VARIABLE-FREQUENCY OSCILLATOR OS3/5

General Description

The OS3/5 comprises a three-stage 15-90 Hz variable-frequency Wien-bridge type oscillator with an output stage containing a frequency-selective network suitable for driving a low-power shaded-pole induction motor via a power amplifier. It has a gain control and requires a power supply of 40 mA at −35 volts.

The oscillator OS3/5 was designed to work into an amplifier AM1/37. Both are subunits of power supplier PS1/27, which provides disk reproducer RP2/6 with a variable-frequency drive supply.

The components of the OS3/5 are mounted on a printed wiring board of standard ISEP size (7 by 4·4 in) and fitted with a 25-way plug (coding pins 3, 11, 19) for use in a standard ISEP nest. A two-gang variable resistor for changing the frequency of oscillation is mounted remotely, e.g., on the PS1/27.

References

Power Amplifier AM1/37.
Variable-frequency Power Supplier PS1/27.
Disk Reproducer RP2/6*.

Circuit Description (Fig. 1)

TR1 to TR3 form the Wien-bridge oscillator. C1 and C2 and R1 to R4 provide the positive-feedback chain; R1 and R2 are ganged and give the required frequency range. The highest frequency occurs when R1 and R2 equal 0, and its value is determined by the product R3.C1, which equals R4.C2. The lowest frequency occurs when R1 and R2 are each 10 kilohms, and its value is determined by the product (R1 + R3)C1, which equals (R2 + R4)C2.

R10 and lamp LP1 provide the correct amount of negative feedback to maintain oscillation with minimum harmonic content. The lamp being a positive temperature coefficient device is connected in the 'shunt' arm of the negative-feedback network and provides the variable limitation required in the design of an oscillator. The 'series' arm resistor R10 is made A.O.T. because of the manufacturing tolerances of the lamp. Additional negative feedback is provided by R8 and high-frequency limitation by C5 and C6.

The output of the oscillator is fed to the hold-off resistor R12 in series with the preset gain control R13. Across R13 are connected two Zener diodes back-to-back acting as a limiter to prevent excessive transient voltages being fed to the power amplifier. These voltages may occur when the frequency is being changed, due to tracking faults on the two-gang variable resistor. The preset gain control feeds an emitter-follower TR4 which is connected to the output via the frequency-selective network R17, R18, C11 and R19. This network provides a 6·5-dB loss at 15 Hz compared with 90 Hz (an almost linear law) so as to give a roughly constant-current supply to the motor from the power amplifier.

When the OS3/5 is used as part of a PS1/27 the −35 volt supply to the oscillator is obtained from the power amplifier AM1/37 which also forms part of the PS1/27.

Maintenance

D.C. Tests

The following typical voltage and current measurements, which apply at any frequency of the oscillator, were made using an Avometer Model 9 Mark 2 on the 0-100 volt, 0-30 volt and 0-100 mA ranges.

Supply Voltage	−35
Regulated Voltage	−24·9
Total Current	37 mA
TR1 Emitter Voltage	−2·6
TR2 Emitter Voltage	−6·8
TR3 Emitter Voltage	−16·5
TR4 Emitter Voltage	−11·5

A.C. Tests

1. Value of R10

First check that the value of R10 is 300 ohms ±2 per cent.

2. Output Waveform and Voltage

1. Examine the waveform over the frequency range and at the same time measure the voltage with an a.c. voltmeter at the junction of R12 and R13. (R13 is the preset control and it should be set at maximum.) The waveform should be a sinewave and without any kinks and the a.c. voltmeter should give a minimum reading of 1 volt.
2. If necessary, try to remove any kinks in the waveform by reducing the value of R10, which will also reduce the voltmeter reading.
3. If it is not possible to get a kink-free waveform and a 1-volt minimum voltmeter reading simultaneously, change lamp LP1.

* Designs Department Technical Memorandum No. 1.51(70).

