NONLINEARITY MEASUREMENT PROCESSING AMPLIFIER AM1/505

General Description

The AM1/505 is designed for use in conjunction with test signal generator GE4/505 and filter FL1/509A, or generator GE4/505A and filter FL1/509B. (Instruction V.3, Section 6.) The pulses produced by the generator and filter are amplified by the AM1/505 so that their amplitude can be accurately measured on an oscilloscope. To facilitate measurement, a variable-amplitude d.c. shift of the amplifier output waveform is provided.

The amplifier has a maximum gain of 30 dB, but a three-position switch provides gain settings of 30, 12 and 0 dB. The input impedance in all three gain positions is 75 ohms; the output circuit is designed to work into a high-impedance load.

The input signal applied to the amplifier contains not only wanted pulses due to differentiation by the FL1/505A of the leading edges of the steps of the GE4/505 staircase waveform, but also includes other, unwanted, spikes. The unwanted spikes result from the differentiation of the trailing edge of the staircase and the leading and trailing edges of the line-sync pulses. These spikes are of large amplitude and, if amplified, could cause overloading and synchronising difficulties to the oscilloscope. To avoid this the unwanted spikes are clipped in the amplifier.

The amplifier uses two 9-volt batteries, one providing power for the amplifier and the other providing the d.c. bias at the output. Because the bias current drain is low, the second battery is available as a spare.

The amplifier is constructed on a printed-wiring board and is mounted, together with its batteries, in an Eddystone box which measures $7\frac{3}{8}$ by $4\frac{3}{4}$ by $2\frac{1}{4}$ inches. The box can be mounted on the filter unit by means of the studs in its base which engage with corresponding spring clips on top of the filter.

Circuit Description (Fig. 21)

The circuit consists of voltage amplifiers TR1 and TR3 coupled by an emitter-follower TR2. The output from TR3 collector is taken to a second emitter-follower TR4 which provides a low output impedance. The three-position switch (SB) routes the input signal as follows:
(a) 30-dB position: the signal is taken directly to the first amplifier stage TR1. (b) 12-dB position: the signal is taken to TR1 via an 18-dB pad which consists of R21, R20 and R19. (c) 0-dB position: the signal is taken directly to the output socket.

In (a) and (b), termination of the input line is provided by a 75-ohm resistor R1. In (c) the termination is provided by a 75-ohm resistor R22.

The d.c. bias applied to the output of the amplifier is derived from the potential divider chain R17, RV1 and R18 connected between the −9 volt and +9 volt rails.

The low-frequency response of the amplifier is adjusted by suitable choice of R13; the high-frequency response is adjusted by choice of C3. The value of both of these components is determined during the initial alignment of the amplifier and should not be altered under normal circumstances.

Test Procedure

Apparatus Required

Wayne Kerr Video Oscillator Type O22 or equivalent
Decibel Meter
Tektronix Oscilloscope Type 515A or equivalent
Nonlinearity Test Signal Generator GE4/505 with Filter FL1/509A, or Generator GE4/505A with Filter FL1/509B.
Standard Variable Attenuator
Avometer Model 8
Change-over Box

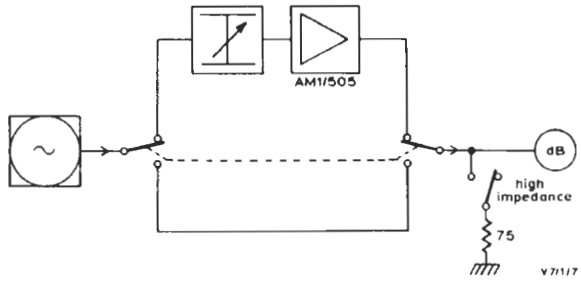

Fig. 1.6. AM1/505: Frequency Response Test Circuit

Alignment Check

1. Connect the amplifier and test equipment together as shown in Fig. 1.6.
2. Check the voltage and connection of the two

batteries in the amplifier, set the dB-gain switch to 30 and switch on.

3. With the change-over switch in the through position and the termination switch in the 75-ohm position, set the oscillator frequency to 10 kc/s and obtain a zero reference on the dB meter.
4. Switch the change-over box to the measure position and the termination switch to high impedance. Adjust the variable attenuator to a suitable value and measure the gain of the amplifier; this should be 30 dB ±0·5 dB. During an initial alignment, the value of R13 should be altered to bring the gain within these limits.
5. Set the dB gain switch to 12 and check that the gain falls within the limits 12 dB ±0·5 dB.
6. Set the dB gain switch to 0 and check that the gain is 0 dB.
7. Set the dB gain switch in the 30 position and measure the frequency/gain characteristic of the amplifier over the range 10 kc/s to 3 Mc/s. The increase in gain in the region of 1·5 Mc/s should not be greater than 0·7 dB and the loss at 3 Mc/s should not be greater than 7 dB. During an initial alignment the value of C3 should be altered to bring the response within these limits.
8. Set up the GE4/505 generator, the FL1/509A filter and the AM1/505 amplifier as shown in Fig. 1.7.

