MISCELLANEOUS SOUND EQUIPMENT

SECTION 1

REVERBERATION PLATE EMT 140

1.1 Introduction

The reverberation time of a sound studio is not always suitable for the musical or dramatic effects desired for a particular programme and it has been common practice in the past to introduce artificial reverberation by employing a so-called echo room. A loudspeaker in a reverberant echo room is fed from the studio programme chain and the sound is picked up by a microphone and fed back into the programme chain at a suitable strength to give the desired effect.

This method has a number of disadvantages, such as the space required, and the difficulty of obtaining a sufficiently high reverberation time which is reasonably independent of frequency over the required range because of the pronounced natural resonances due to the small room dimensions. Also the build-up time is usually too short in a small echo room.

Alternative methods, such as the use of magnetic recording to give a delayed sound to produce a reverberant effect, have not proved to be very suitable, but considerable use is now being made of equipment utilising a suspended steel plate which is caused to vibrate by a moving-coil transducer attached to it near its centre and fed via an exciter amplifier from the programme chain. The delayed and prolonged vibrations are picked up by a piezo-electric microphone mounted nearer the edge of the plate and taken to a further amplifier. The reverberation time can be varied by altering the position of a damping plate which is mounted behind the main plate.

This principle is used in the Reverberation Plate EMT 140 described in this Instruction, and further information is contained in a paper by Walter Kuhl entitled 'The Acoustical and Technological Properties of the Reverberation Plate', published in the *E.B.U. Review*, Part A—Technical, No. 49, May 1958.*

* Copies are available as Reprint Article No. A.13 from Technical Instructions Section.

1.2 Description of Apparatus

1.2.1 General (Figs. 1.1 and 1.2)

Reverberation Plate EMT 140 is of German design and manufacture and an English translation of the Maker's Operating Instructions is supplied with each equipment purchased by the BBC.

The reverberant plate itself, which is the basis of the equipment, is made of cold-drawn tinned steel, one metre by two metres, with a minimum thickness of 0·5 mm. This gives a reverberation time of about 5 seconds at a frequency of 500 c/s. The sheets have to be specially selected to obtain the required degree of flatness.

The plate is suspended vertically by steel wires at each corner in a welded tubular steel frame (Fig. 1.1) and the tension of these wires is adjusted on assembly after transport in accordance with the maker's instructions, to ensure that the plate is as flat as possible.

The tubular steel frame is fitted with two vertical angle-iron cross members that carry the magnet for the moving-coil transducer which is used to excite the plate, and a third cross-member supports the microphone cable and a screening can which encloses the microphone and its leads to screen them electrostatically.

The upper and lower sides of the frame each carry two bearings for the swinging arms of the damping plate which control its distance from the main plate. These arms are operated by a handwheel which is fitted with a pointer to indicate the reverberation time corresponding to the position of the plate.

The whole tubular frame assembly is mounted on rubber shock absorbers in an outer angle-iron frame enclosed in a building-board case.

The single-stage power amplifier which excites the transducer, and the microphone amplifier, together with a mains unit, are mounted on a common chassis accommodated inside the angle-iron framework at one end of the case. A removable plate gives access to this amplifier unit from outside the case.

Some equipments are fitted with apparatus for remote control of the reverberation time and this also is fitted at the same end of the case. It includes a motor for moving the arms which control the position of the damping plate, and a unit which houses relays and associated components. The remote control unit itself is situated in the studio cubicle or other convenient place.

The equipment, which is 8 ft long, 4½ ft high, 14 in. wide and weighs 3½ cwt, can be installed in any reasonably quiet dry place but it is fairly sensitive to extraneous noise, particularly in the 200-c/s region. It is often necessary to enclose it in a cabinet made of thick building board when it is installed in such places as a studio lobby. It is also very sensitive to electrical interference from such sources as impulse clock circuits and cue light relays, and this interference must be made negligible by suppression at source.

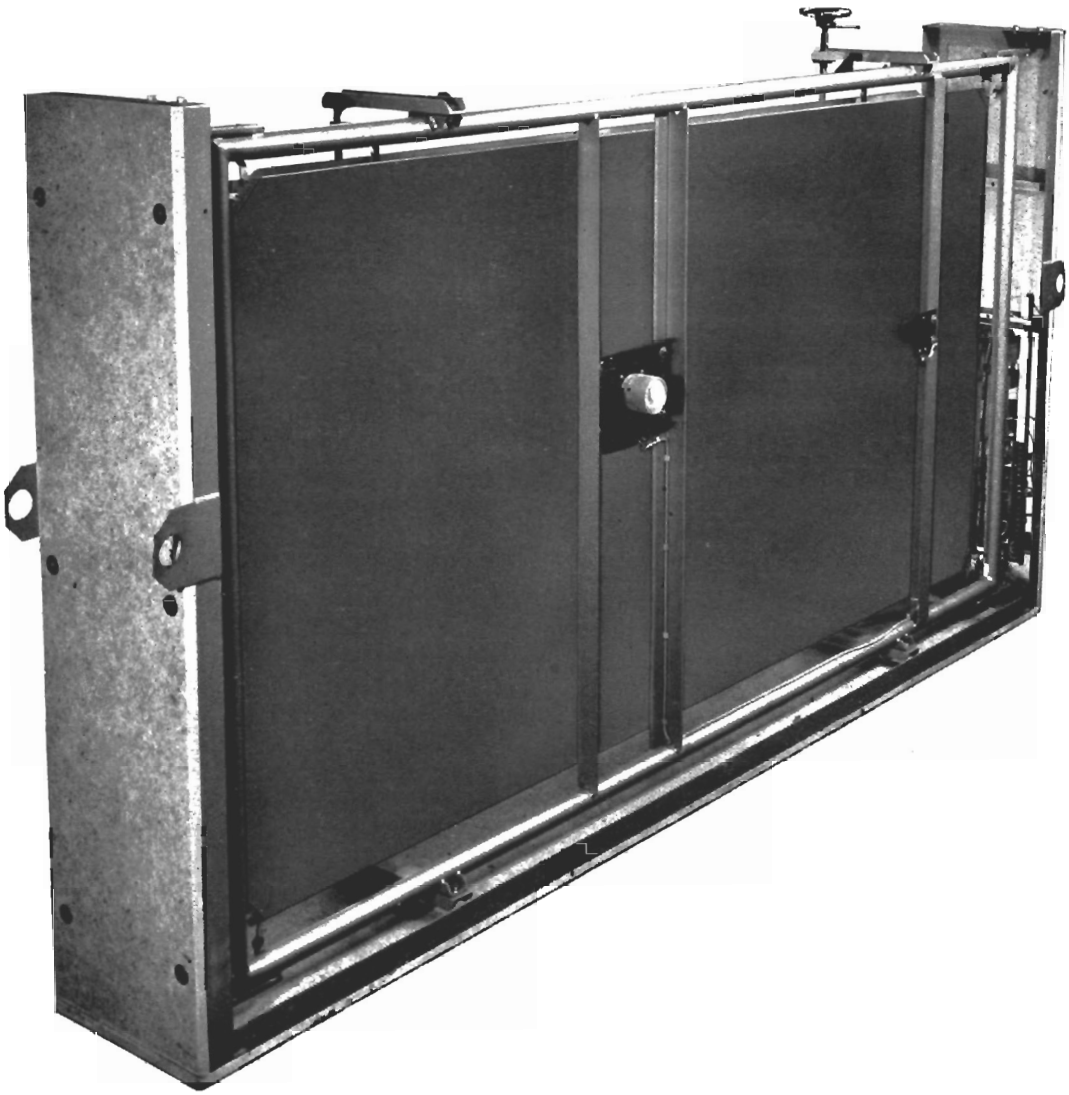

Fig. 1.1. Reverberation Plate EMT 140: Front View with Case Removed

Because of the difficulty of ensuring that no buckling of the damping plate occurs there is a risk that the two plates will touch at low settings of

reverberation time, and in practice settings of less than 1 second should not be used; this minimum setting corresponds to an average clearance of 4 mm. The settings are indicated by a pointer attached to the handwheel which controls the position of the damping plate and are marked on a scale on the top of the case to show reverberation times of from 1 to 5 seconds at 500 c/s.