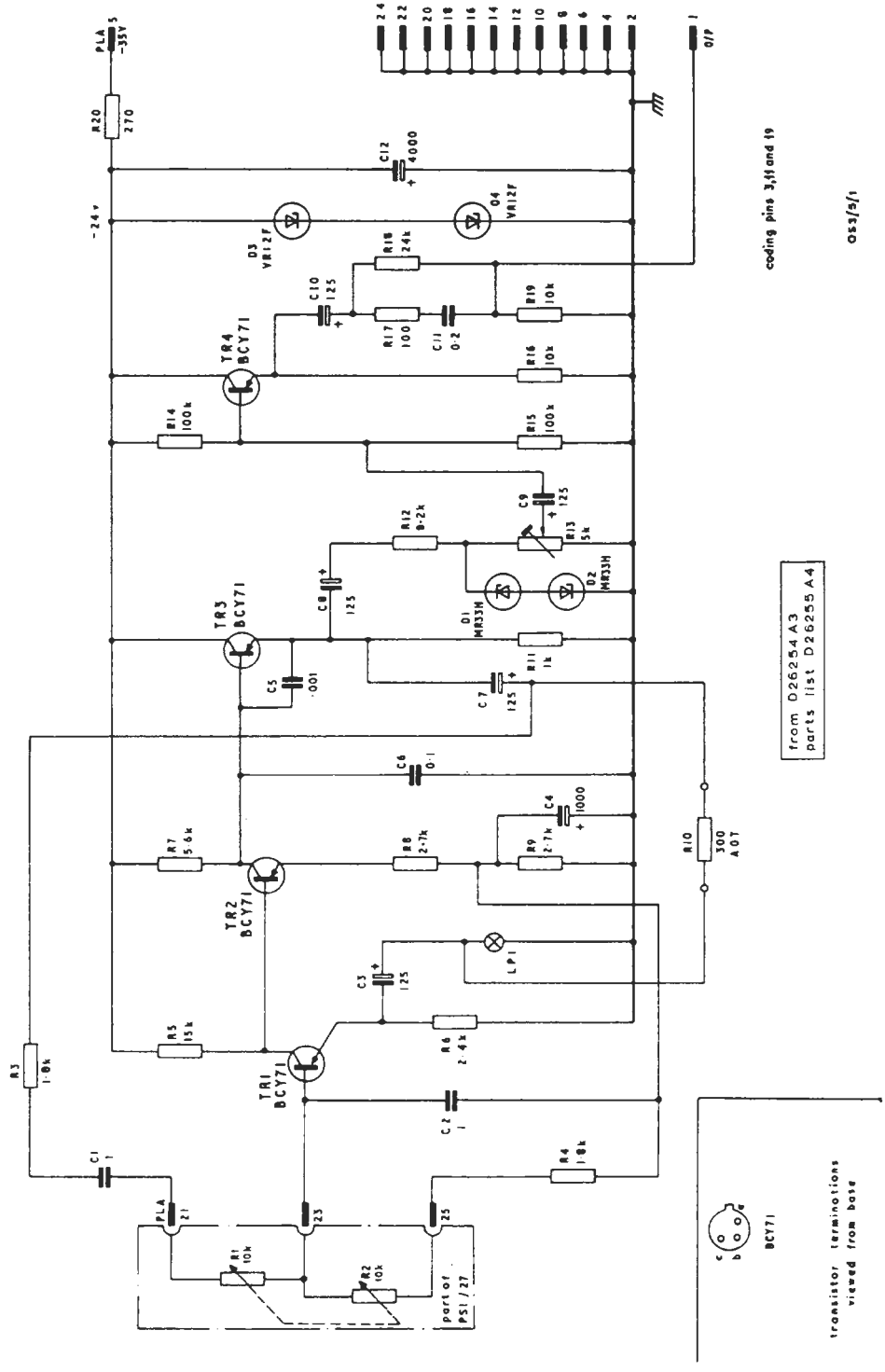

Fig. 1. Circuit of the OS3/5

3. Frequency Range

Check that the frequency range is within the following limits:

Low-frequency End	10-17 Hz
High-frequency End	85-92 Hz

These tolerance figures are entirely dependent upon the components C1 and C2 (1 μF $\pm$2 per cent), R1 and R2 (10 kilohms $\pm$20 per cent) and R3 and R4 (1·8 ohms $\pm$2 per cent).

4. Frequency Response

The frequency response, measured with an a.c. voltmeter of input impedance greater than 1 megohm, is given in Table 1. The load on the output must be not less than 100 kilohms and the preset gain control must be set at maximum.

The tolerance on the measurements at the junction of R12 and R13 is that the 15-Hz output should not exceed that at 90 Hz by more than 1 dB. The maximum tolerance at the output, PLA 1, should be $\pm$0·5 dB taking into account the response at the junction of R12 and R13.

TABLE 1

Freq. Hz	*Measuring Point*			
	Junction R12/R13		*Output (PLA 1)*	
	Volts	*Rel. dB*	*Volts*	*Rel. dB*
90	1·03	0	0·675	0
80	1·03	0	0·63	−0·6
70	1·03	0	0·58	−1·3
60	1·03	0	0·54	−1·9
50	1·03	0	0·48	−3
40	1·03	0	0·43	−3·9
30	1·04	+0·1	0·38	−5
20	1·065	+0·3	0·34	−6
15	1·08	+0·5	0·32	−6·5

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