

TECHNICAL INSTRUCTION

RX.2

**CENTRAL TAPE RECORDING
AND REPRODUCING ROOMS**

**BRITISH BROADCASTING CORPORATION
ENGINEERING DIVISION**

**TECHNICAL INSTRUCTION
RX. 2**

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CENTRAL TAPE RECORDING AND REPRODUCING ROOMS

SECTION 1

INTRODUCTION

1.1. GENERAL

Central apparatus rooms for magnetic tape recording and/or reproduction are installed in Bush House and Broadcasting House London. Each room is capable of accommodating 10 or more machines, together with ancillary apparatus which normally comprises control consoles and a bay carrying a linking panel and other equipment. One of the central rooms at Broadcasting House differs considerably from all the others and has no consoles.

Any individual machine may be used to handle a single-reel programme in conjunction with one set of controls provided on its adjacent console, and any two machines may be linked via the bay and any selected console to handle a multi-reel programme. (Fig. RX2.1.)

The central tape rooms are primarily intended for the recording or reproduction of programmes in circumstances where checking can conveniently take place elsewhere. Examples of normal use are the recording of such items as talks by a single speaker, with the machine output monitored in the studio cubicle; also reproductions to transmission, which are monitored by the continuity operator. The central rooms are not suitable for recording complicated closed-circuit productions, for which continuing liaison with the producer is essential.

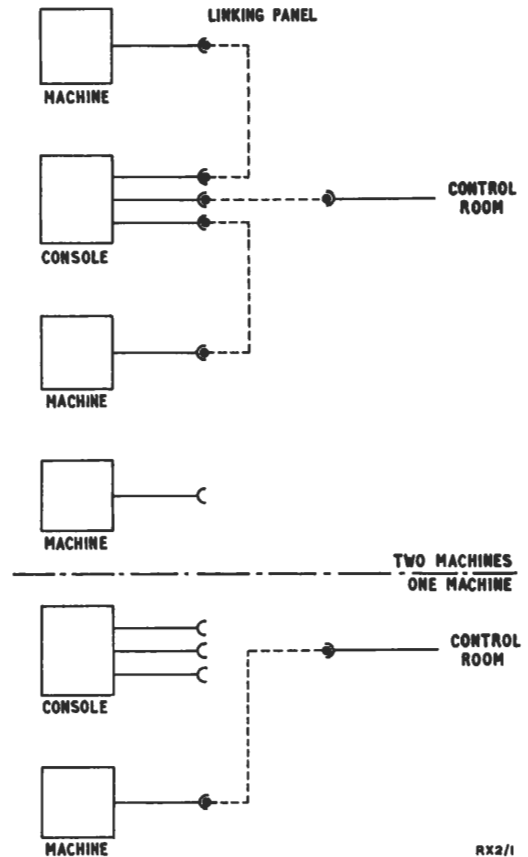


FIG. RX2.1 BASIC LINKING SYSTEM

1.2 INSTALLATION

Two central tape rooms, **CTR1** and **CTR2**, are installed at Bush House and two more, **H12** and **H18**, at Broadcasting House London. **CTR1** and **CTR2** are provided with **BTR/2** machines and **Type-C** linking consoles, which can be used either for recording or for reproduction. **H12** is also provided with **BTR/2** machines, but has **Type-B** linking consoles, which can be used for reproduction only. **H18** has bay-mounted **TR/90** machines without linking consoles, and is intended for recording and playback purposes.

Further differences between the rooms arise from the fact that whereas **CTR1** and **CTR2** are designed to operate in conjunction with the semi-automatic control-room equipment at Bush House, **H12** and **H18** are at present used with a 'wartime' control room.

The installations at Bush House are described first because they are representative of current standard design practice. The Broadcasting House installations, which are likely to be modified under Studio Centres Scheme B, are described in the latter part of the Instruction.

