AIR PUBLICATION

113F-0629-13A6

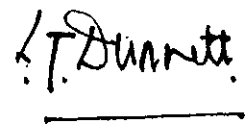
ELECTRONIC FIRE BELL, S.T.C., TYPE 107-LRU/61B

GENERAL AND TECHNICAL INFORMATION

ILLUSTRATED PARTS CATALOGUE

REPAIR AND RECONDITIONING INSTRUCTIONS

BY COMMAND OF THE DEFENCE COUNCIL



Ministry of Defence

FOR USE IN THE

ROYAL NAVY

ROYAL AIR FORCE

(Prepared by the Ministry of Technology)

AMENDMENT RECORD SHEET

To record the incorporation of an Amendment List in this publication, sign against the appropriate A.L. No. and insert the date of incorporation.

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GENERAL AND TECHNICAL INFORMATION

REPAIR AND RECONDITIONING INSTRUCTIONS (-16)

ILLUSTRATED PARTS CATALOGUE (-3A)

ELECTRONIC FIRE BELL, S.T.C., TYPE 107-LRU/61B
(AUDIO WARNING UNIT, PART No. A1205)

ILLUSTRATED PARTS CATALOGUE

MEMORANDUM OF INSTRUCTIONS (R.N.)

(1) **CONTENTS**

This schedule contains a list of spare parts applicable to the equipment.

(2) **COLUMN 1**

The Item Number in Col. 1 is for sponsor departmental use.

(3) **DEMANDS**

Items marked N.P. in Col. 6 are not provisioned as spares, but are included to assist identification of components. Requirements for these items can usually be met by demanding:—

(i) Next highest assembly.
(ii) The individual components of the item required.

If requirements for N.P. items cannot be met by (i) or (ii), demands are to be submitted after approval by the Engineer Officer, on Form S130, to M.O.D.(N) for approval.

On demands the full Reference Number shown in Col. 2 is to be used, prefixed by the appropriate Management Code where indicated in the Interservice Index.

(b) Parts not qualified by the numeral 2 in Col. 7 are available 4th line only.

(c) Parts qualified by the symbol LM in Col. 7 are to be manufactured by consumer units.

(4) **MODIFICATIONS**

This publication will be amended at convenient intervals. Users should use this book in conjunction with appropriate modification leaflet.

(5) **COMPILATION OF TEXT (Col. 4)**

The multi-indentation system has been used. The indentation is in accordance with the following outline:—

(a) Indent 1. Main Units.
(b) Indent 2. { Sub-Assemblies / Detail parts main units.
(c) Indent 3. Breakdown of Sub-Assembly.
(d) Indent 4, 5, 6, 7, 8. Further breakdown.
(e) Attaching parts are listed after the indents and refer to the item directly above.

(6) **CLASS OF EQUIPMENT**

Letters denoting Class of Stores are defined as follows:—

'C' Consumable items.
'CM' Consumable with a limited repair capability.
'PA' Permanent attractive.
'PN' Permanent. Repairable at 2nd line only.
'PR' Permanent. Repairable at 2nd line/or 4th line.

(7) The Item Number and Reference Number are repeated on the Interservice Index sheet. This sheet also incorporates Management Code, Usage Code and Interchangeability Code (I.C.Y.).

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(7250) 714049 500 11/69 483/1