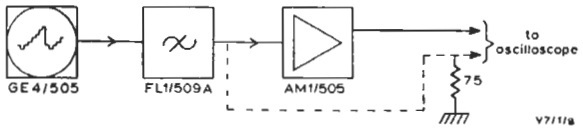

Fig. 1.7. AM1/505: Distortion Test Circuit

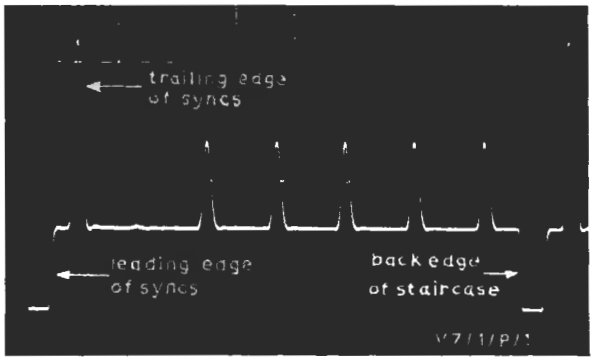

Fig. 1.8. AM1/505: Displayed Waveform: Amplifier Gain 30 dB

9. Set the GE4/505 to give a 5-step staircase waveform. Compare the resulting train of sine-squared pulses from the FL1/509A with those from the output of the AM1/505. There should be no visible distortion of the output waveform in any of the three switch-positions of the amplifier.
10. Ensure that the d.c. bias voltage at the output terminal of the amplifier can be varied between −3·5 volts and +1·5 volts.
11. Set the dB gain switch to 12 and ensure that there is no clipping of the equal positive and negative pulses produced by the differentiation of the leading and trailing edges of the sync pulses.
12. Set the dB gain switch to 30 and ensure that there is a difference in amplitude of at least two volts between the staircase step spike and the clipped spike produced by the trailing edge of the sync pulse. (See Fig. 1.8.)
13. Measure the current drain of the batteries. This should be:
    1. B1: 14·5 mA ±1 mA
    2. B2: 50 μA

P.D.M. 3/66

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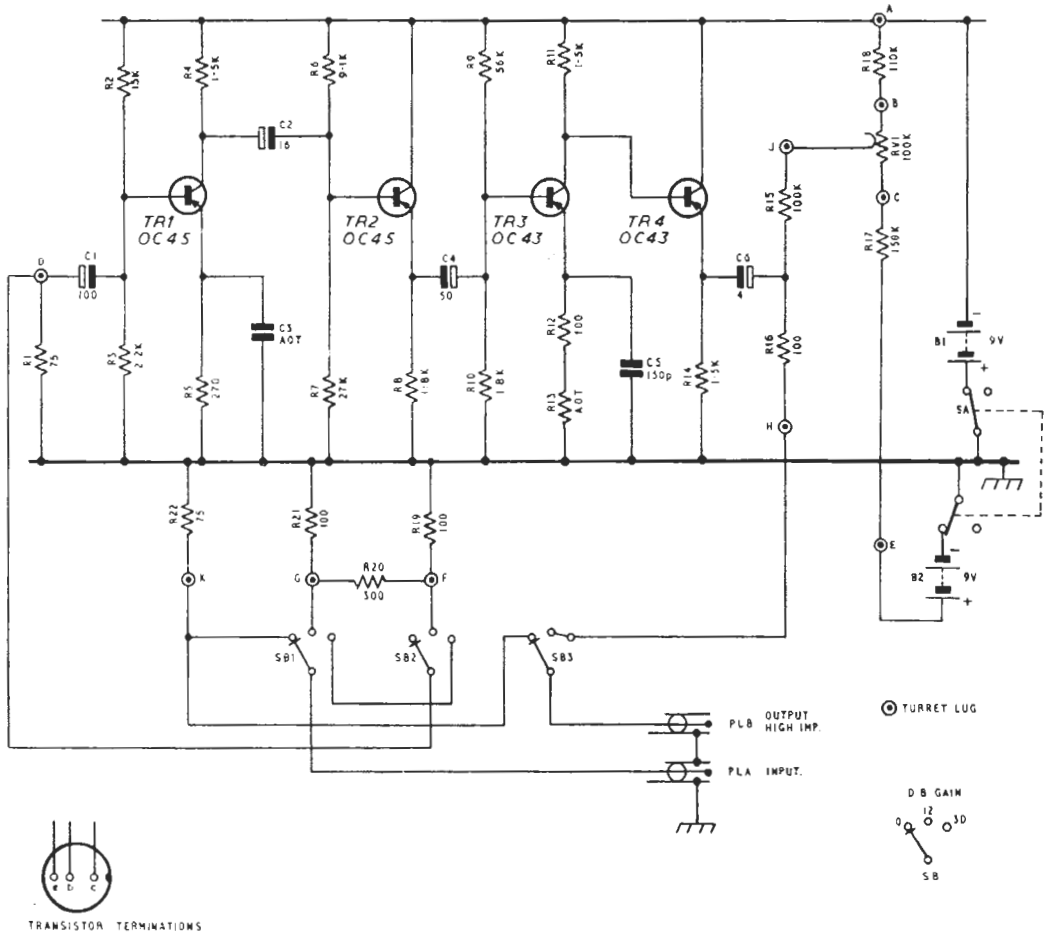

COMP	TYPE	TOLERANCE PER CENT	COMP	TYPE	TOLERANCE PER CENT
C1	U.C.C. SC541/8LS 6V		R10	Erie 109	2
C2	U.C.C. SM62S 12V		R11	Erie 109	2
C3	T.C.C. CSM20N		R12	Erie 109	2
C4	U.C.C. SC517/8LS 25V		R13	Erie 109	2
C5	T.C.C. CSM20N		R14	Erie 109	2
C6	U.C.C. SM56S 12V		R15	Erie 109	2
			R16	Erie 9	10
R1	Erie 109	2	R17	Erie 109	2
R2	Erie 109	2	R18	Erie 109	2
R3	Erie 109	2	R19	Erie 109	2
R4	Erie 109	2	R20	Erie 109	2
R5	Erie 109	2	R21	Erie 109	2
R6	Erie 109	2	R22	Erie 109	2
R7	Erie 109	2			
R8	Erie 109	2	RV1	Morganite LH/WN	
R9	Erie 109	2			

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