SOUND DEMODULATOR DM3/501

Introduction

The DM3/501 is a sound demodulator designed primarily for use in television rebroadcast and monitoring receivers.[1] It accepts a 6 MHz i.f. carrier, frequency modulated, and provides a balanced audio output. Vision and sound carrier sensing facilities are included. The unit is built on to a standard CH1/12A chassis with index pegs 10 and 39. Signal connection is via a BNC socket on the front panel.

General Specification

Input Impedance	75 ohms ±2%
Input Signal Frequency	6 MHz
Deviation of Input Frequency	±50 kHz
Input Signal Level	3 mV to 1 V
Output Impedance	
Line to line	600 ohms ±2%
Line to earth	300 ohms ±2%
Frequency Response 30 Hz to 15 kHz	±0·2 dB
Output Level for 50 kHz Deviation	
Balanced into 600 ohms	+8 to +14 dB w.r.t. 1 mW
Unbalanced, two outputs into 300 ohms	+2 dB to +8 dB w.r.t. 1 mW
Output Regulation for Specified Range of Input Levels	±0·2 dB
D.C. Level at Outputs Line to line or line to earth	not greater than 50 mV
Weighted Signal-to-noise Ratio	58 dB relative to 1 mW
Harmonic Distortion (measured with Harmonic Routine Tester HRT/1) relative to 50 kHz deviation at 100 Hz and 1 kHz and with output 14 dB above 1 mW	−50 dB
Power Supplies	+25 volts, 190 mA +12 volts, 40 mA −30 volts, 80 mA
Weight	1 lb.

Circuit Description

The circuit diagram is given in Fig.1 on page 3. The unit operates on the pulse-counting principle. One fixed-duration pulse is derived from each cycle of the input 6 MHz carrier signal with the spacing between the pulses dependent on the input frequency. The mean voltage level of the pulse train is directly proportional to the carrier deviation; therefore, by integrating the pulses the a.f. signal is obtained.

The input signal is amplified and limited by IC1 and then passed to the feedback amplifier TR1/TR2. The level at the collector of TR2 is about 9·5 volts p-p. The signal is clipped by D2 and TR3, D1 supplying a small amount of bias so that the action is symmetrical. The signal is differentiated by C17 and R17 and appears as a series of negative going pulses at the collector of TR4 which then trigger the monostable multivibrator TR5/TR6. Thus, at the collector of TR6, there appears a train of constant-duration positive-going pulses (approximately 80 ns) having variable spacing depending on the deviation of the input signal. TR7 and TR8 raise the pulse amplitude to about

13 volts p-p. TR9 and TR10 act as switches;TR9 conducts on each positive swing and partly charges the integrating capacitor C27 which is then partially discharged by TR10 during each interpulse period when TR9 is cut off. The time constant of the integrating circuit, R29/C27, provides the correct de-emphasis. The a.f. signal across C27 is amplified by the a.f. preamplifier TR15/TR16. This has a gain of about 17 dB and a very high input impedance because of the bootstrap configuration of the circuit.

The output amplifier consists of a long-tailed pair with a gain of about 17 dB and giving balanced outputs via two emitter followers TR18 and TR22. R57 is the d.c. balance control and R54 adjusts the d.c. at the output emitters to be approximately zero. R61 is the overall gain control and has a range of about 9 dB.

Sound carrier sensing facilities are provided by relay RLA. This is operated by the d.c. amplifier formed by TR11 to TR14 which measures the current drawn by the limiting amplifier IC1. R33 adjusts the operating point of the relay and the diodes D11 to D21 provide temperature compensation for changes in IC1.

Vision carrier sensing is done by relay RLB in conjunction with the d.c. amplifier TR23 and TR24. The circuit is driven by a.g.c. voltages supplied from an associated unit[2,3]. R66 adjusts the operating point of the relay.

Maintenance

Routine maintenance is not required but the following tests may be carried out if the performance becomes suspect.

1. The current in the three supply leads should be as shown in Table 1.
   If there is no output from the unit and the current in the +12 volt supply line is only about 30 mA, it is likely that the circuit has failed before the final stage of the pulse amplifier TR9/TR10. The waveforms and the signal amplitudes to be expected in this part of the circuit are indicated in Fig. 1.
2. With a 6-MHz input signal, amplitude 3 mV r.m.s., the signal amplitude at the junction of R10 with R13 should be 9·5 ±0·5 V p-p. This is set by R10.
3. The potential between pins 5 and 6 and between these pins and earth should be less than 50 mV.