SECTION 2

GENERAL DESCRIPTION OF BUSH HOUSE CTR1 AND CTR2

2.1 FACILITIES

2.1.1 CENTRAL TAPE ROOM 1 (CTR1)

This room is equipped with 7 BTR/2 machines, 3 consoles, a distribution bay and a cubicle. One of the machines is tied direct to Facilities Unit for the recording of emergency despatches, leaving 6 machines for handling normal programmes. There is also accommodation for two further pairs of machines and two further consoles. Recording or reproduction with remote starting can be carried out via any of 10 groups of circuits (designated E11 to E20) connecting with the control room. Thus, any studio control desk or any continuity or other control (or control/monitor) position can remotely start the machines. There are also four groups of circuits connecting CTR1 with CTR2 and two further groups connecting CTR1 with E7.

2.1.2 CENTRAL TAPE ROOM 2 (CTR2)

This room is equipped with 9 machines, 6 consoles, a distribution bay and a cubicle. There is accommodation for three further machines. (Fig. RX2.2.) Recording or reproduction with remote starting can be carried out via any of 10 groups of circuits (designated E21 to E30) connecting with the control room. The installation is generally similar to that in CTR1.

2.2 MACHINE ROOM

2.2.1 DISTRIBUTION BAY

The equipment mounted on the distribution bays in CTR1 and CTR2 is:-

OS/10A oscillator (in CTR1) providing line-up tone for CTR1, CTR2 and adjacent channels. (A C/8 amplifier in CTR2 cubicle receives the tone from CTR1 and distributes it in CTR2.)

MNA/1 amplifiers to feed the P.P.Ms. on the control consoles.

Linking panel or 'master jackfield' comprising 15-way F. and E. sockets. Each socket connects the recording, reproducing and telephone lines, together with the signalling and miscellaneous technical control circuits concerned in machine operation. The sockets are arranged in rows as follows:-