MAIN EQUIPMENT AUDIO WARNING UNITS PT. NO. A1205 REF. NO. 5CZ/5651 and 5CZ/6479

(1) Item No.	(2) Ref. No.	(3) Part No.	(4) Description	(5) No. Off	(6) Remarks	(7) C of E	(8) Plate/ Cct Ref.
1	5CZ/5651	A1205	AUDIO WARNING UNIT	1	A	P	
2	5CZ/6479		AUDIO WARNING UNIT	1	B	P	
			Spares for :-				
3	0621-5960-99-000-0448		. VALVE ELECTRONIC	6		2C	MR1,2 3,4,5, 6.
4	0621-5960-99-037-2006	Mullard OC72	. VALVE ELECTRONIC	6		2C	X1,2, 3,4,5, 6.
5	0632-5905-99-022-1214		. RESISTOR 680 ohms ± 10% 1/4w	2		2C	R16, 17
6	0632-5905-99-022-2004		. RESISTOR 1K ohms ± 10% 1/4w	1		2C	R8
7	0632-5905-99-022-2025		. RESISTOR 1.5K ohms ± 10% 1/4w	5		2C	R2,3, 7,13, 14.
8	0632-5905-99-022-2088		. RESISTOR 4.7K ohms ± 10% 1/4w	1		2C	R18
9	0632-5905-99-022-2130		. RESISTOR 10K ohms ± 10% 1/4w	2		2C	R4,12
10	0632-5905-99-022-2151		. RESISTOR 15K ohms ± 10% 1/4w	2		2C	R5,15
11	0632-5905-99-022-2172		. RESISTOR 22K ohms ± 10% 1/4w	2		2C	R1,6
12	0632-5905-99-022-2184		. RESISTOR 27K ohms ± 10% 1/4w	2		2C	R10, 11.
13	0632-5905-99-022-3016		. RESISTOR 68K ohms ± 10% 1/4w	1		2C	R9
14	0632-5905-99-932-1637	Plessey MH2	. RESISTOR VARIABLE 1K ohms ± 20% 1/4w	1		2C	RV2
15	0632-5905-99-900-4572	Morganite BJ	. RESISTOR VARIABLE 20K ohms ± 20% 1/4w	1		2C	RV1
16	0632-5905-99-011-9467	DEF 5122 RVC 15A	. RESISTOR VARIABLE 50K ohms ± 20% 1/4w	1		2C	RV3
17	0631-5960-99-011-5560	DEF 5136 CPM 2-G	. CAPACITOR 0.1mfd ± 25% 150v dc	2		2C	C1,2
18	0631-5960-99-011-9827	RLC 136A CPM4-G	. CAPACITOR 0.1mfd ± 25%	2	A only	2C	C1,2

MAIN EQUIPMENT AUDIO WARNING UNITS PT. NO. A1205 REF. NO. 5CZ/5651, and 5CZ/6479

(1) Item No.	(2) Ref. No.	(3) Part No.	(4) Description	(5) No. Off	(6) Remarks	(7) C of E	(8) Plate/ Cct Ref.
19	0631-5910-99-012-0114	RCL 136A CPM5-C	. CAPACITOR 0.02mfd ± 20% 250v d.c.	1		C	C3
20	0631-5910-99-014-5289	RCL 134B CET 11E	. CAPACITOR 20 mfd ± 20% 25v dc	2		2C	C5,6
21	0631-5910-99-014-5291	RCL 134B CET 11A	. CAPACITOR 0.75mfd ± 20% 50v d.c.	1		2C	C4
22	0631-5910-99-014-5332	RCL 134B CET 11D	. CAPACITOR 2mfd ± 20% 150v dc	1		2C	C7
23	0569-5355-99-012-0237		. NUT SPINDLE LOCKING	3		2C	

LIST OF CHAPTERS

Chapter 1

ELECTRONIC FIRE BELL, S.T.C., TYPE 107—LRU/61B

CONTENTS

ILLUSTRATION

LEADING PARTICULARS

Electronic fire bell, S.T.C., Type 107-LRU/61B	**Ref. No. 5CZ/6479**
Operating voltage	20 *to* 30*V d.c.*
Power output	8 *milliwatt approx. into a* 50 *ohm load*
Temperature range	—30 *to* +55 *deg. C*
Fixing centres	1·85 × 5·5 *in.*
Overall dimensions	6 × 2·587 × 2·157 *in.*
Weight	1 *lb.*

Introduction

1. The Electronic Fire Bell 107–LRU/61A or B, the letter A or B merely denoting the type of components employed in the circuit, is a component of the centralized warning system which provides aural and visual warning of fire, serious defects in vital services, or other emergencies necessitating immediate action by the aircrew.