Fig. 1.2. Rear View of EMT 140 with Case Removed Showing Damping Plate

1.2.2 Main Plate

The natural reverberation time of the main plate without any additional damping due to the damping plate falls from a very high value at low audio frequencies to about 5·3 seconds at 500 c/s and to about 1·5 seconds at 10 kc/s. This is the condition when the damping plate is approximately 120 mm away from the main plate, and corresponds roughly to an empty stone hall or church.

The result has been achieved by suitable choice of the material and dimensions of the plate, its method of suspension, and control of the damping introduced by the transducer and microphone to spread the natural resonances of the plate over as wide a range as possible without introducing any pronounced resonances at particular frequencies. This avoids the introduction of coloration into the

artificial reverberation when complex sounds are being handled. It also gives a basic reverberation curve which can be varied by the introduction of additional damping to give desired frequency characteristics at lower values of reverberation time as shown in the curves in Fig. 1.3. In practice the equipment is used to give reverberation times of 1 to 5 seconds at 500 c/s.

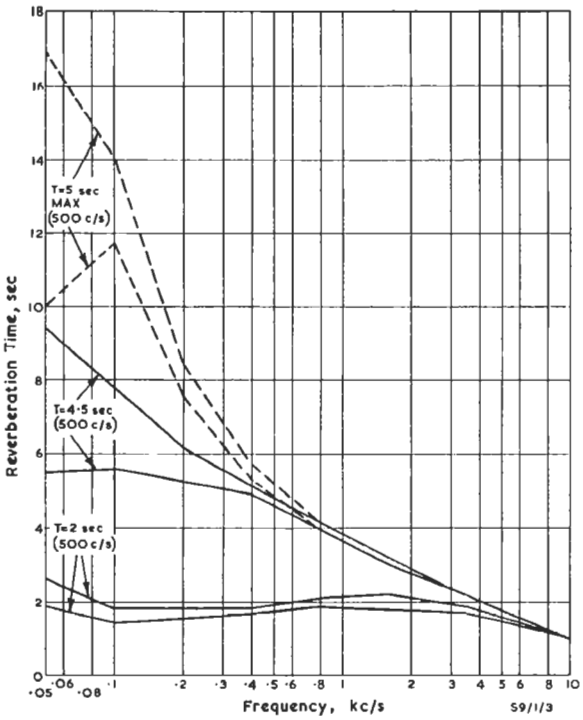

Fig. 1.3. Reverberation Time of EMT 140 as a Function of Frequency and Spacing Between the Plates

1.2.3 Damping Plate

The damping plate has been designed to reduce the reverberation time of the undamped oscillating plate by introducing additional damping which is as independent of frequency as practicable. For this reason it must be composed of sound-absorbing material which is sufficiently stiff and heavy to allow it to remain as stationary as possible in the presence of the sound waves radiated by the main plate, and its thickness must be small compared with the wavelength. It must also be as flat as possible so that it can be brought very close to the main plate without actually touching.

The material used is a form of compressed glass fibre 0·8 mm thick applied in numerous small pieces, which are stiffened by a strip connected on the back, to a framework consisting of horizontal U-shaped aluminium members connected by vertical steel rods.

This construction enables the damping plate to be brought to within about 3 mm of the main plate (giving a minimum reverberation time of approximately 0·8 second) provided no buckling of the plate occurs through mishandling or other causes.

As shown in Fig. 1.3 the shorter the reverberation time the wider is the range over which it is almost independent of frequency.

1.2.4 Moving-coil Transducer

The moving coil of the transducer which excites the main plate is wound on a brass former, because a cardboard cylinder of the required length would have a longitudinal natural oscillation at the upper end of the audio-frequency range.

The brass former has a hard-soldered conical steel point which is spot-welded to the plate. (In later models the cone is attached to the plate by a small bolt.) The air gap of the magnet is arranged to be sufficiently wide to prevent the steel cone being attracted by the magnet.

It is important that the magnet system should be mounted and adjusted in accordance with the maker's instructions and it must be removed whenever it is necessary to transport the equipment.

1.2.5 Microphone

The piezo-electric microphone is mounted in a cylindrical steel case which has a cone-shaped point spot-welded or screwed to the reverberation plate. The microphone consists of a barium-titanate plate, 1 mm thick and 12 mm in diameter, cemented to the case and in contact with a mechanical mass which makes it sensitive to acceleration. A disk-shaped compression spring safeguards the cemented connection between the mass and the case.

The microphone is free to move inside a screening can mounted on a vertical cross-member of the plate frame, and a removable cover to the can gives access to the microphone and its flexible connections. These connections terminate on soldering tags to which the screened coaxial cable leading to the amplifier is connected.

1.2.6 Exciter and Microphone Amplifiers

The common chassis on which the two amplifiers and their power supply unit is mounted is fitted at

the bottom of one end of the reverberation plate frame and is accessible through a cut-out in the case by removing a cover plate which has holes for the mains switch and indicating lamp. Four screws secure the chassis in position.

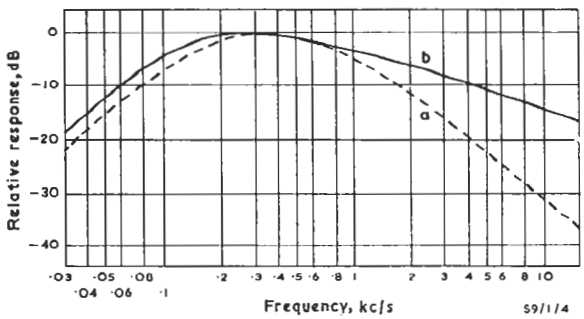

Fig. 1.4. Reverberation Plate EMT 140: Frequency Response

(a) Plate Alone without Electrical Equalisation

(b) Overall Response including Exciter and Microphone Amplifiers

Plug and socket connectors at the back of the chassis connect the output of the exciter amplifier to the moving-coil transducer, and the input of the microphone amplifier to the microphone (Fig. 1.6). The input to the exciter amplifier and the output of the microphone amplifier are brought out to a plug and socket connection on a small panel on the outside of the case adjacent to the amplifier cover plate. This panel also carries the mains input socket, and a wing-nut and earthing bolt for connecting an external earth lead as a safety precautions measure if the metalwork of the equipment is not otherwise suitably earthed.

The circuit of the amplifier and power supply unit is shown in Fig. 1.

The exciter amplifier is a single-stage power amplifier with an input impedance of 6 kilohms. When an input impedance of 600 ohms is required a 680-ohm resistor should be fitted at the rear of the 5-pin input and output connector. The output impedance is less than 6 ohms between 40 c/s and 1 kc/s and less than 45 ohms between 1 and 15 kc/s. Monitoring sockets for the output are fitted. A pre-set gain control is provided, marked *Errg*.

The maximum input level is 1·55 volts r.m.s. from a 600-ohm source. The response characteristic is shown in Fig. 1.5.

The microphone amplifier has four stages and its maximum output level is 1·55 volts r.m.s. at 300 c/s into 600 ohms. The output impedance is less than 25 ohms. A pre-set gain control marked *Wdg.* is provided. A hum control marked *Entbr.* is accessible from outside the case without removing the amplifier cover plate. Equalisation is embodied to give the overall response characteristic for the equipment as shown in Fig. 1.4 when warble tone with a frequency deviation of ± 25 c/s is used. The frequency characteristic of the amplifier alone is shown in Fig. 1.5(b).

The overall equalisation has been divided between the two amplifiers in the manner shown in Fig. 1.5 to avoid too much difference between the tone quality of the artificial reverberation and that of the direct transmission, and to obtain a good signal-to-noise ratio.

If an output attenuator is required it is fitted behind the small removable panel situated above the input and output connector panel.

1.2.7 Earth Connections

Provision is made for separate programme and mains earths when required. All externally accessible metalwork is connected to the wing nut and bolt on the end of the case so that a separate protective earth can be connected externally if necessary as a safety precaution. Normally, however, a mains earth should be provided by the incoming mains cable and connected to the case of the 2-pin mains plug and socket.