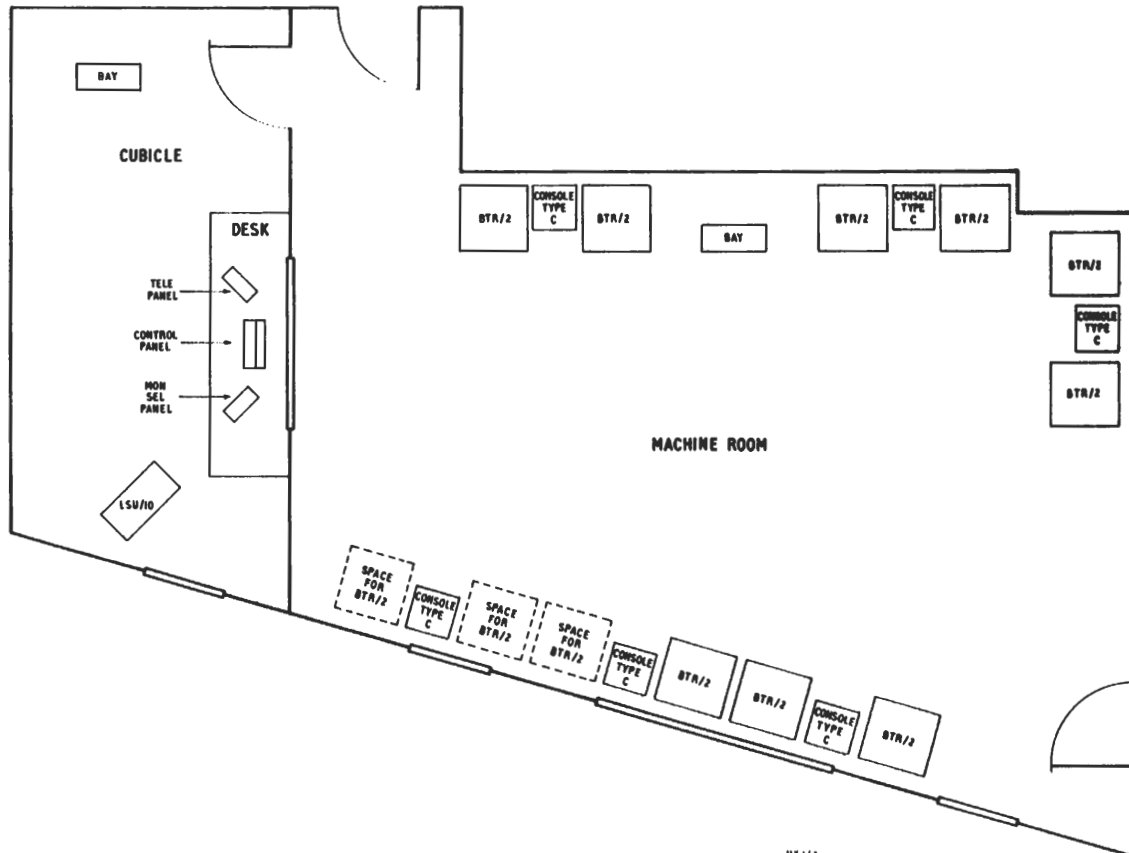


FIG. RX2.2 CENTRAL TAPE ROOM: PLAN VIEW
(BUSH HOUSE: CTR2)
Drawing No. PID 4093.2.1K

- (i) Machines LISTEN sockets. Above these is a row of keys, one per machine, which determine whether the machine on being started remotely will be switched to recording or reproduction.
- (ii) MACHINES.
- (iii) Console OUT RECORD/IN REPRODUCE. (Two sockets, A and B, per console.)
- (iv) Console IN RECORD/OUT REPRODUCE. (One per console.)
- (v) CONTROL ROOM LINES.
- (vi) MISCELLANEOUS LINES. (E.g., four 15-wire tie-circuits between CTR1 and CTR2, and two 15-wire tie-circuits between CTR1 and E7.)

A row of HV/7C switches, one for each control room line. The switches are provided to select cue programme from ring-mains for reproductions. Any programme not available on ring-main can be obtained from control room on the recording line, which is connected to a point on the HV/7C.

A row of change-over keys for switching the HV/7C outputs between lines 1 - 9 and 10 - 18.

3 mains units Type MU/16H for the amplifiers and (in CTR1) the oscillator.

2.2.2 MACHINES

Standard BTR/2 machines as used elsewhere in the Corporation are installed in CTR1 and CTR2. The capstan-drive motors can when necessary be fed from a separate stabilised-frequency supply as described in Instruction R.8.

A 3-position switch on each machine gives the following facilities:

- (a) Manual operation,
- (b) Auto-follow,
- (c) Remote start.