TABLE 1

Supply Voltage	*Current in milliamperes*		
	Normal Operation	*Sound Off*	*Vision Off*
+25	190	150	170
+12	40	40	40
30	74	73	73

   This is adjusted by R57 and R54.
4. Sound Carrier Alarm.
   Feed a 6-MHz signal having an amplitude of 3 mV r.m.s. to the input of the unit. The potential at the junction of R3/C3 should be 7 ±0·5 V. RLA should be operated and the green lamp alight.
   Reduce the signal input by 10 dB, the relay should operate (and the lamp should light) within a signal-level range of 6 dB about this point. R33 provides an adjustment for this. For final adjustment see reference 1.
5. Vision Carrier Alarm.
   The direct potential at the base of TR23 with respect to chassis should be 3 volts with a direct potential of 10·5 volts on pin 8 of the connector. This is adjusted by R66. If the potential of pin 8 is increased from zero, the relay should operate and the amber lamp should light within the range 10·3 volts to 10·7 volts. For final adjustment see reference 1.
6. Frequency Response.
   With respect to 1 kHz, the fall at 30 Hz and 15 kHz should not be more than 0·4 dB. It should not be more than 0·2 dB from 300 Hz to 10 kHz. The overall specification figure of ±0·2 dB from 30 Hz to 15 kHz must be maintained. If the specification is not met, a possible cause is a change in the value of C27.
7. With an input signal level of 3 mV r.m.s. and a deviation of ±20 kHz, zero level should be obtained into a 600 ohm output load. R61 provides adjustment.

References

1. Television Rebroadcast Receiver RC5M/501
2. Vision A.G.C. Unit UN1/564
3. Power Supplier PS2/45
4. Designs Department Specification No. 6.126(67).

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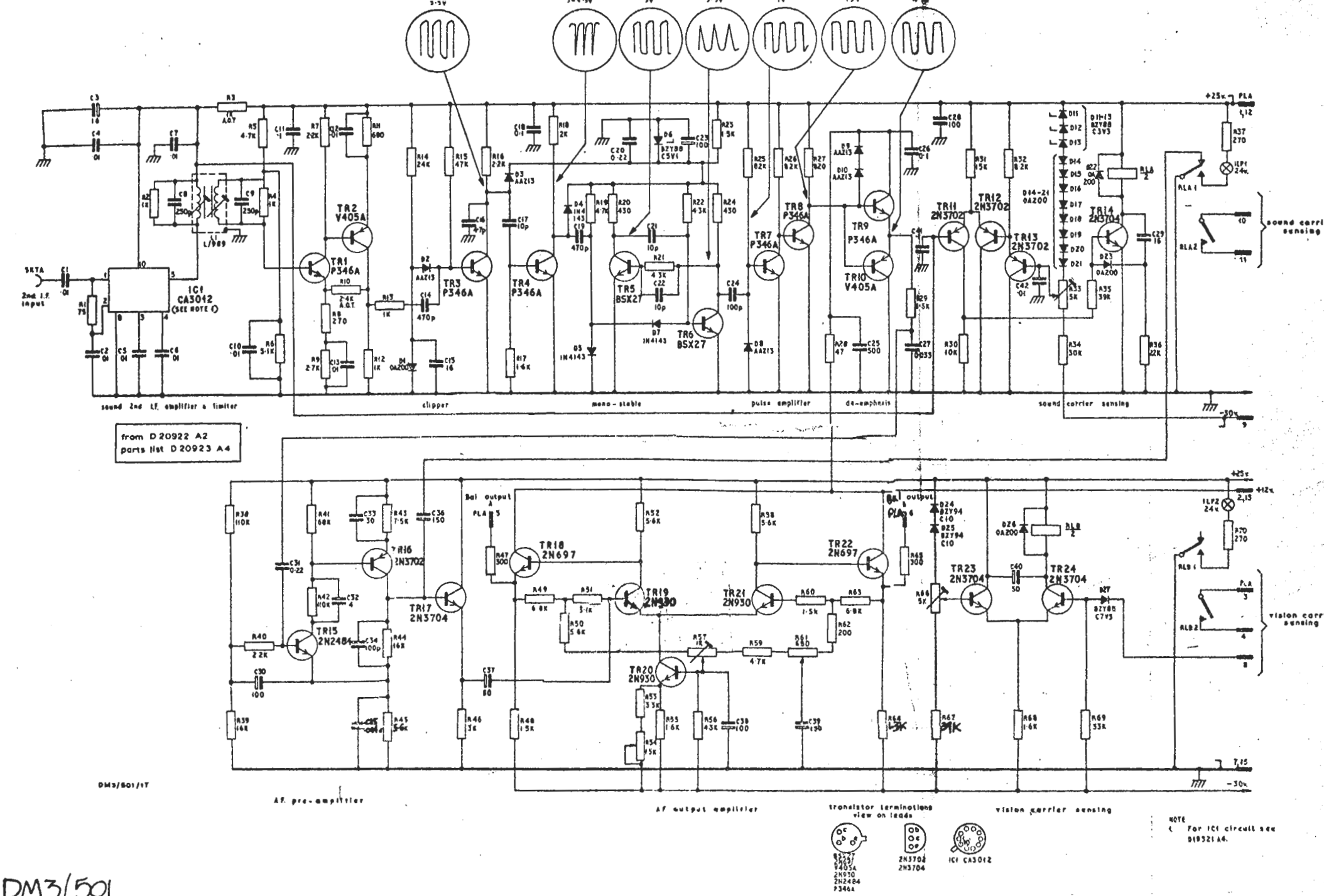

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Circuit.

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Fig.1.