

TECHNICAL INSTRUCTION

RX.5

LINE IDENTIFICATION UNIT RP4/1

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AMENDMENT RECORD

<i>Amendment Sheet No.</i>	<i>Initials</i>	<i>Date</i>	<i>Amendment Sheet No.</i>	<i>Initials</i>	<i>Date</i>
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FRONTISPIECE

Fig. 1.1. RP4/1 Unit showing Main Components

DIAGRAM AT END

Fig. 1. Line Identification Unit RP4/1: Circuit

Instruction RX.5
Frontispiece

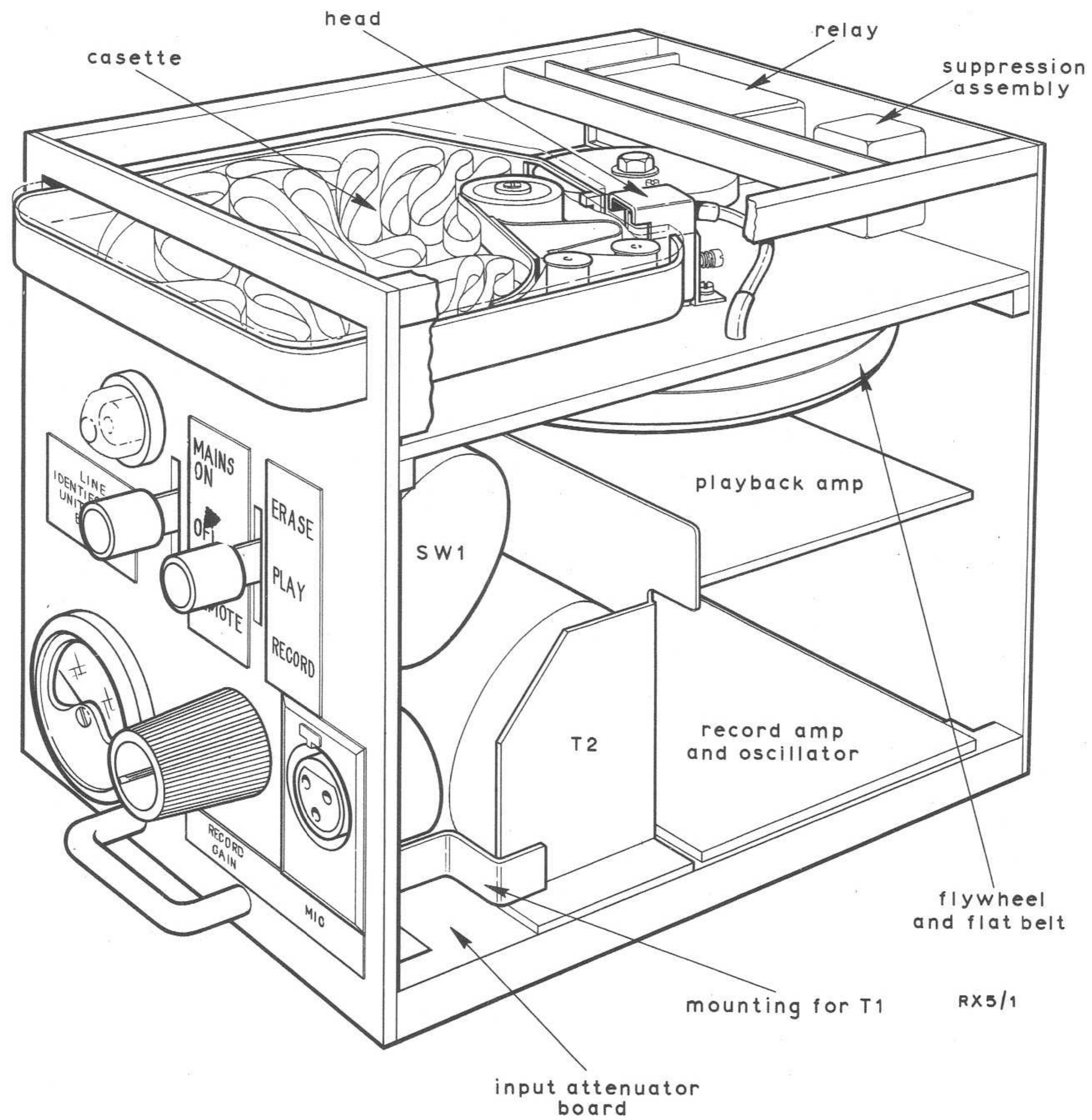


Fig. 1.1. RP4/1 Unit Showing Main Components

SECTION 1

INTRODUCTION

1.1 General

Line-identification unit RP4/1 is a mains-operated magnetic tape machine capable of providing about 15 seconds of continuously repeated playback. It is used mainly to identify and guard the sound circuits for international broadcasts. The tape forms an endless loop in a removable cassette. The unit includes circuits for recording the identifying message, and is fitted with a 30-ohm microphone socket and also a 600-ohm line input via an attenuator.