In the MANUAL position of the switch, the push-button controls

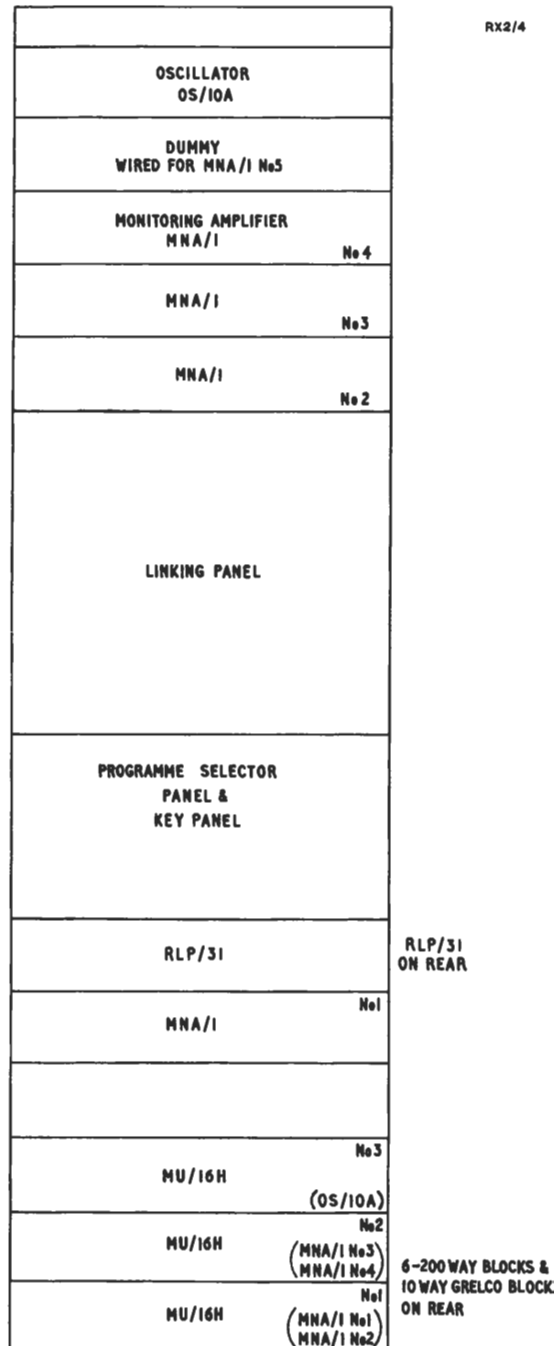


FIG. RX2.3 MACHINE ROOM DISTRIBUTION BAY: LAYOUT
(BUSH HOUSE: CTR1)
Drawing No. PID 3218.2.1A

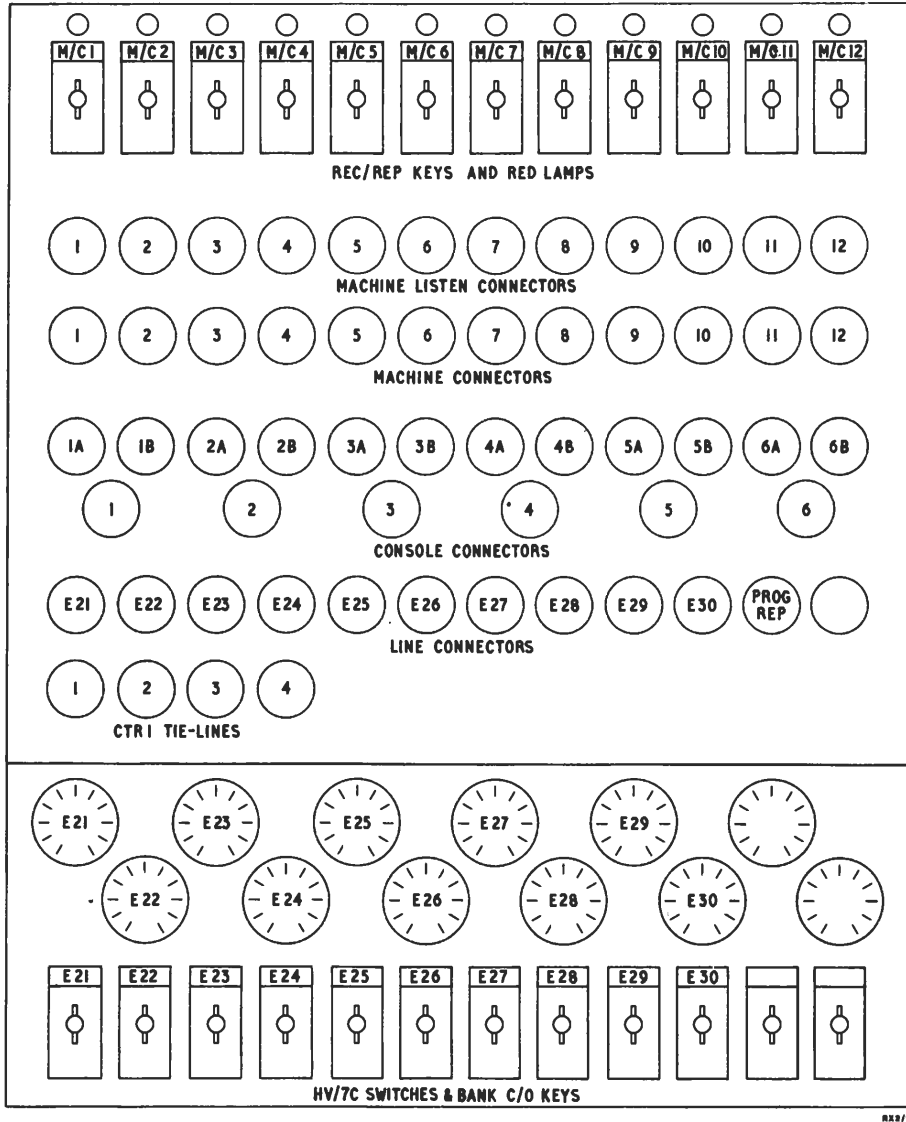


FIG. RX2.4 MACHINE ROOM DISTRIBUTION BAY: LINKING PANEL
(BUSH HOUSE: CTR2)

on the machine work normally. In the **AUTO-FOLLOW** position the **OFF** and **SPOOL** buttons are normal, but the **RECORD** and **REPLAY** buttons prepare the