2. The aural warning is provided by the audio warning unit which generates a sound, similar to the clanging of a fire bell, when the unit is switched on by a connection from the centralized warning circuit. This sound is fed into the pilot's headphones through a high speed relay which breaks the normal telephone circuit and substitutes the fire bell.

DESCRIPTION

3. The unit consists of a circuit arrangement of six transistors. Four of these transistors are connected such as to form two multivibrator type oscillator circuits, one to represent the ringing pitch of the bell (transistors X1 and X2) the other to produce the "clapper" action (transistors X5 and X6). The remaining transistors, X3 and X4, are used in the output circuit, X3 being the output transistor, while X4 under the action of the clapper multivibrator circuit modulates the output to produce the characteristic sound of a bell in the pilot's headphones.

4. The first multivibrator operates in the region of 1 Kc/s and is fed into the output transistor, in the collector of which there is a transformer tuned to approximately 3 K c/s. This suitably accentuates the harmonic content of the waveform and, in conjunction with the damping and resonance characteristics of the pilot's headphones, produces a sound which corresponds to the ringing of a bell. The frequency of this multivibrator is adjustable by a potentiometer which is called the PITCH control.

5. The "striking" component of the required bell sound is provided by the second multivibrator which operates at about 6 c/s. This oscillator is arranged to modulate the pitch oscillator output in a sawtooth fashion designed to represent the sharp strike of a mechanical clapper followed by the slow die away, or decay before the next strike. The amount of decay between each strike is adjustable by a control referred to as the STRIKING control; this control is provided partly to take up tolerances and partly to give an adjustment of quality to suit individual requirements.

6. A third control, known as the VOLUME control limits and adjusts the maximum audio output of the unit. All the controls are accessible after removal of the cover.

OPERATION

General

7. With the circuit arrangement shown in fig. 1, a small current flow in the emitter-base circuit of each transistor causes an amplified current to flow in the emitter-collector circuit. When no current flows in the emitter-base circuit, the emitter-collector circuit does not conduct.

Pitch multivibrator circuit

8. When 20–30 V d.c. is applied to the unit via terminals A and B, the current flow in the emitter-base circuit is approximately 1 mA. Since the current gain is 50 to 100, the current in the emitter-collector circuits tries to rise to 50 to 100 mA. Obviously this cannot happen since the voltage which would exist across the collector resistors, if this current was flowing, would exceed the input voltage. What actually happens is that transistor X1 bottoms, i.e. the collector voltage rises to equal that of the emitter and settles at that value. Transistor X2 is prevented from bottoming by the action of the "starting" circuit.

9. The condition of the pitch of the multivibrator circuit shortly after voltage is applied is therefore, that transistor X1 is conducting maximum current and bottomed, whilst X2 is conducting less current and prevented from bottoming by the low potential existing at the upper end of resistor R18. Resistor R18 and capacitor C7 form the starting circuit, the charging circuit current for C7 causing an initial large voltage drop across R18 which holds the collector of X2 negative.

10. Since transistor X1 is bottomed, a positive potential is applied to capacitor C2 which initially carries the base of X2 positive. With its base at a positive potential, no current flows in the emitter-base circuit of X2 and therefore, no current flows in the emitter-collector circuit; in this condition the transistor is said to be cut-off. As C2 charges, the base of X2 becomes increasingly negative until finally the emitter-collector circuit again starts to conduct. Since C7 is also nearing its fully charged condition, the upper end of R18 is at a higher potential than previously and allows the collector voltage of X2 to rise as more current flows through the collector resistor R2.