The unit uses semiconductors throughout and most of the electronic circuits are constructed on four printed-wiring boards two of which, the record and playback amplifiers, are mounted as plug-in assemblies.

The operating controls are on the front of the machine, as shown in Fig. 1.1. They comprise a mains ON/OFF/REMOTE switch and indicator-lamp, and an ERASE/PLAY/RECORD switch together with a RECORD GAIN control and recording-level meter. The unit can be switched on either by setting the mains switch to ON, or by setting the switch to REMOTE and applying 24 volts to a relay on the machine from a remote position.

1.2 Mechanical Construction

The main features of the construction are shown in Fig. 1.1. The unit is assembled from three panels. The front and rear panels are held together by four rectangular-section bars, one at each corner, and the third panel forms a horizontal deck on which is mounted the capstan assembly and the single record/replay head. The capstan motor is bolted to the underside of the deck and drives a large-diameter capstan flywheel through a flat belt. The remainder of the components are mounted on the front and rear panels or between the rectangular bars.

A 16-way McMurdo plug is mounted through the rear panel and all connections to the unit (except the microphone input) are made through this. The unit is mounted by plugging it into a Pye Nest.

The tape cassette is inserted through a slot at the top of the front panel and it slides on strips of p.t.f.e. toward the capstan. A spring-loaded fork engages with a pin on the underside of the cassette and draws it into close contact with the capstan. There are two compartments in the cassette; the larger of these holds the bulk of the tape, which is folded into it in a random manner, and the smaller compartment contains two guide pulleys, a tensioning device and a rubber-covered pinch roller which is driven by the

Section 1

capstan. The cassette is open between the guide rollers and the pinch roller to allow the magnetic head to make contact with the tape.

The front panel carries the two 3-position switches and other controls previously mentioned and also three fuses.

1.3 General Specification

Mains supply	230 volts, 110 \pm 5 mA.
Internal d.c. supplies	
Replay	19 \pm 1 volts, 30 \pm 5 mA.
Record	19 \pm 1 volts, 40 \pm 5 mA.
Erase	17.5 \pm 1 volts, 110 \pm 10 mA.
Remote Relay	24 volts, 35 mA.
Head	Single full-track: used for erase, record and replay.
Azimuth	Preset.
Tape speed	7 $\frac{1}{2}$ in/sec \pm 2 per cent.
Line input	600 ohms balanced.
Microphone input	300 ohms balanced (sensitivity -58 dB).
Output	600 ohms balanced.
Frequency response	300 - 6,000 c/s: \pm 3 dB.
Distortion	Recording and replaying 1 kc/s at zero level: better than 30 dB harmonic separation.
Noise volume	Not greater than -30 dB after two passes on Erase.
Bias current	7 \pm 1 mA.
Bias frequency	30 \pm 1 kc/s.
Erase current	50 mA minimum.
Erase frequency	30 \pm 1 kc/s.
Cassette toggle-arm pressure	350 - 450 grammes (at tip of toggle arm).
Dimensions	
Height	5 $\frac{5}{8}$ in.

Width	$5\frac{5}{8}$ in.
Depth overall	$9\frac{1}{2}$ in (approximately) including plug and controls.
Weight	$10\frac{1}{2}$ lb approximately.

SECTION 2

OPERATION

2.1 Normal Operation

1. Connect a 30-ohm microphone via the 3-pin socket on the front panel of the machine. (Alternatively, apply a 600-ohm line input at zero level via leads 1 and 9 of the cable from the 16-way rear connector.)
2. Set the MAINS switch to ON.
3. Make a level test by speaking into the microphone or applying the required signal from line.
4. While the level test is in progress, hold the right-hand switch at RECORD and adjust the RECORD GAIN control to bring the needle of the record-level meter onto the coloured part of its scale.
5. With no signal incoming, raise the right-hand switch and hold it at ERASE for at least 30 seconds to remove all previously recorded signals from the tape.
6. Now hold the switch at RECORD and record the required line-identification message, which cannot be longer than 15 seconds.
7. Release the right-hand switch to PLAY. The unit will now reproduce the recorded message continuously.
8. To stop the machine, set the MAINS switch to OFF.

