5/507 is a general-purpose mains-operated video amplifier employing transistors. It has a gain of 15 dB together with a good noise performance, and can handle coded colour signals of any system or line standard; it can therefore be used in place of the AM5/501, the AM5/505 and the AM5/505A.

It has an output at the standard level of 1 volt peak-to-peak into 75 ohms, and a second output at 15 dB below standard level for use where required. Each output has an impedance of 75 ohms. The input impedance is high to enable several amplifiers to have their inputs connected in parallel.

A plug-in chassis CH1/12A is used with printed wiring. The power and signal connections are made via a multi-way connector when the amplifier is plugged into one of the standard mounting panels of the PN3/21 or PN3/23 type used to accommodate amplifiers constructed on this type of chassis.

Input and output monitoring sockets and mains fuses are provided on the front panel.

Circuit Description

General

The circuit of the amplifier is shown in Fig 1.

The first two stages are used to provide the voltage gain and are followed by an impedance-transforming stage. Feedback is used to obtain the required performance and to give a low output impedance and a high input impedance.

The transistor TR1 in the first stage is of a special high-frequency low-noise variety, with a cut-off frequency in excess of 1,000 Mc/s and a noise figure given as 3·5 dB relative to a 120-ohm source. The biasing of this transistor is an important consideration in the design of the amplifier, and optimum conditions for noise are obtained with a 3-mA collector current.

The rectifier MR5 is connected between the base and emitter of TR1 to avoid the risk of a reversed input which might be caused by surges from capacitors.

The second transistor TR2 is operated in the normal way, i.e., with its bias and load conditions adjusted for optimum differential phase distortion. It is directly coupled without difficulty to TR1 since the latter is a pnp transistor. The Zener diode ZD1 in the emitter circuit of TR2 sets the bias conditions. The capacitor C2 is used to offset certain non-linear effects produced by the Zener diode.

The transistor TR3 in the output stage is of the same type as TR2 since only one output at normal level is required. A second output at a level of −15 dB is derived from the main output by using R16 and R17 as a resistive splitter, chosen to give a 75-ohm output. The output stage is directly coupled to the previous stage, the d.c. conditions in the amplifier being so arranged that the output terminal is at earth potential.

Two feedback loops are used. One loop, from the emitter of the output stage TR3 to the emitter of the input stage TR1, includes the gain control RV2. The other loop is from the collector of TR3 to the base of TR1 and is only operative at d.c. and at very low frequencies, of the order of a few cycles per second. The object of this loop is to maintain the d.c. stability of the amplifier. The control RV1 in the loop is used to adjust the d.c. potential at the output of the amplifier.

Power Supply

The self-contained power-supply unit uses a bridge rectifier followed by a conventional stabiliser, similar to the one used in other amplifiers such as the AM4/511 and AM4/513. The output voltage between rails is about 24 volts with the earth tap so set that the supply rails are at +14 volts and −10 volts with respect to earth. The provision of two rails, above and below earth, allows the output of the amplifier to have a d.c. connection and still be at earth potential.

General Data

Voltage gain	15 dB ±0·2 dB.
Number of outputs	1 at standard level. 1 at −15 dB.
Nominal output level	1 volt peak-to-peak in 75 Ω.
Overload point	2·8 volts peak-to-peak sine wave from 10 kc/s to 5·5 Mc/s.
Amplitude/frequency response	±0·1 dB from 4 c/s to 6 Mc/s. 3-dB points 0·4 c/s and 18 Mc/s.

50-c/s square wave	< 1% sag on a 50-c/s symmetrical square wave.
Low-frequency bump	< 14% overshoot for a d.c. step signal fed to the input through any single *CR* circuit. Nil overshoot for a d.c. step signal on the input.
Pulse-and-bar response (625 lines)	No visible distortion on any single unit.
Input impedance	10 kΩ in parallel with 30 pF from 100 c/s to 3 Mc/s. 8 kΩ in parallel with 28 pF at 5·5 Mc/s. 5·6 kΩ at 10 c/s.
Output impedance return loss figure (with respect to 75 Ω)	> 60 dB at 10 kc/s. > 30 dB at 5·5 Mc/s.
Permitted d.c. at input	The d.c. voltage at the input must not exceed ±6 V.
Permitted a.c. at input	Peak-to-peak a.c. excursion at the input not to exceed 6 V.
D.C. at output	±0·01 V over range 10°—30° C. ±0·03 V over range 10°—40° C.
Hum on output	< 0·5 mV peak-to-peak.
Noise figure	< 8 dB w.r.t. 37·5 Ω source.
Mains bump	Negligible.
Non-linearity or picture signal distortion factor	< 0·5%.
Differential phase distortion	< 0·15° at 4·43 Mc/s.
Operating temperature	10°—40° C.
Change of gain with temperature	Negligible.
Power requirements	210—250 V r.m.s. 50 c/s.
Current consumption	About 30 mA at 240 volts.
Weight	2 lb.