machine while leaving the operation of the drive motor to special contacts on the other machine connected to the console;

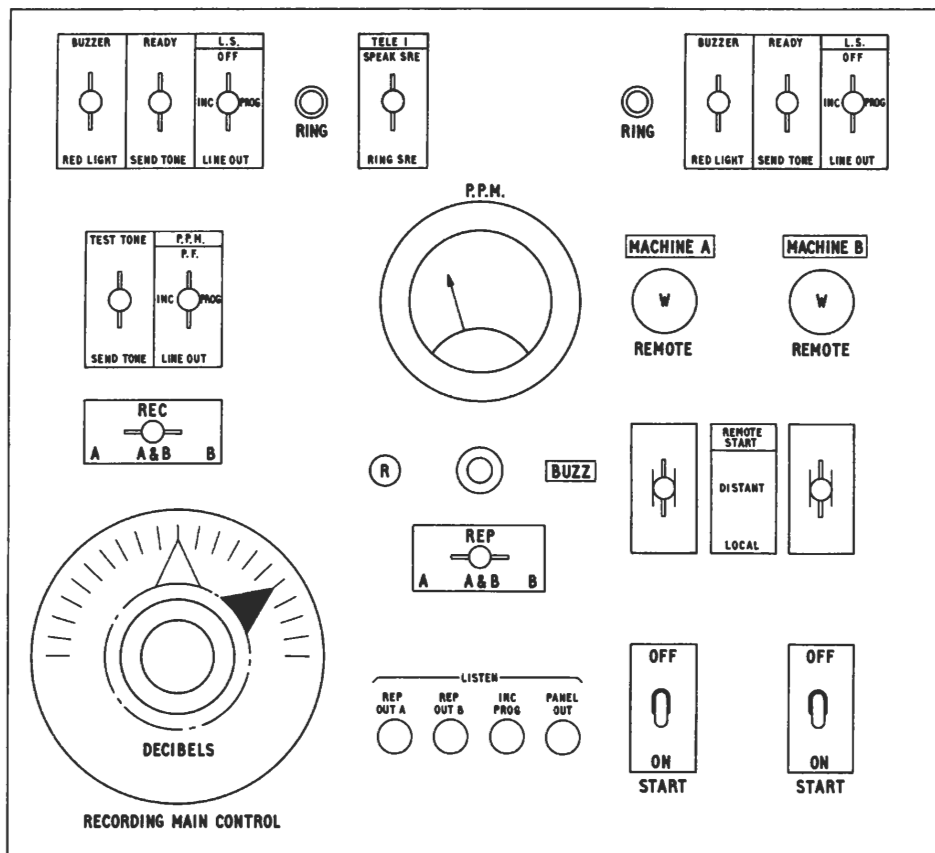


FIG. RX2.5 TYPE-C CONSOLE: PANEL 99: LAYOUT
(CTR1 AND CTR2)

the auto-follow circuits, although wired, are not used by the BBC except as mentioned at the end of Section 5.2. In the **REMOTE** position of the rotary switch, the push-buttons are not operative and the machine can only be started and stopped remotely.