2.2 Remote Operation

The REMOTE position of the MAINS switch allows the unit to be started and stopped from a remote control position. For this purpose, a remotely situated ON/OFF switch in series with a 24-volt supply must be provided and connected in series with leads 12 and 15 of the cable from the 16-way rear connector.

SECTION 3

CIRCUIT DESCRIPTION

3.1 Replay Amplifier (Fig. 1)

Although referred to as a replay amplifier this sub unit is used in both the reproduce and the recording mode. With switch SW1 in the RECORD position the input to the amplifier is connected to the input transformer T1; with SW1 in the PLAYBACK position the amplifier is connected to the record/reproduce head; with SW1 in the ERASE position the amplifier input is short-circuited.

The primary winding of the input transformer is connected to the MIC. input socket and also to the input attenuator. This attenuator, which is assembled on a small printed wiring board mounted on the underside of the RP4/1, is fed from tags 1 and 9 of the McMurdo plug; it provides a 600-ohm input which will accept zero level.

The amplifier uses four transistors. VT1 and VT2 are connected as a d.c.-coupled feedback pair using both d.c. and a.c. negative feedback; d.c. feedback is applied from the emitter of VT2 to the base of VT1 and a.c. feedback from the collector of VT2 to the emitter of VT1. VT3 is connected as an emitter-follower and VT4 as an output amplifier; the variable resistor VR1 connected in the emitter circuit of VT4 provides variable negative feedback and forms a preset gain control.

The output of the amplifier is fed to transformer T2 the secondary winding of which is connected to the traveller of switch SW1C. In the RECORD position of the switch the output from the transformer is fed to the record amplifier; in the PLAYBACK position the output is fed to the line-output pins of the McMurdo plug (Nos. 6 and 14): in the ERASE position the transformer secondary winding is terminated in the 680-ohm resistor R13.

3.2 Record Amplifier

This amplifier, which is used only in the RECORD mode, is assembled on a board together with the erase-and-bias oscillator. The amplifier consists of a two-stage complementary pair amplifier, a record-current metering circuit and a filter to isolate the amplifier from the bias oscillator.

The base of VT5 is returned, via the variable resistor VR2, to a bias potential which is developed at the junction of R15 and R16; the output signal from the replay amplifier is applied across VR2 so that it varies

the bias. The collector current of VT5 is fed to the base of VT6 and the emitter of VT5 is connected into the collector load of VT6; thus both d.c. and a.c. feedback are applied.

The output signal at the collector of VT6 is coupled through C11 to the metering circuit; a second output is taken from the junction of R19 and R20, via the oscillator filter, to switch SW1A. The output of the oscillator is connected permanently to the output side of the filter and so this point is connected to both the RECORD and the ERASE positions of the switch.

3.3 Bias and Erase Oscillator

This is a balanced circuit using two transistors VT7 and VT8. The collectors of these two transistors are coupled through the tuned primary winding of transformer L2; the emitters are cross-coupled by means of the two base-limiting resistors, R23 and R24, to provide positive feedback. The emitters are connected together to the traveller of switch SW1E which, with a make-before-break contact, selects one of three possible emitter resistors which provide negative feedback. Resistor R26 in the PLAYBACK position is large enough to prevent oscillation; R25 in the RECORD position permits oscillation at a low level for record bias purposes; R27 in the ERASE position allows the circuit to oscillate strongly so as to develop sufficient power for erase purposes.

3.4 Power Supplies

The unit operates directly from the mains supply. It can be switched on either by moving mains switch SW2 to the ON position or, with SW2 in the REMOTE position, by applying 24 volts (d.c.) to relay RL1. The suppression components C20 and R37, which are connected across the relay contacts, are mounted as a single standard assembly beside the relay on the motor deck. The mains-indicator neon and the capstan motor are connected directly across the supply following the mains switch and the relay contacts.

The output from the mains transformer, T3, is rectified in a four-diode bridge circuit; this is assembled on a board which is mounted inside the transformer can. The rectified a.c. is fed to the smoothing unit board which is mounted behind the motor. The smoothing consists of an RC filter R35, C18, C19 followed by a zener-diode stabiliser circuit R36, ZD1, ZD2. The output is 19 volts.

SECTION 4

TEST PROCEDURE

4.1 Casette

The cassette should be loaded with $9\frac{1}{2}$ ft of bulk-erased E.M.I. 77 tape (or its equivalent) which is formed into a loop with the active surface outwards. A cemented joint should be used.

As the cassette is inserted into the machine the stud on the underside of the cassette should engage with the fork on the toggle-arm of the machine. The cassette should be drawn into position by the action of this arm after it has passed about the half-way position. See General Specification in Section 1.3.