Test Procedure

Apparatus Required

Wayne Kerr Video Oscillator Type 022B.
Tektronix Oscilloscope Type 515.
H.F. Double-pole Change-over Box.
General-purpose Panel Connector Block Type PN3A/2.
15-dB 75-ohm Attenuator.
75-ohm Unbalanced Wide-band Decibel Meter Type E3233.
Two 75-ohm Musa Terminations.
75-ohm F. & E. Termination.
Philips Low-frequency Amplifier Type GM4574.

Alignment

1. Arrange the apparatus so that the video oscillator feeds the 75-ohm F. & E. termination on the oscilloscope via the change-over box, which switches the signal either direct or via a 15-dB attenuator and the amplifier. The amplifier should be terminated at the input with 75 ohms and the low level output (−15 dB) should also be terminated in 75 ohms.
2. Adjust RV2 to the centre of its range. Switch on. Adjust RV1 to give zero d.c. at the output by switching the oscilloscope to a suitable d.c. range, and using the change-over box to give a reference zero with the oscillator switched to *Osc. E.M.F.*
3. Wait 10 minutes, then readjust RV1 to give zero d.c. at the output.
4. Replace the oscilloscope with the decibel meter terminated in 75 ohms and switch the video oscillator output to *Load Ohms.*
5. Using the change-over box technique, adjust the gain of the amplifier at 10 kc/s by means of RV2 to give a reading of 0 dB on the decibel meter for both switch positions.
6. In the same way, adjust the gain to give a reading of 0 dB in both switch positions at 5·5 Mc/s by adjustment of C4.
7. Check that the output obtained from the low-level output (−15 dB) is −15 dB in relation to the standard level, i.e., the same as the input to the amplifier.
8. Replace the decibel meter with the oscilloscope, increase the input voltage to give 2·8 volts peak-to-peak at the output of the amplifier at 10 kc/s and check that no limiting occurs.
9. With no input signal, but with the amplifier terminated in 75 ohms at input and output, feed the output of the amplifier to the oscilloscope via the Philips amplifier. Check that the

hum at the AM5/507 output is less than 0·5 mV peak-to-peak.

10. Finally reset RV1 if necessary to give zero d.c. output volts.

Power Supply Voltages

Point of Measurement	*Avo 8 Range*	*Maximum Voltage*	*Minimum Voltage*
†Across C10	100	33·5	30·5
C7 +ve side	25	15·5	13·5
C8 −ve side	25	−10·7	−9·3
TR1 emitter	2·5	−0·06	−0·04
TR1 collector	10	−3·7	−2·7
TR2 emitter	10	−4·4	−3·4
TR2 collector	2·5	1·2	0·6
TR3 emitter	2·5	0	0
TR3 collector	10	7·6	5·8
TR4 emitter	10	5·8	4·6

All voltages, except that marked†, are to be measured with respect to chassis. The measurement should be made with the equipment lined up and terminated, and with a mains input of 240 volts.

Use of Amplifier

Amplifiers in Cascade

The AM5/507 was designed as a replacement for existing amplifiers with 15 dB gain. Particular attention has been paid to noise performance so that two amplifiers can be used in cascade in such applications as the equalisation of long cables.

Input Conditions

As the input impedance is about 10 kilohms at low frequencies, the inputs of three amplifiers can be paralleled across a 75-ohm termination without causing a change in level greater than 0·1 dB.

The amplifier was designed for a source impedance of 37½ ohms and if it is driven from a signal source of a much higher impedance the amplitude/frequency response may be affected.