11. Capacitor C1 thus receives a positive charge causing a positive surge to be applied to the base of X1. This positive surge causes X1 to cut-off. X1 collector now falls to earth potential because no current is flowing through R3 and capacitor C2 discharges. The discharging action of C2 carries the base of X2 even more negative and the emitter-collector circuit rapidly passes maximum current.

12. The base of X1 travels negative as capacitor C1 charges until eventually X1 conducts once more. Capacitor C2 commences to charge, X2 base is carried positive and X2 cuts-off. This regenerative switching procedure is repeated continuously at a frequency dependent upon the value of C1 and C2 and the base resistors of X1 and X2.

Striking multivibrator circuit

13. This circuit operates in exactly the same manner as the pitch circuit except that the values of capacitance and resistance are such that the frequency of oscillation is approximately 6 c/s.

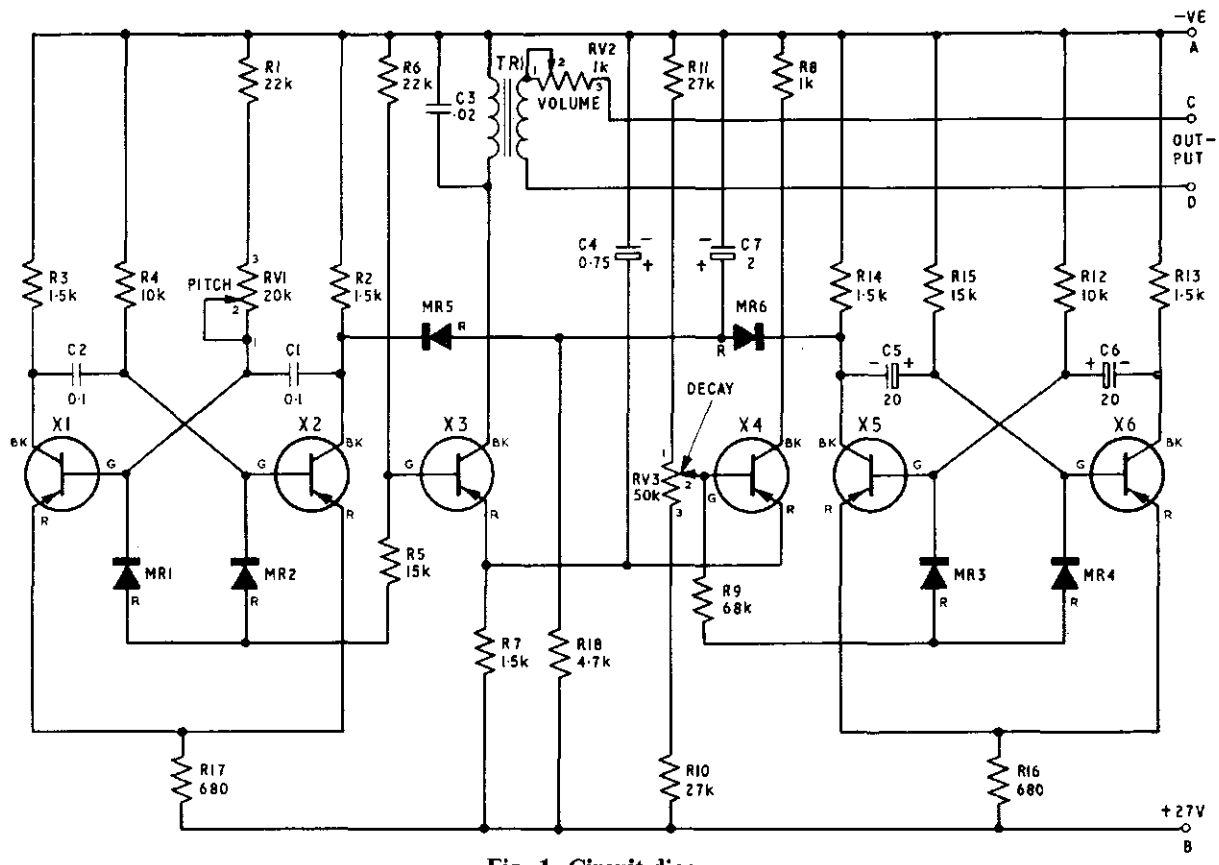

Fig. 1. Circuit diagram

Output and modulation circuit

14. The outputs from the transistors in each of the multivibrator circuits are passed through rectifiers MR1, MR2, MR3 and MR4. These rectifiers are in effect, shaping diodes since they cut off the negative half of the output waveform and leave a triangular pulsing output from each transistor. The outputs from the two transistors in each multivibrator circuit are combined and, since they are anti-phase, the resulting waveform is triangular in shape but not intermittent as before.

15. The pitch circuit output is applied to the base of the output transistor X3 and varies its potential, thus varying the current in the emitter-collector circuit. If this output were not modulated by the output of the striking circuit, a steady note in the pilot's headphones would result.

16. The output from the striking multivibrator is applied to the base of a modulating transistor X4, the emitter of which is connected to the emitter of X3. The base of X4 has its potential varied by the output of the striking multivibrator and, consequently the emitter-collector current is varied also. The decay or striking potentiometer RV3, adjusts the base-bias potential of X4 which has the effect of varying the amplitude of the emitter-base current.

17. When X4 is conducting maximum current it, in effect, by-passes current from the output transistor X3, causing the output of X3 to be modulated from maximum to minimum at a frequency of 6 c/s. This modulated output is applied to the primary of the output transformer TR1, which is roughly tuned to the third harmonic (3–4 Kc/s) by capacitor C3. The reason for this tuning is that it produces a note which is more characteristic of the tone of a bell.