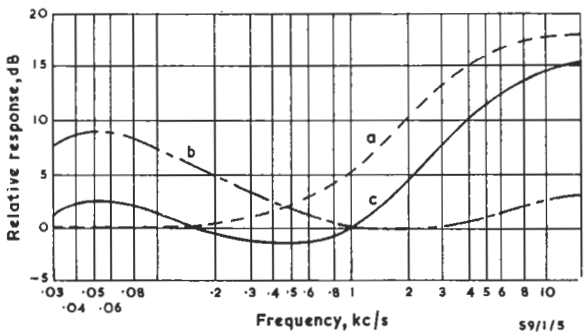

Fig. 1.5. Reverberation Plate EMT 140: Amplifier Frequency-response Characteristics

(a) Exciter Amplifier *(b) Microphone Amplifier*

(c) Both Amplifiers Together

The earthy side of the amplifier circuits inside the equipment terminates on tag 7 on the bottom rear of the amplifier chassis and is connected by the makers to tag 8, which goes to the mains earth.

This strap should be removed and a programme earth provided via pin 3 of the 5-pin input and output connector.

Note that the steel plate and its tubular inner supporting frame are connected to the earthy side of the amplifier circuits via the screen of the coaxial microphone cable, the inner frame being insulated from the outer frame by the rubber suspensions.

1.3 Remote Control System

1.3.1 General Description

Apparatus for the remote control of the EMT 140 reverberation plate is available from the makers but within the Corporation a system designed by the BBC is used when remote control is required. This utilises a small reversible geared induction motor which is coupled to one of the pivoted arms of the damping plate and controlled by a relay unit which is mounted above the amplifier unit. (See Fig. 1.8.) The relays are operated by two non-locking push-buttons on the studio desk, or in a separate studio unit, to drive the motor in either direction to increase or decrease the reverberation time.

The original handwheel is replaced by a pointer within a Perspex cover, and a variable-ratio potential divider is coupled to an arm of the damping plate to control the current in a meter on the studio unit which gives a remote indication of the position of the damping plate and therefore of the reverberation time (Fig. 1.7).

Over-riding controls on the relay unit enable the plate to be operated locally when necessary for adjustment purposes or in the event of failure of the d.c. supply to the relays.

1.3.2 Mechanical Design

The reversible induction motor is of minimum size to keep electrical interference as low as possible. It has an integral gearbox and a final speed of 1 r.p.m. The normal load current is 60 mA.

The motor is mounted on a cradle suspended on Silentbloc mountings and is coupled to an arm of the damping plate by a crank arm and connecting rod. The connecting rod also has Silentbloc bushes. The crank arm is capable of complete rotation, and continuous running of the motor in either direction only results in the damping plate being driven backwards and forwards through its normal range without fear of damage to the gear-train. If the crank arm is driven beyond its normal limits the sense of the push-buttons controlling the increase or decrease of reverberation time becomes reversed. The sense can again be reversed by depressing either button until the correct conditions are restored.

The cradle which mounts the three relays in the relay unit is suspended freely on Silentbloc bushes.

The motor is grease packed and needs no lubrication. For transport purposes it is essential that the motor connecting rod is removed to avoid damage to the gears, and the damping plate must then be lashed as described in the maker's instructions.

1.3.3 Electrical Design

The circuit of the relay unit and the remote unit is shown in Fig. 2. The two relays RL1 and RL2 in the relay unit are operated by non-locking push-buttons SW1 and SW2 in the remote unit on the studio desk and control the forward or reverse running of the motor. The push-button contacts are arranged so that only one relay may be operated at a time.

Two non-locking push-button switches are also fitted on the control panel of the relay unit on the plate and their contacts over-ride those of RL1 and RL2 and provide forward or reverse running of the motor by mains switching independent of the d.c. supply.

Relay RL3 is operated by application of the d.c. supply at the studio end, and controls mains supply to the plate and operates the remote indicator lamp at the studio. The mains supply can also be applied by a local mains switch SW3 on the control panel on the plate which over-rides the relay contacts. A large red pilot lamp on top of the case indicates when the mains are switched on. The incoming mains supply is brought to a 3-pin plug and socket connector on the relay unit instead of via the 2-pin connector which is used when no remote control system is fitted.

Remote indication of reverberation time is provided by a moving-coil milliammeter calibrated in seconds, and a simple bridge circuit controlled by a high-grade wire-wound variable-ratio potential divider RV3 mechanically coupled by a nylon cord to an arm of the damping plate and fitted with a return spring (see Fig. 1.7). Potential dividers RV1 and RV2 (Fig. 2) provide for calibration of the remote indicator at two positions of the damping plate, namely 1 second and 4 seconds, corresponding to currents of zero and 0·5 mA.

These currents may be measured on an Avometer inserted in series with the remote indicator by use

