OSCILLATOR CORRECTION UNIT UN17/509

Introduction

The UN17/509 is fed with picture-frequency error-signal pulses or with trains of pulses on either of two inputs. The pulses are used to drive a stepping motor which is coupled to a 10-turn helical variable resistor. This variable resistor is used as part of the tuning circuit of an oscillator[1] in the Natlock system[2].

The Unit front panel carries a meter which monitors the voltage on the slider of the tuning resistor.

The UN17/509 is constructed on a CH1/12B chassis with index peg positions 13 and 19.

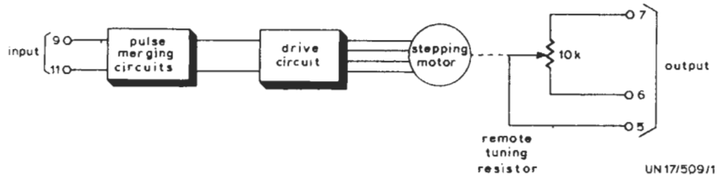

Fig. 1 Block Diagram of the UN17/509

General Description

A block diagram of the UN17/509 is shown in Fig. 1. The input signal consists of a train of error pulses at picture repetition rate to either of two input terminals but not to both simultaneously. In the slavelock mode, *Advance* error signals are fed via pin 9 and *Retard* error signals are fed via pin 11. In the genlock mode the error-signal inputs are reversed.

The error signals occur as a continuous train of pulses during the initial synchronising process and as isolated pulses thereafter. The trains of pulses are merged into single pulses so that the UN17/509 does not mistune the OS2/505 during the initial synchronising process. The merged pulses are fed to the drive circuit of a stepping motor[3]. This circuit has four possible states and is switched between them by the merged pulses. The order in which these circuit states occur depends on the sequence of the input signals. This order controls the direction of rotation of the stepping motor which in turn controls the setting of the 10-turn helical tuning resistor.

Circuit Description

The circuit of the UN17/509 is given in Fig. 2.

Pulse Merging Circuits

The capacitors in the collector loads of transistors TR1 and TR2 extend the duration of each input pulse so that a continuous train of input pulses is merged into one long pulse. A merged pulse starts only after a break in a sequence of input pulses. Because the input pulses, if they occur, are at picture repetition rate the highest repetition rate for the merged pulses is 12·5 Hz.

Drive Circuit

The merged pulses are fed to a pulse sequential circuit comprising two bistable circuits and feedback gating. The states of the bistable circuits, indicated in Table 1, are switched by the pulses in a cyclic manner. The direction in the switching cycle depends on which of the two error signals is being applied. This is shown in Table 2.