18. The overall operation of the unit is, then, that the pitch circuit produces a note of similar frequency to that of a bell, and is modulated to a sharp maximum, dying away to a minimum by the action of the striking circuit. The result is a sound in the pilot's headphones similar to that of a "clapper" striking a bell and the note slowly dying away.

Trigger circuit

19. Under certain circumstances it is possible for the multivibrators to assume a stable state and fail to oscillate when switched on. To overcome this difficulty a trigger circuit consisting of resistor R18, rectifiers MR 5, MR6 and capacitor C7 is connected to one collector of each of the multivibrators. This circuit functions by virtue of the fact that, at the moment of switching on, C7 carries no charge and a surge therefore occurs through one half of a multivibrator losing its stability. After a brief period of time C7 is held charged via R18 and any further flow of current through rectifiers in the trigger circuit ceases.

BAY SERVICING

20. Remove the cover and examine the unit for cleanliness and mechanical damage. The serviceability of the unit can be ascertained by applying the standard serviceability test detailed in Chapter 2.

Chapter 2

STANDARD SERVICEABILITY TEST

Introduction

1. The following test should be applied prior to installation or whenever the serviceability is suspect.

TEST EQUIPMENT

2. The following supply and test equipment will be required:—

Item	Ref. No.
(1) 0–28 Vd.c. supply	
(2) Headphone set	10A/13466
(3) Multimeter, Type 12889 or equivalent	5QP/17447

TEST PROCEDURE

3. With the unit energized at 28V d.c., the output connected to a headphone set should realistically simulate the sound of a fire bell. The three potentiometers can be adjusted to achieve this noise. The striking control (RV3) provides the correct die-away between individual strokes of the "bell". The pitch control (RV1) adjusts the tone of the bell while the volume control (RV2) adjusts the audio output. Lock potentiometer locking screws after adjustment.

4. Switch the unit on and off several times and ensure that it operates correctly each time it is energized, i.e., both striking and pitch multivibrators operate.

5. Check that the current consumption is between 40 and 44 mA.

6. Reduce the supply voltage to 21V d.c. and repeat above tests.

Chapter 3

REPAIR

Introduction

1. The following instructions apply only to authorized units with the necessary spares and facilities. Repairs must be done under clean, dustfree conditions.