4.2 Performance Tests

4.2.1 Line Input

1. Remove the cassette and switch to MAINS ON. The panel lamp should light and the capstan pulley should revolve.
2. Insert the cassette. Erase any existing recording by holding the function key in the ERASE position for 30 seconds. When this key is released the machine returns to the REPLAY condition. Measure the replayed noise output volume with a T.P.M. of 600 ohms input impedance. The level should be not greater than -30 dB.
3. Remove the cassette. Feed 1-kc/s tone at zero level into the 600-ohm line input. Hold the function key in the RECORD position and adjust the RECORD GAIN control to bring the needle of the meter to the right-hand edge of the green sector. Release the key.
4. Insert the cassette and record the 1-kc/s tone for 15 seconds. Release the key and measure the output level from the machine using a 600-ohm ATM/1. The level should be 0 dB \pm 1 dB. The machine should replay the tape repeatedly without reduction in the output level.
5. Use this same output to determine the harmonic separation using a Harmonic Routine Tester Type FHP/3 or similar.
6. Erase the 1-kc/s recording by allowing the tape two complete passes (30 sec) with the function key held in the ERASE position. Release the key and measure the machine noise output level. The result should be similar to that obtained in (2).

7. Change the input signal to 300 c/s at zero level and record for 15 seconds.

Note:- The recording-level meter is not equalised and it should not be used to set the input level at any frequency other than 1 kc/s.

8. Replay the recording obtained in (7). The output level should be similar to that obtained with the 1-kc/s signal.
9. Erase the recording and repeat the test with an input signal of 6 kc/s at zero level.

4.2.2 Microphone Input

Erase any previous recording. Plug in a 30-ohm microphone and carry out a speech test. Speech which gives meter readings to the right-hand edge of the green sector of the meter when on RECORD should give peaks to 6 on an ATM/1 when on REPLAY. A lip-microphone technique is required.

Check that the speech quality is satisfactory with high intelligibility.

4.2.3 Remote Operation

Set the mains switch to REMOTE.

Connect a d.c. supply at 24 volts to pins 12 and 15 of the 16-way connector and check that the machine starts.