D.C. Applied to the Input

In no circumstances should the d.c. applied to the amplifier be allowed to exceed ±6 volts with respect to earth. If this figure is exceeded, damage may be caused to the input coupling capacitor or the first transistor.

Differential Phase

To improve the differential phase performance of some amplifiers an extra resistor (R25) has been added in the power-supply circuit and this is adjusted to make the positive supply 15 volts.

See over to Fig. 1

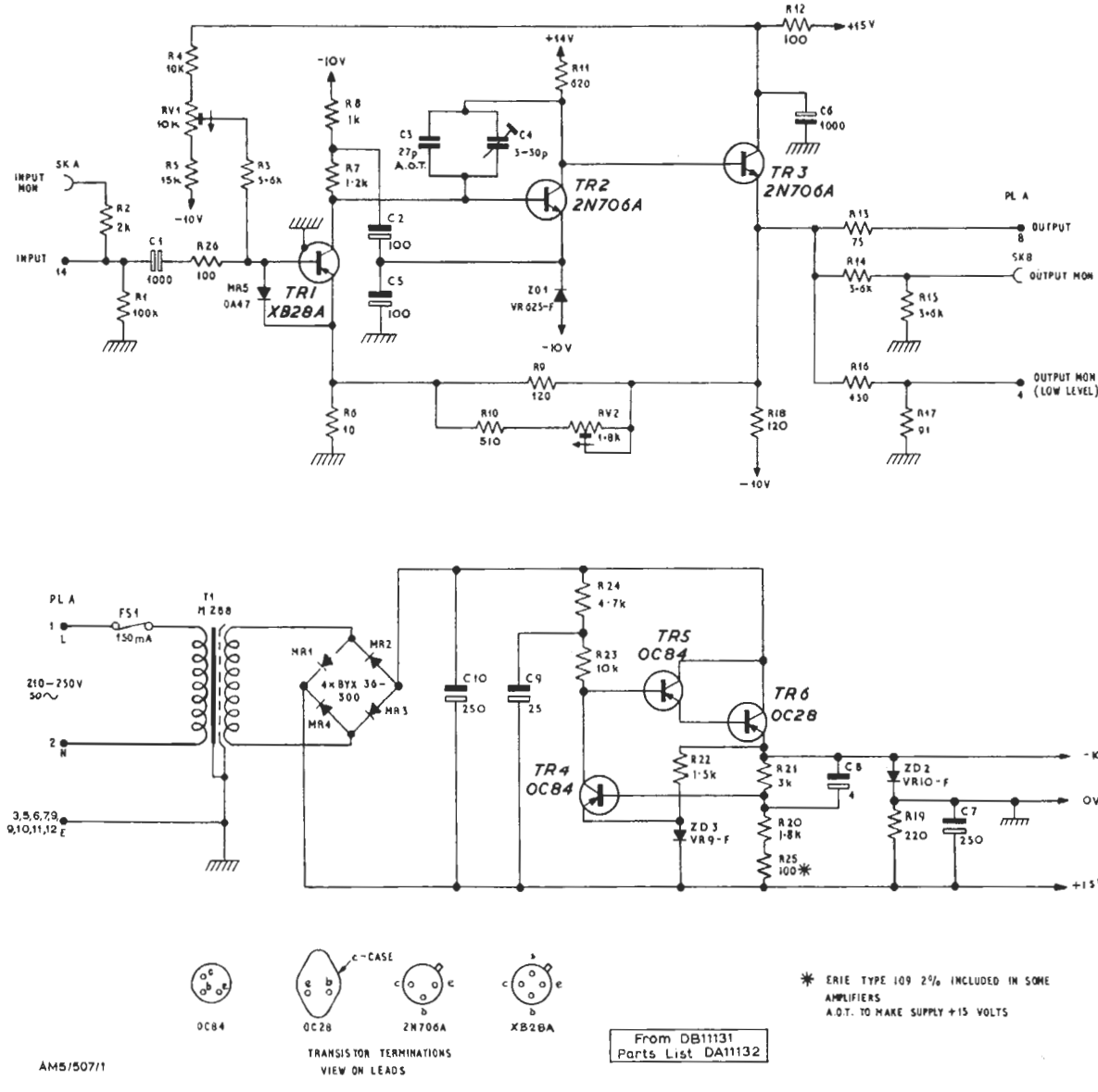

Fig. 1 Circuit of the AM5/507

FIG 7

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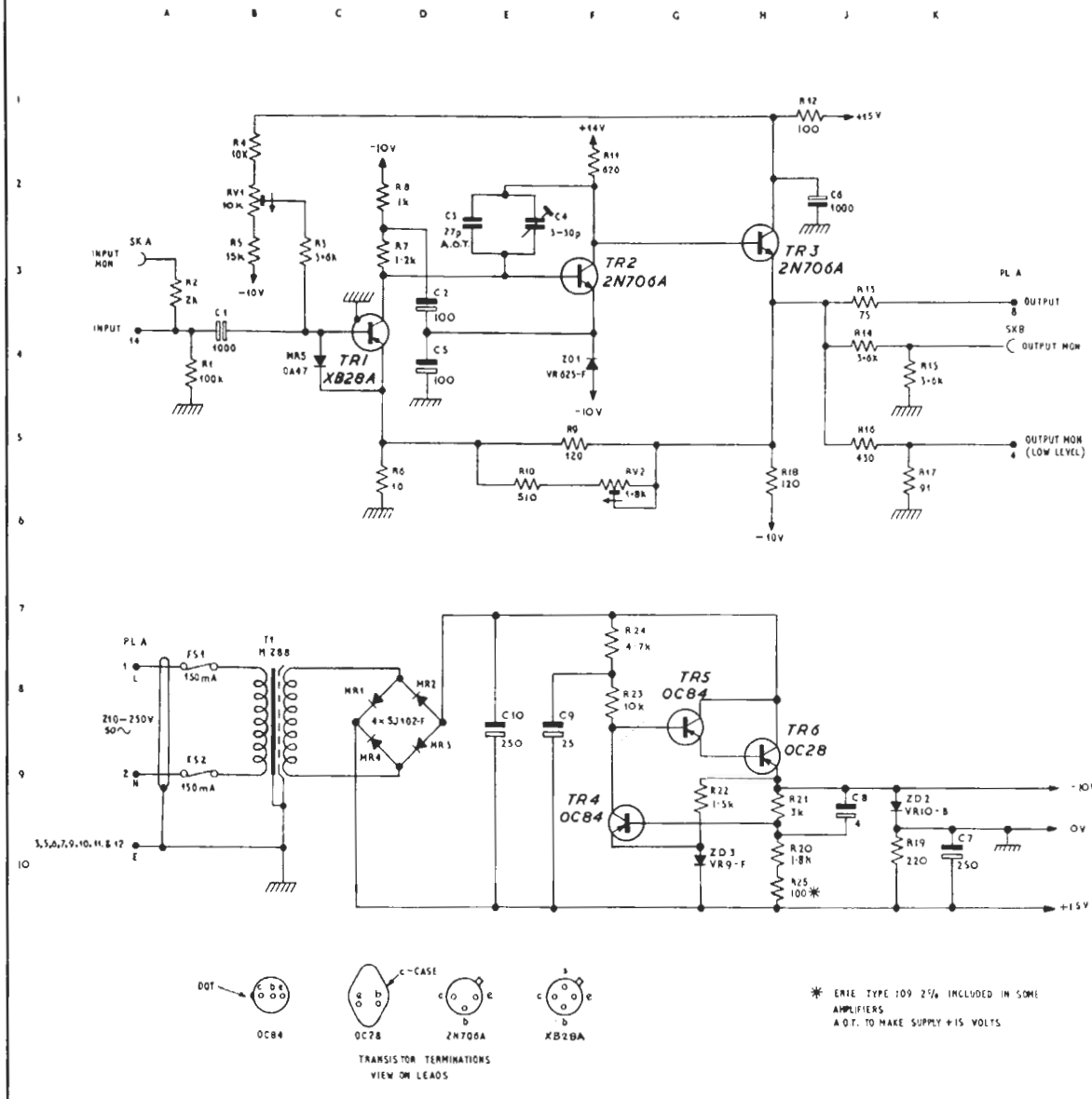

GENERAL PURPOSE AMPLIFIER AM5/507 : CIRCUIT