Special tools and test equipment

2. No special tools or test equipment are required.

Fault diagnosis

3. The nature of a breakdown is often indicated by the form of telephone output obtained as follows:—

(1) A continuous note suggests that multivibrator X1 and X2 and the audio output stage are functioning normally but that the 6 c/s multivibrator X5 and X6 or the associated output transistor X4 is at fault.

(2) A 6 c/s clicking noise in the headphone set indicates that X5 and X6 are normal and that the 1000 c/s multivibrator X1 and X2 is at fault.

4. The layout of the components is illustrated in fig. 1, 2 and 3 and details of each component is given in table 1.

5. Having traced the trouble to a particular stage and a transistor is suspect the base and emitter voltages can be compared. The base voltage should be between 0·1 and 0·15 volts negative with respect to the emitter.

Note . . .

Care must be taken during soldering operations; a heat shunt must be used and the operation must be completed as quickly as possible.

Testing

6. The unit should be tested in accordance with the standard serviceability test.

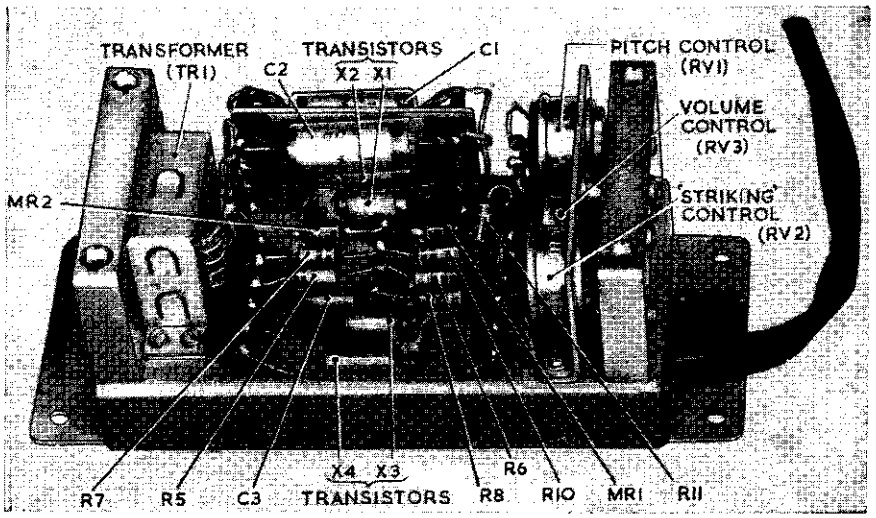

Fig. 1 View of unit from above (cover removed)