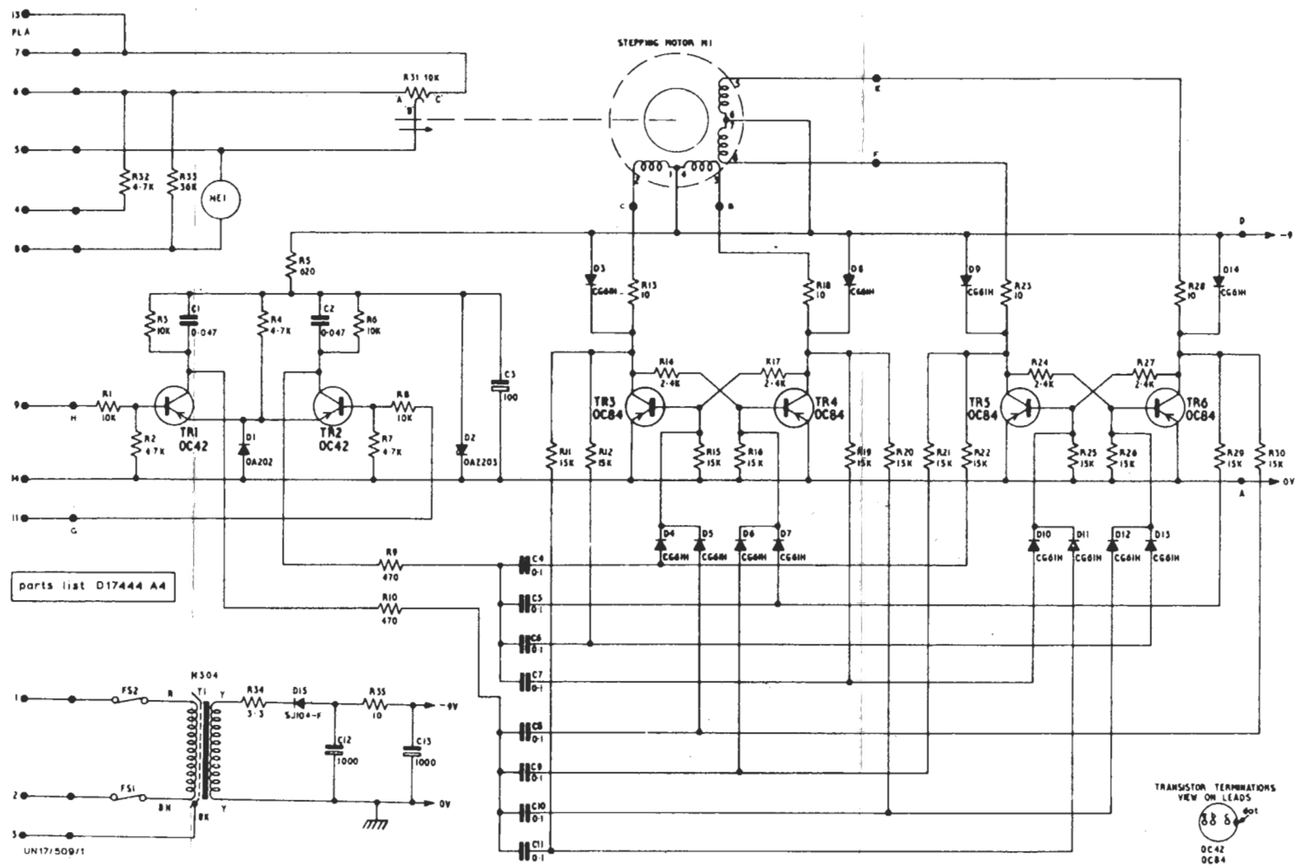

Fig. 2 Circuit of the UN17/509

TABLE 1

State	*TR3*	*TR4*	*TR5*	*TR6*
1	on	off	on	off
2	off	on	on	off
3	off	on	off	on
4	on	off	off	on

TABLE 2

Initial State	*State caused by error signal on:*	
	pin 9	*pin 11*
1	4	2
2	1	3
3	2	4
4	3	1

Stepping Motor

The stepping motor consists of two stators and a permanent-magnet rotor which has 12 pairs of poles. Each stator consists of two coils wired as a single centre-tapped coil. Rotation in steps is effected by reversing the direct current in each stator in turn. In Fig. 3, which illustrates the principle of the stepping motor, only three pairs of poles are shown. The behaviour of the simplified stepping motor is indicated in Table 3. The motor is

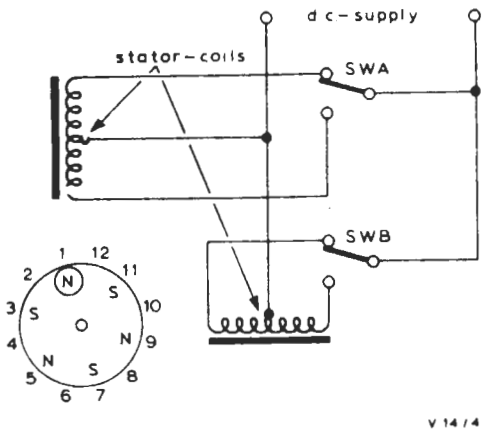

Fig. 3 Illustrating the Principle of the Stepping Motor

reversed by operating one of the switches twice in succession.

Fig. 4 shows an exploded view of the motor used in the UN17/509. This motor should not be dismantled.

TABLE 3

*Order in which the switches are reversed**	*Position of the reference pole*	*Sense of rotation*
	1	
A		
	2	
B		
	3	
A		anti-clockwise
	4	
B		
	5	
and so on		
	and so on	
	1	
B		
	12	
A		
	11	
B		clockwise
	10	
A		
	9	
and so on		
	and so on	

* starting from the position shown.