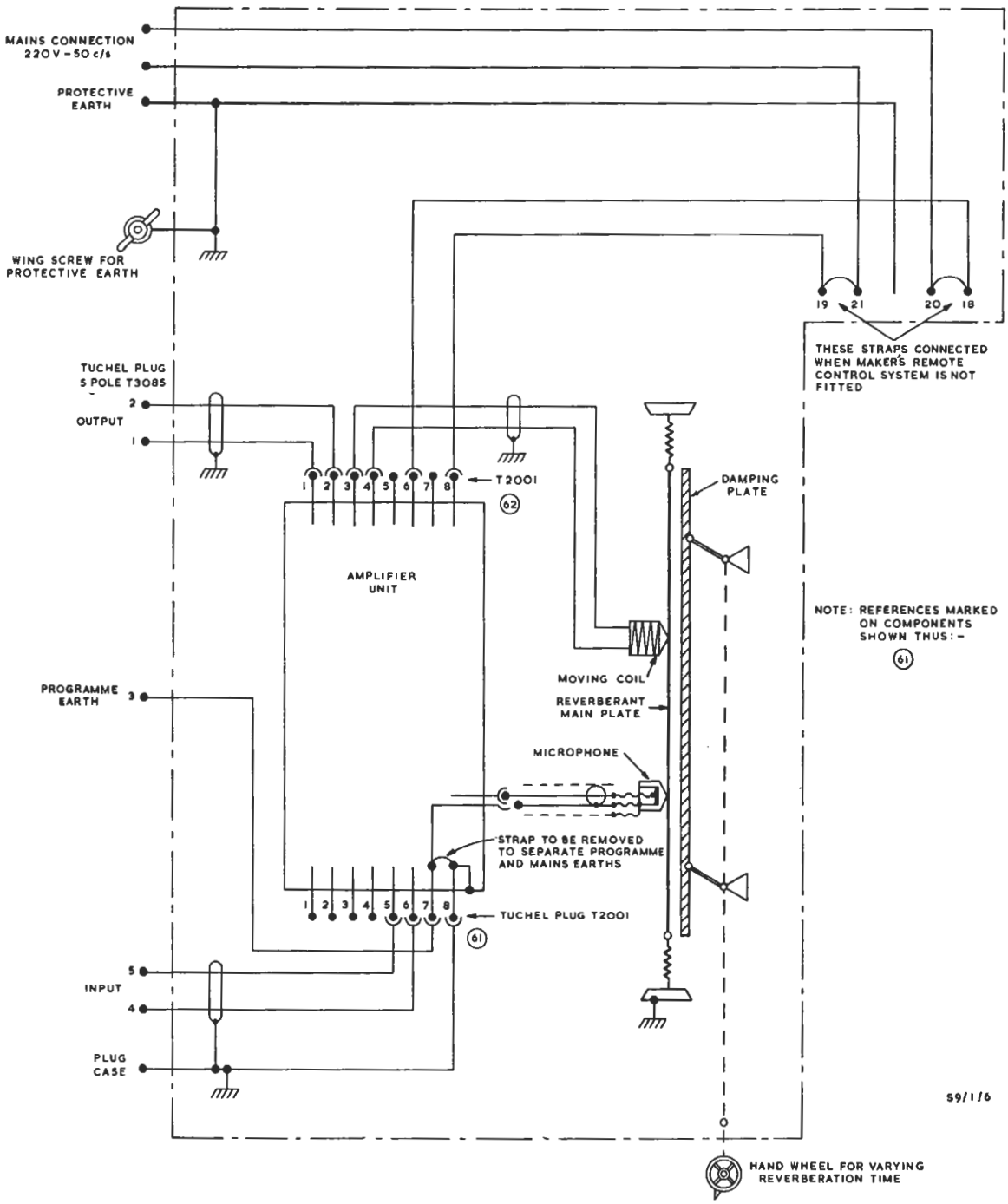

Fig. 1.6. Reverberation Plate EMT 140: Schematic Diagram

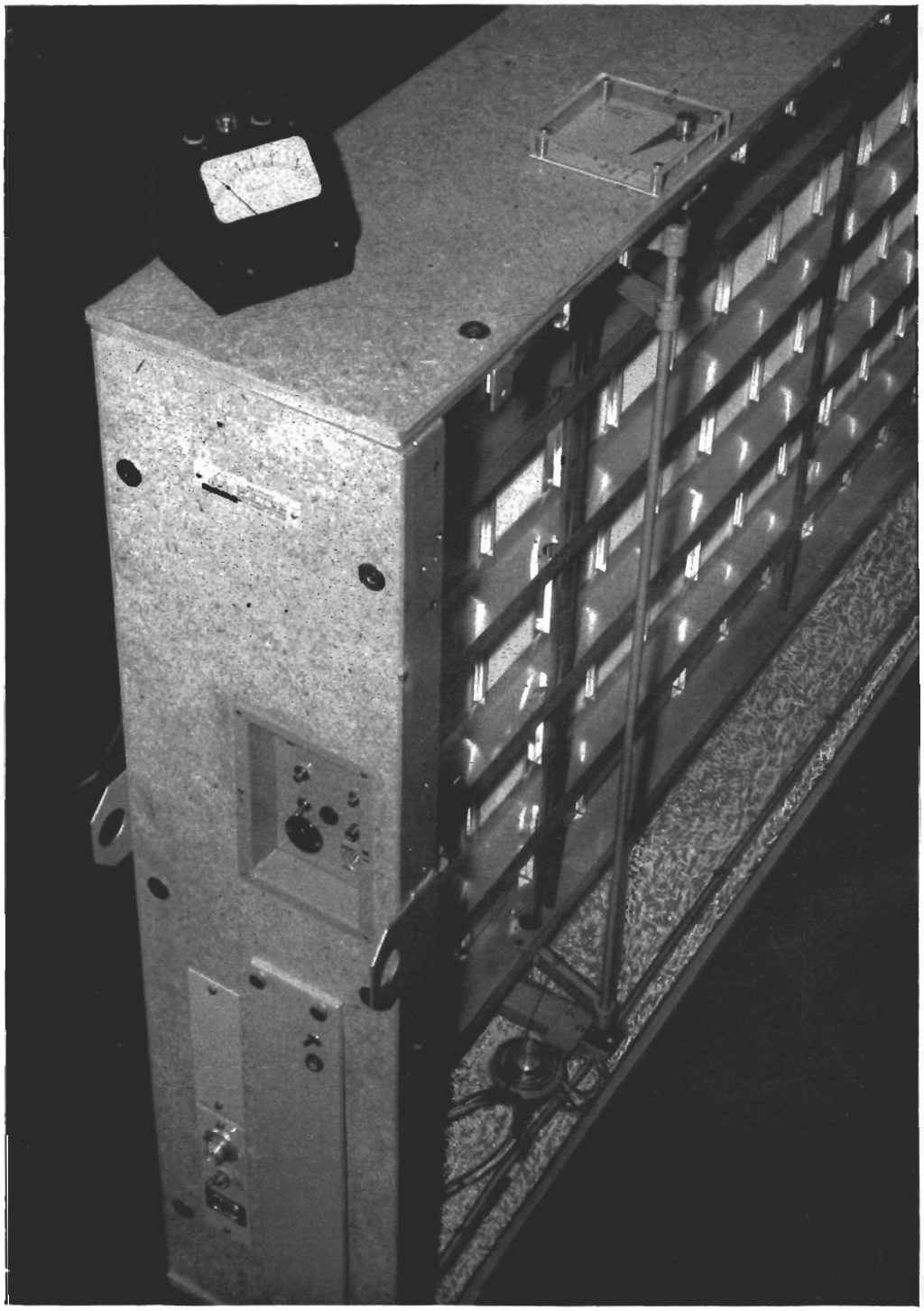

Fig. 1.7. Reverberation Plate EMT 140: View with Side of Case Removed Showing Back of Damping Plate and Master and Slave Indicators and Front Panel of Relay Unit of Prototype Remote Control System (The slave indicator potential divider is on the bottom of the case)

of the meter jack on the relay unit. The remote meter has an offset zero, the indication of 1 second corresponding to zero current.

This system of calibration ensures that the current is least affected by variations in d.c. supply voltage at low reverberation time settings at which suppression circuits where necessary to minimise electrical interference, enable the control to be operated without fading out the echo chain during rehearsal. It is not advisable to operate the control during transmission with the echo chain faded up as occasional slight clicks may be audible.

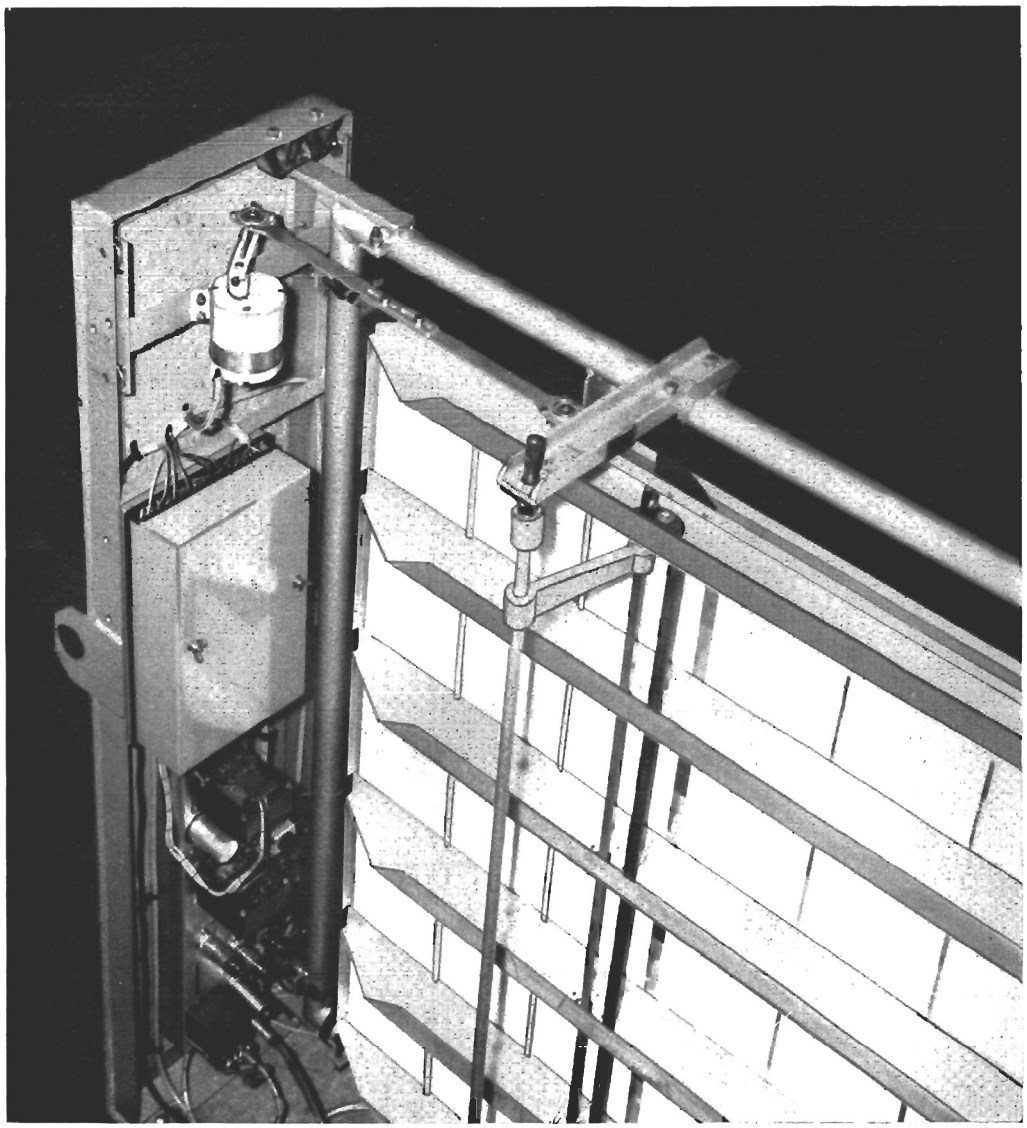

Fig. 1.8. Reverberation Plate EMT 140: Rear View Showing Motor and Covered Relay Unit of Prototype Remote Control Unit and Rear of Amplifier Unit

greatest accuracy is necessary.