COMPONENT TABLE: FIG. 1

PAGE 1

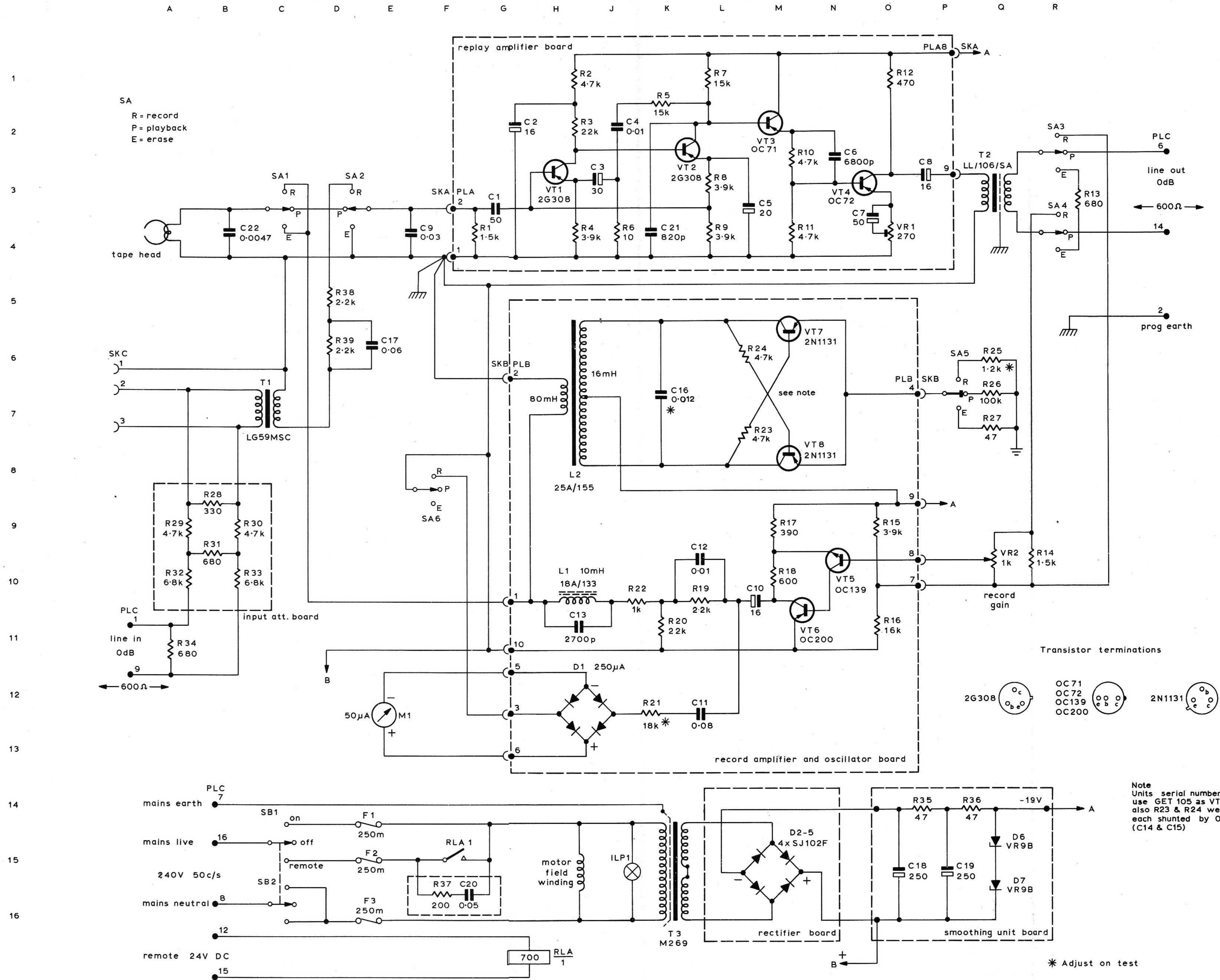
Comp.	Loc.	Type	Tolerance per cent
C1	G3	U.C.C. SM51S 6V	
C2	G2	U.C.C. SM90S 25V	
C3	J3	U.C.C. SM48S 6V	
C4	J2	Hunt 500V	
C5	L3	Plessey CE19/1 12V	
C6	N2	Salford PF 125V	2
C7	O3	U.C.C. SM51S 6V	
C8	P3	U.C.C. SM90S 25V	
C9	E4	Hunt 250V	
C10	M10	U.C.C. SM90S 25V	
C11(a+b)	L12	Hunt 250V	
C12	L10	Hunt 500V	
C13	H11	Salford PF	2
C14	L7	Hunt 500V	
C15	L6	Hunt 500V	
C16	K7	Hunt 250V	
C17(a+b)	E6	Hunt 250V	
C18	O15	Hunt MEF45T 50V	
C19	P15	Hunt MEF45T 50V	
C20	F16	Dubilier SFK43/RATA	
C21	K4	Salford PF 125V	2
C22	B4	Salford PF 125V	2
R1	G4	Erie 109 0.25W	2
R2	H1	Erie 109 0.25W	2
R3	H2	Erie 109 0.25W	2
R4	H4	Erie 109 0.25W	2
R5	K1	Erie 109 0.25W	2
R6	J4	Erie 109 0.25W	0.5
R7	L1	Erie 109 0.25W	2
R8	L3	Erie 109 0.25W	2
R9	L4	Erie 109 0.25W	2
R10	M2	Erie 109 0.25W	2
R11	M4	Erie 109 0.25W	2
R12	O1	Erie 109 0.25W	2
R13	R3	Erie N6 0.125W	2
R14	R9	Erie 109 0.25W	2
R15	O9	Erie 109 0.25W	2
R16	O11	Erie 109 0.25W	2
R17	M9	Erie 109 0.25W	2

COMPONENT TABLE: FIG. 1

PAGE 2

Comp.	Loc.	Type	Tolerance per cent
R18	M10	Erie 109 0.25W	2
R19	L10	Erie 109 0.25W	2
R20	K11	Erie 109 0.25W	2
R21	K12	Erie 109 0.25W	2
R22	K10	Erie 109 0.25W	2
R23	L7	Erie 109 0.25W	2
R24	L6	Erie 109 0.25W	2
R25	Q6	Erie 109 0.25W	2
R26	Q7	Erie 109 0.25W	2
R27	Q7	Erie 109 0.25W	2
R28	B9	Erie N1 0.1W	2
R29	A9	Erie N1 0.1W	2
R30	B9	Erie N1 0.1W	2
R31	B9	Erie N1 0.1W	2
R32	A10	Erie N1 0.1W	2
R33	B10	Erie N1 0.1W	2
R34	A11	Erie N6 0.125W	2
R35	P14	Painton MV1A 1.5W	5
R36	Q14	Painton MV1A 1.5W	5
R37	F15	Dubilier SFK43/RATA	
R38	D5	Erie N6 0.125W	2
R39	D6	Erie N6 0.125W	2
RV1	O4	Plessey 404/1/00142/271	
RV2	Q10	Plessey CP161101/207	

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LINE IDENTIFICATION UNIT RP4/1: CIRCUIT