Test Schedule

Apparatus Required

Avometer Model 8.
Tektronix oscilloscope Type 515.
Square-wave oscillator with a 12·5-Hz output at 0 to 6 volts p-p.
Resistor of correct value to terminate the oscillator output.
1000 μF capacitor.
OA81 diode or equivalent.
Changeover switch.
6-volt supply.
15-way Painton socket.

Test Procedure

1. Check that the alignment between the motor and the variable resistor is correct and that they are free to rotate over 10 turns. Check the mechanical zero of the meter on the unit and adjust if necessary.

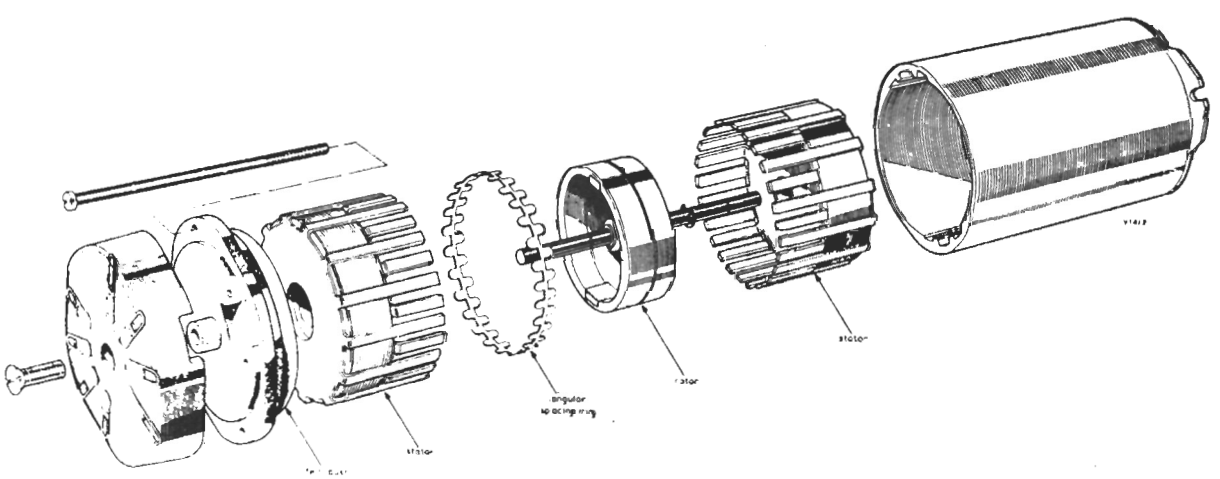

Fig. 4 Exploded View of the Stepping Motor

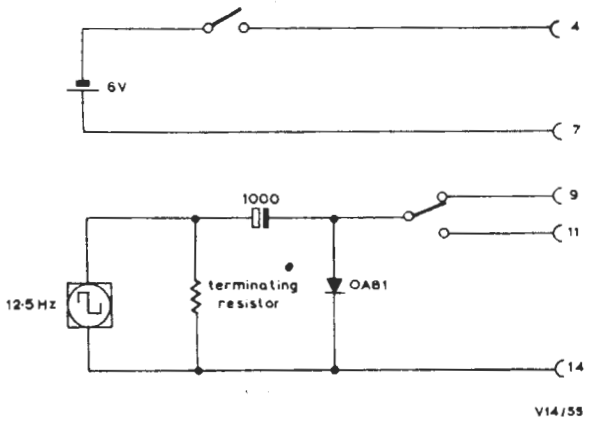

Fig. 5 Test Unit for the UN17/509

2. Switch on and measure the voltage across capacitor C13 with the Avometer. It should be 9·0 ±0·2 volts.
3. Feed the output of the oscillator to the UN17/509 using the test unit shown in Fig. 5. Connect the oscilloscope to the collector of transistor TR1 and switch the input pulses to pin 9. Adjust the output level of the oscillator so that the amplitude of the observed waveform is 4·2 ±0·2 volts p-p. Check that the motor rotates clockwise, as seen from the front of the unit.
4. Switch the input to pin 11 and observe the waveform at the collector of transistor TR2. Check that the motor rotates anti-clockwise.

References

1. Oscillators OS2/505,A, OS2/514.
2. *Picture Source Synchronising;* Instruction P.1.
3. Edwards, M. J.; *Drive Circuits for Stepping Motors:* Mullard Technical Communications, Vol. 8, No. 72.

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