The precautions taken to minimise mechanical interference by the use of rubber mountings for the motor assembly and for the relays, and the use of

1.4 Electrical Tests

The maker's instructions involve the use of special apparatus for electrical testing of the equipment, and the following procedure using BBC

test apparatus should be adopted for maintenance purposes.

1.4.1 Line-up: Use PPM/6 (High Z) or TPM (High Z)

1. Apply warble tone at zero level to input by replay of Test Record DOM 24. In a Type-A studio installation the input level may be checked at the *Echo B2 Output Listen* jack.
2. Remove amplifier cover and adjust Gain Control of Exciter Amplifier *Errg.* to provide zero level at the Exciter Coil, measured at the test sockets *Errg.*
3. Set the Reverberation Time Control at 2 seconds. Adjust Gain Control of Microphone Amplifier *Wdg.* to provide zero level at amplifier output. Where an internal attenuator is fitted the amplifier output must be measured at the input of the attenuator, which is accessible by removing the cover plate situated above the connector panel.

The normal setting of both these gain controls is approximately 20 degrees below maximum.

1.4.2 Noise Level: Use TPM (High Z)

After lining up remove the input connector and measure noise level at the Microphone Amplifier output. Adjust hum control *Entbr.* for minimum. A noise level of approximately −40 dB should be obtainable.

1.4.3 Remote Control System

When apparatus for remote control is fitted it should be checked as follows using the controls on the local control panel which are accessible by removal of the cover plate situated above the amplifier cover plate at the end of the Reverberation Plate case.

1. Set Reverberation Time Indicator on Plate to 1 second by use of local push-button controls.
2. Check that Remote Indicator reads 1 second. Adjust, if necessary, by *Set 1* pre-set control on local panel.
3. Set Reverberation Time Indicator on Plate to 4 seconds by use of local push-button controls.
4. Check that Remote Indicator reads 4 seconds. Adjust, if necessary, by *Set 4* pre-set control on local panel.

The current through the Remote Indicator can be measured by connecting an Avometer in series with it by means of the jack on the local control panel. Zero current should correspond to 1 second on the Remote Indicator, and 0·5 mA should correspond to 4 seconds.

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1.5 Control Units UN3/4 and UN3/5

1.5.1 General Description

Remote Control Unit UN3/4 and Local Control Unit UN3/5 are improved versions of the control units used previously with the EMT 140 reverberation plate. The main difference is the use with the new units of earth/phantom circuits of the input and output programme pairs to transmit control signals by direct current over one earth/phantom, and indication of the reverberation time by direct current over the other earth/phantom. Thus no additional cables are required and the complete system can operate over any non-repeatered O.B. lines likely to be encountered, provided the phantom of each line is continuous and the loop resistance does not exceed 2 kilohms.

Any UN3/4 can be used with any UN3/5 without lining-up adjustments over any reasonable length of line, and thus it is possible to centralise a number of reverberation plates and select them from studios or O.B. points as required.

Another difference is that both units are mains-operated, and a separate relay supply is not required.

1.5.2 Remote Control Unit UN3/4 (Fig. 3)

The UN3/4 is approximately 6 inches cube. Its sloping front panel mounts the *Plate* on/off switch, the two push-button switches for increasing or decreasing the reverberation time, and the micro-ammeter which indicates the reverberation time. A mains switch and neon indicator lamp and fuses are mounted on the top of the case.

The small stabilised power-supplier, the two line repeating-coils and miscellaneous components are mounted so that they can be slid into the case.

The whole unit is normally screwed to the surface of a studio desk, but the front panel can be detached and mounted separately if desired, the rest of the unit being fitted with a dummy panel and mounted elsewhere.

The circuit is shown in Fig. 3. When the mains switch SA is closed the mains unit provides a source of 47 volts which is stabilised by the diode ZD1. This voltage, however, is not applied to the outgoing phantom circuit to the reverberation plate until the switch SB, labelled *Plate*, is closed. Closing of this switch connects the negative of the supply to the phantom tap on T1 via R4, R7 and R2, the positive pole already being earthed via the break contact RLA2 and R5. The current via the phantom circuit and the UN3/5 at the far end under these conditions is 2·12 mA, and it switches on the mains supply to the reverberation plate.

When the push-button switch SC is closed the 16-kilohm resistor R7 is short-circuited; the current then increases to 8·06 mA and provides the control current for *increasing* reverberation time.

Closing of the push-button switch SD operates the relay RLA whose contacts change over the earth from the positive to the negative of the supply and apply the positive instead of the negative to the phantom tap on T1. At the same time push-button switch SC is disconnected. The current is again 8·06 mA but is in the reverse direction to that which is obtained by operation of switch SC, and this reverse current is used to *decrease* reverberation time.

The rest of the circuit shows the connections of the meter for indicating reverberation time and the phantom circuit on the output pair from the reverberation plate. Indicating current flows through this phantom circuit from the UN3/5 when its mains supply has been switched on by closing the *Plate* switch SB on the UN3/4.

1.5.3 Local Control Unit UN3/5 (Fig. 4)

The mechanical design of the UN3/5 closely follows that of the previous equipment. The circuit is shown in Fig. 4.

When the mains switch SA is closed the 47-volt d.c. relay supply is available but until further contacts are made the mains supply to the plate and the control motor are off, and no current flows to indicate the delay time.

When the *Plate* switch on the UN3/4 at the remote control point is closed a current of 2·12 mA flows from the phantom point of R1, R2 via MR1, relay A winding and R12 to earth. This current operates relay A but not relay B; the operate and release limits for relay B in terms of current flowing from relay A winding are 5 mA and 3 mA.

When relay A operates it operates relay D and the mains supply is connected to the reverberation plate and lights up the pilot lamp. The wiper of the potential divider RV1 is also connected via RLD2 to the phantom tap of R3, R4 on the outgoing line and current will flow through the meter on the UN3/4, its value being dependent on the position of the wiper.

When the push-button to increase reverberation time is pressed on the UN3/4, the current through the phantom circuit on the input line is increased to 8·06 mA and the transistorised relay B operates and relay A is kept operated. Relay B operates

relay E which applies power to the motor, causing it to run in the forward direction until the push-button is released.

Similarly when the push-button to decrease reverberation time is pressed on the UN3/4, the reverse current of 8·06 mA flows through MR2 and operates relay C. Reversal of current takes place quickly because the controlling relay in the UN3/4 is reasonably quick-acting and the time constant of the associated phantom circuit is only about two to three milliseconds for a 10-mile line.

Relay C operates the slave relay F and contact RLF1 applies power to drive the motor in the reverse direction. Contact RLF2 holds relay D which keeps the power connected to the reverberation plate and sends the indicating signal back to the UN3/4 meter.

Relays C, F and D are slugged on release by the rectifiers connected across their windings, and although the build-up time of the line current to the *Plate On* condition is about 15 to 20 milliseconds, there is no tendency for the mains relay D to release when the line current reverses. The release time of these relays is of the order of 25 milliseconds each.

Over-riding local control is provided by switches SA, SB, SC and SD, switch SA being normally left on. A voltmeter connected to jack J1 allows the operation of the potential divider circuit to be checked, any line faults being masked by R5 (51 kilohms).

1.5.4 Indication of Reverberation Time Setting

The potential-divider arrangements in the UN3/5 have been designed to avoid special calibration of the remote reverberation-time meter for its associated reverberation plate and thereby enable any UN3/4 to be used with any reverberation plate. In addition they had to be made suitable for transmitting the indicating current over a circuit with an earth return, and also to avoid employing zero current as an indicating signal because of possible failure of the signal path on a long line.