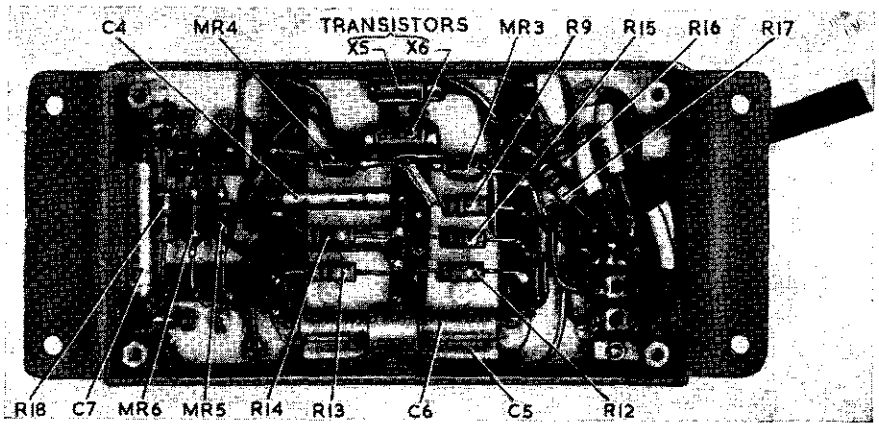

Fig. 2 Unit viewed from below

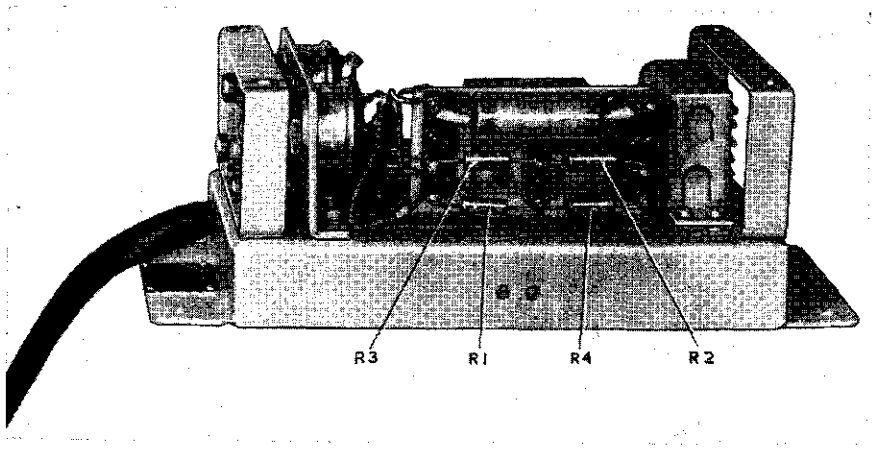

Fig. 3 Side view of unit

TABLE 1

List of Components

Capacitors

Component No.	Ref. No.	Value (μF)	% Tol. (±)	Rating (Volts)
C1, C2 } Model A	0631-5910-99-011-9827	0·1	25	150
C1, C2 } Model B	0631-5910-99-011-5560	0·1	25	150
C3	0631-5910-99-012-0114	0·02	20	250
C4	0631-5910-99-014-5291	0·75	20	50
C5, C6 }	0631-5910-99-014-5289	20	20	25
C7	0631-5910-99-014-5332	2	20	150

TABLE 1 *contd.*

Rectifiers

Component No.	Ref. No.	Description
MR1 MR2 MR3 MR4 MR5 MR6	0621-5960-99-000-0448	Germanium crystal CV448

Resistors (Fixed)

Component No.	Ref. No.		Value (ohms)
R1	0632-5905-99-022-0172	22K	± 10% tol., 0·25W rating
R2	0632-5905-99-022-2025	1·5K	
R3	0632-5905-99-022-2025	1·5K	
R4	0632-5905-99-022-2130	10K	
R5	0632-5905-99-022-2151	15K	
R6	0632-5905-99-022-2172	22K	
R7	0632-5905-99-022-2025	1·5K	
R8	0632-5905-99-022-2004	1K	
R9	0632-5905-99-022-3016	68K	
R10	0632-5905-99-022-2184	27K	
R11	0632-5905-99-022-2184	27K	
R12	0632-5905-99-022-2130	10K	
R13	0632-5905-99-022-2025	1·5K	
R14	0632-5905-99-022-2025	1·5K	
R15	0632-5905-99-022-2151	15K	
R16	0632-5905-99-022-1214	680	
R17	0632-5905-99-022-1214	680	
R18	0632-5905-99-022-2088	4·7K	

TABLE 1 *contd*

Resistors (Variable)

Component No.	Ref. No.	Value (ohms)	Description
RV1	0632–5905–99–900–4572	20K	
RV2	0632–5905–99–932–1637	1K	± 20% tol., 0·25W rating — Morganite BJ(LIN)
RV3	0632–5905–99–011–9467	50K	

Transformer

Component No.	Ref. No.	Description
TR1	5CZ/7151	STC Code 125–LRA.3A

Transistors

Component No.	Ref. No.	Description
X1, X2, X3, X4, X5, X6	0621–5960–99–037–2006	Mullard OC. 72

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