The reverberation time scale has been opened out at the lower end and closed up for higher values by offsetting the pin driving the pulley on the shaft of the potential divider (RV1 in Fig. 4). The potential divider itself is tapped at 15-degree intervals and the appropriate taps are connected to Zener diodes which maintain constant voltages between them. The average drop per diode is 6·4 volts. Thus the voltage applied to the phantom indicating circuit can be adjusted for each reverberation plate to give a standard value for a given reverberation time. Nominal relationships between voltage and reverberation time are given below.

Time (seconds)	*Nominal Voltage (negative to earth)*
1	19·2
2	25·6
3	32·0
4	38·4

In practice it is expected that the actual voltages obtained will not differ by more then ± 2 volts from the nominal values.

The total fixed resistance in series with the indicating meter is about 500 kilohms and depends almost entirely on R5 (51 kilohms) in the UN3/5, and R9 (430 kilohms) plus R8 (nominally 18 kilohms) and the meter resistance (1·5 kilohms) in the UN3/4. Line resistance of the order of 500 ohms therefore has negligible effect on the total.

The current through the meter therefore corresponds to the voltages applied to the phantom circuit by the potential divider, and the meter scale is marked with the corresponding reverberation time in seconds. The following is the actual meter calibration:

Current (μA)	*Marking*
0	*Off*
25·6	(mark only)
38·4	1
51·2	2
64·0	3
76·8	4
100·0	(mark only)

1.5.5 Maintenance of UN3/4 and UN3/5

The local controls on the UN3/5 can be used to vary the reverberation time and check that the reverberation times indicated on the remote meter agree with the times shown on the mechanical indicator mounted on the top of the reverberation plate. The maximum error is not likely to exceed 1/4 second at any point on the scale.

If the error is appreciably greater than this the adjustment of the potential divider can be checked by measuring the voltage at the test jack for various positions of the arm. The voltage should agree with the values given in Section 1.5.4 within ± 2 volts, and if necessary can be adjusted by altering the taps on the potential divider. If satisfactory adjustment cannot be obtained in this manner, the adjustment of the drive cord and potential-divider mounting should be checked to see that 1 second on the plate scale produces a 75-degree setting on the potential divider.

There should be no tendency for the mains switching relay (relay D of UN3/5) to flick when the *Decrease* switch SD of the UN3/4 is operated or released.

Relay clicks should only occasionally be audible at normal listening levels.

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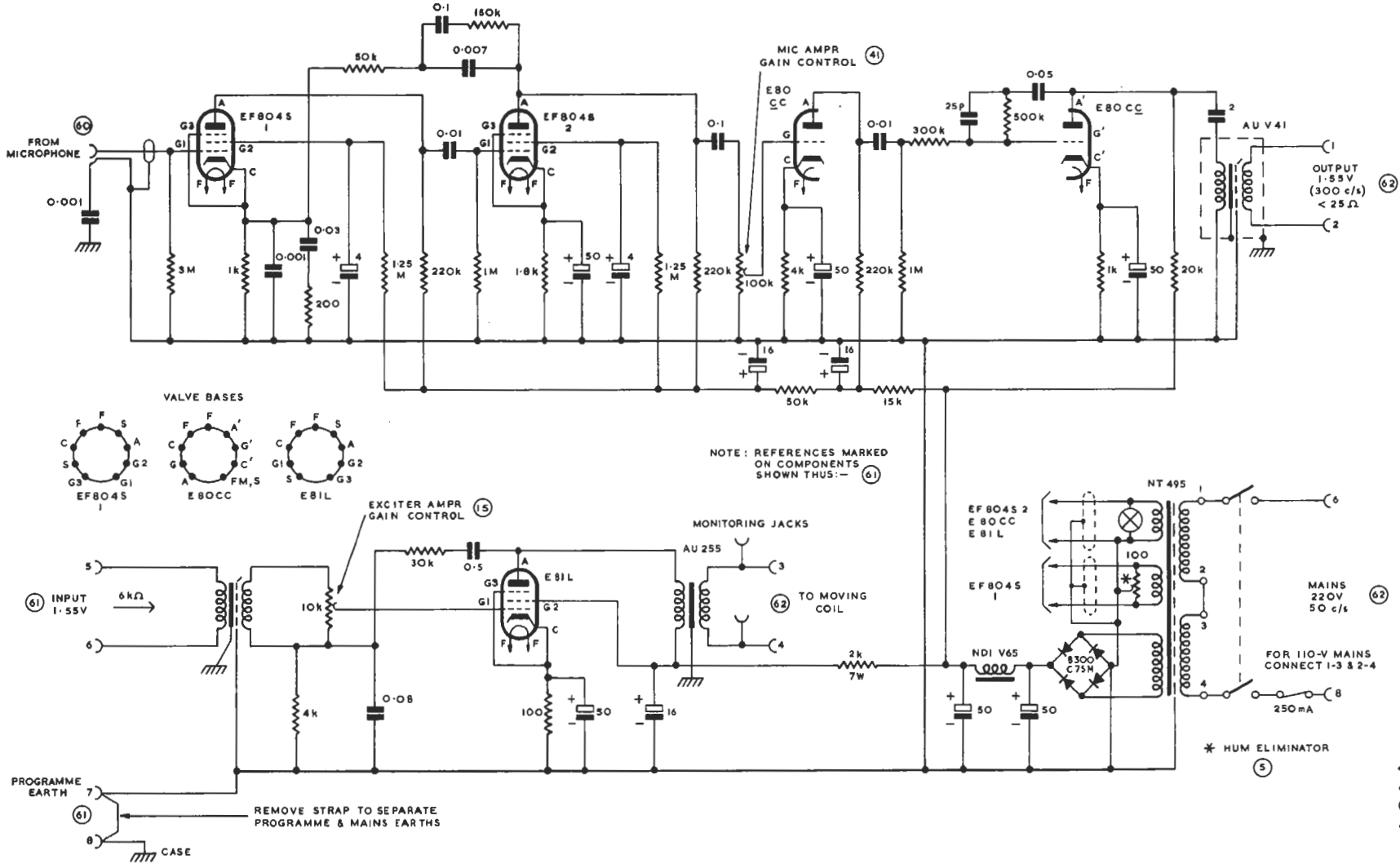
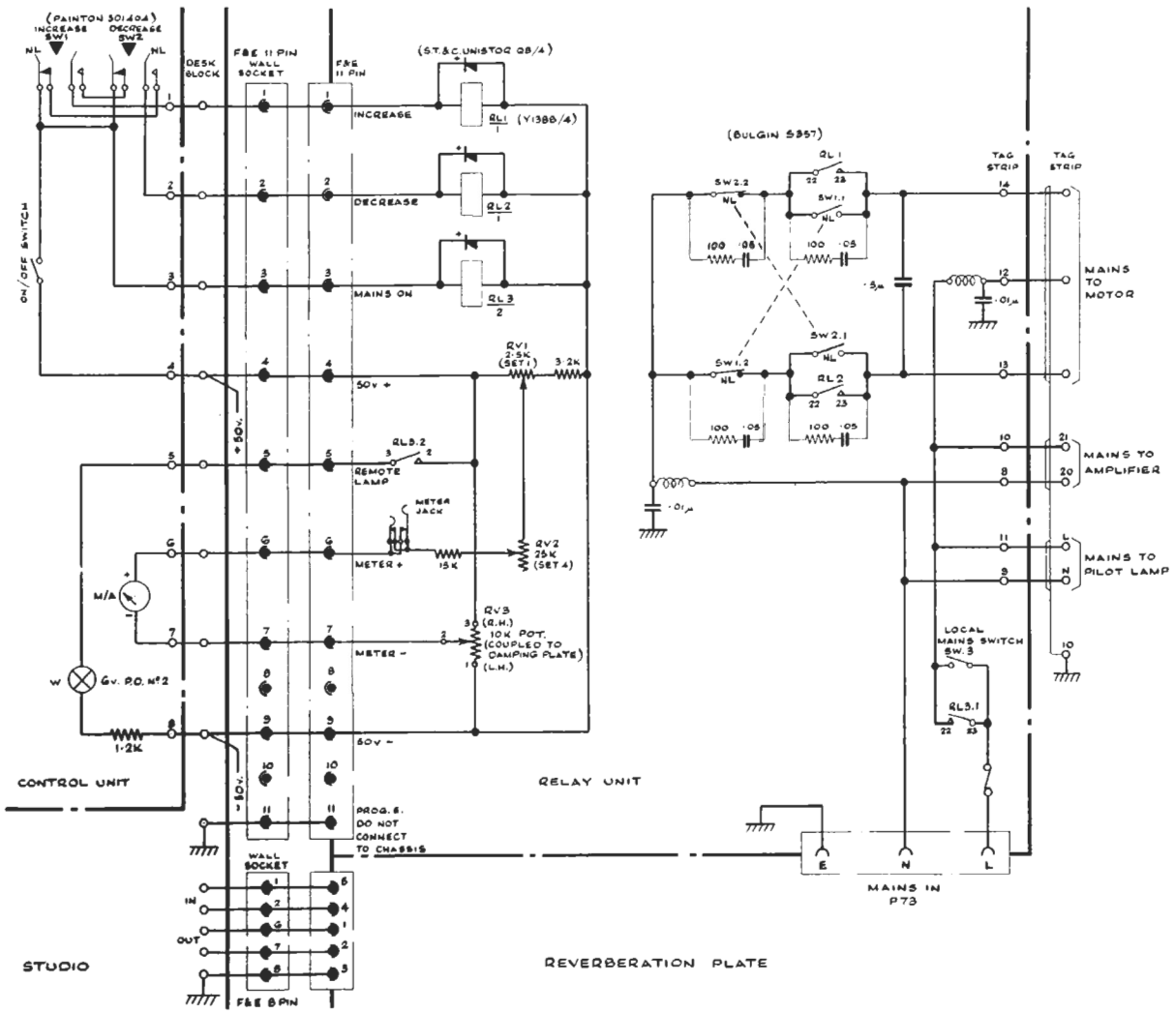
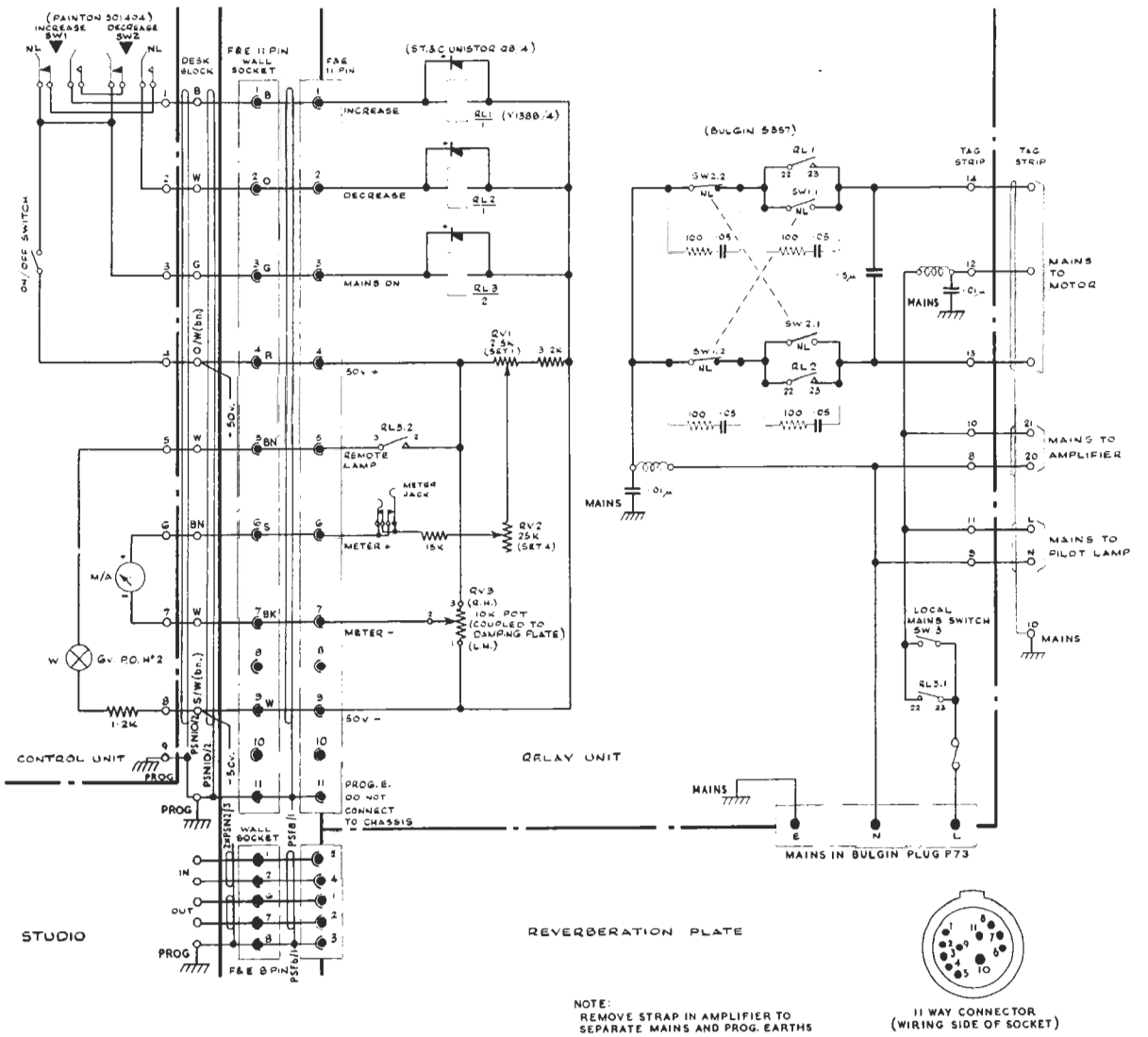


FIG 1

REVERBERATION PLATE EMT 140: AMPLIFIER CIRCUIT DIAGRAM

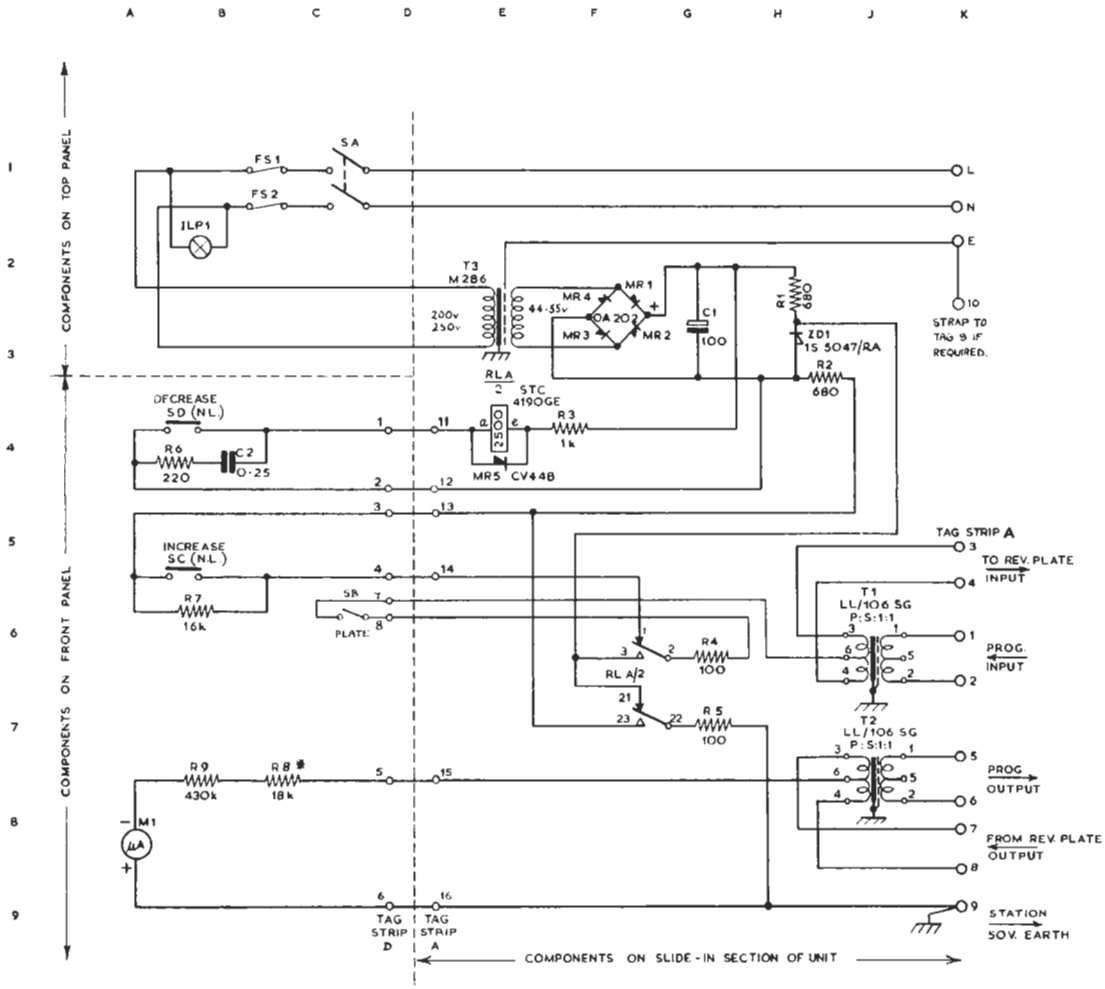


REVERBERATION PLATE EMT 140:
REMOTE CONTROL SYSTEM: CIRCUIT DIAGRAM



REVERBERATION PLATE EMT 140:
REMOTE CONTROL SYSTEM: CIRCUIT DIAGRAM

FIG 3

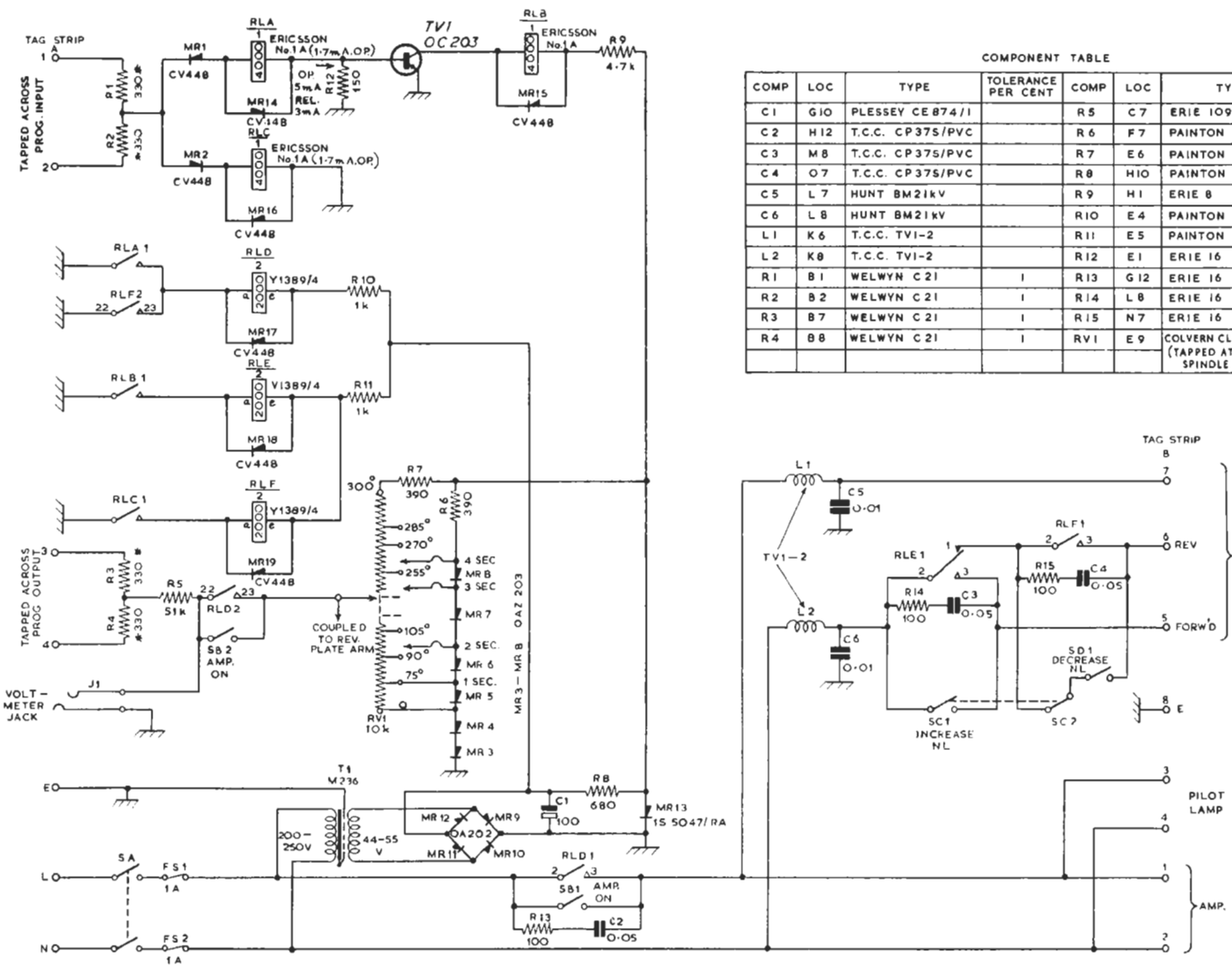


* TO BE ADJUSTED ON TEST TO PROVIDE 439kΩ MIN. TO 457 kΩ MAX. BETWEEN TAGS 5 & 6

COMPONENT TABLE

COMP	LOC	TYPE	TOLERANCE PER CENT	COMP	LOC	TYPE	TOLERANCE PER CENT
C1	G3	PLESSEY CE874/1		R5	G7	ERIE 16	
C2	B4	HUNT B50IK	20	R6	A4	ERIE 16	
R1	H2	PAINTON 301A		R7	B6	ERIE 109	
R2	H3	PAINTON 301A		R8	C8	ERIE 109	
R3	F4	PAINTON 301A		R9	B7	ERIE 109	
R4	G6	ERIE 16					

REMOTE CONTROL UNIT UN3/4 : CIRCUIT



COMPONENT TABLE

COMP	LOC	TYPE	TOLERANCE PER CENT	COMP	LOC	TYPE	TOLERANCE PER CENT
C1	G10	PLESSEY CE874/1		R5	C7	ERIE 109	2
C2	H12	T.C.C. CP375/PVC		R6	F7	PAINTON P301A	5
C3	M8	T.C.C. CP375/PVC		R7	E6	PAINTON P301A	5
C4	O7	T.C.C. CP375/PVC		R8	H10	PAINTON P301A	5
C5	L7	HUNT BM21kV		R9	H1	ERIE 8	10
C6	L8	HUNT BM21kV		R10	E4	PAINTON P301A	5
L1	K6	T.C.C. TV1-2		R11	E5	PAINTON P301A	5
L2	K8	T.C.C. TV1-2		R12	E1	ERIE 16	10
R1	B1	WELWYN C21	1	R13	G12	ERIE 16	10
R2	B2	WELWYN C21	1	R14	L8	ERIE 16	10
R3	B7	WELWYN C21	1	R15	N7	ERIE 16	10
R4	B8	WELWYN C21	1	RV1	E9	COLVERN CLR65/180/22 (TAPPED AT 15° INTERVALS SPINDLE DIAM 0·312 IN)	

TABLE FOR R1/R2 & R3/R4 BALANCE

DIFF	SHUNT
0·1Ω	1MΩ
0·2Ω	560 kΩ
0·3Ω	360 kΩ
0·4Ω	270 kΩ
0·5Ω	220 kΩ
0·6Ω	180 kΩ
0·7Ω	160 kΩ
0·8Ω	130 kΩ
0·9Ω	120 kΩ
1·0Ω	110 kΩ
2·0Ω	56 kΩ
3·0Ω	36 kΩ
4·0Ω	27 kΩ
5·0Ω	22 kΩ
6·0Ω	18 kΩ
7·0Ω	16 kΩ

NOTE:
MEASURE DIFFERENCE BETWEEN R1/R2 & R3/R4 & SHUNT HIGHER VALUE RESISTOR AS PER TABLE FINAL DIFFERENCE TO BE WITHIN ±0·5Ω
* ADJUST ON TEST FOR BALANCE (SEE TABLE)

LOCAL CONTROL UNIT UN3/5: CIRCUIT

FIG 4