2.2.3 CONTROL CONSOLES

The control panel (No. 99) on each console (Type C) provides the following facilities:

The top left-hand group of three keys (Fig. RX2.5), together with the adjacent push-button and the left-hand one (i.e., No. 1, 3, 5, etc.) of the two telephones resting on the flat top of the console are permanently associated with the machine on the left-hand side of the console, and are connected to any line or console to which the machine is plugged.

The top right-hand group of keys, together with the adjacent push-button and the right-hand telephone (No. 2, 4, 6, etc.) are similarly associated with the machine on the right-hand side of the console.

In each group, the left-hand one of the three keys is used for buzzer signalling to the control room or for switching on the local red light. The next key controls 900-c/s line-up tone and also operates an amber **MACHINE READY** lamp above the machine. This lamp is meant to indicate that the machine is set for recording or transmission, and can only be switched off from the desk in the cubicle. The third key operates a small loudspeaker mounted on the wall above the machine.

In **CTR2**, the middle key at the top of the panel enables the left-hand telephone to be used for communicating with the cubicle. In **CTR1** this key is not in use.

The lower part of the panel provides line-up and linking facilities for multi-reel programmes together with **DISTANT** or **LOCAL** remote operation of the machines by means of the following controls:

- (i) A key giving line-up tone or test tone. (See Section 5.9.)
- (ii) A P.P.M. change-over key.
- (iii) A recording change-over key.
- (iv) A constant-impedance reproducing change-over key.
- (v) A recording main gain control potentiometer.
- (vi) A lamp and a buzzer pushbutton mounted above (iv) and used for control room signalling.

Section 2

- (vii) 2 sets of keys, switches and lamps concerned with remote operation of the machines. The left-hand set are associated with the machine plugged to the left-hand or 'A' position of the change-over keys, while the right-hand set are associated with the machine plugged to the right-hand or 'B' position of the change-over keys. (The white REMOTE lamps on the panel are operated by putting the MANUAL/REMOTE switch of the appropriate machine to the REMOTE position. With the machine switch on REMOTE, and the DISTANT/LOCAL key on the panel in the LOCAL position, the machine can be started and stopped by means of the ON/OFF switch on the panel; if the DISTANT/LOCAL key is moved to DISTANT, an indication is given at the remote control point that the machine starting and stopping circuits are switched through, and a lamp lights in the machine-room cubicle to show that that particular control-room line has a machine set for remote control connected to it.)

A small jackfield at the bottom of the panel enables the inputs and output of the console to be checked on headphones. (For circuit details, see Fig. 1.)

Mounted behind the panel are various relays, while the lower part of the console houses the telephone batteries, a modified double-unit amplifier Type PFL/4B and two relay units Type RLP/17.

2.3 LISTENING CUBICLE

2.3.1 APPARATUS BAY

The equipment on the cubicle apparatus bays in CTR1 and CTR2 differs slightly, as shown in Fig. RX2.6. The C/8 amplifier in CTR2 distributes tone from the OS/10A oscillator on CTR1 distribution bay. The cut-off keys, fitted with locking handles, operate the cut-off relays on the panel lower down. The AT/14 attenuator panels in CTR/1 are no longer used. The control-room signalling relay panels for CTR2 are in the R.D.F. room.

2.3.2 CUBICLE DESK

(a) GENERAL

The cubicle desk carries a control panel, a monitor selector panel and (in CTR2) a telephone panel. The telephone panel of CTR1 is in the machine room. The panels form the front portions

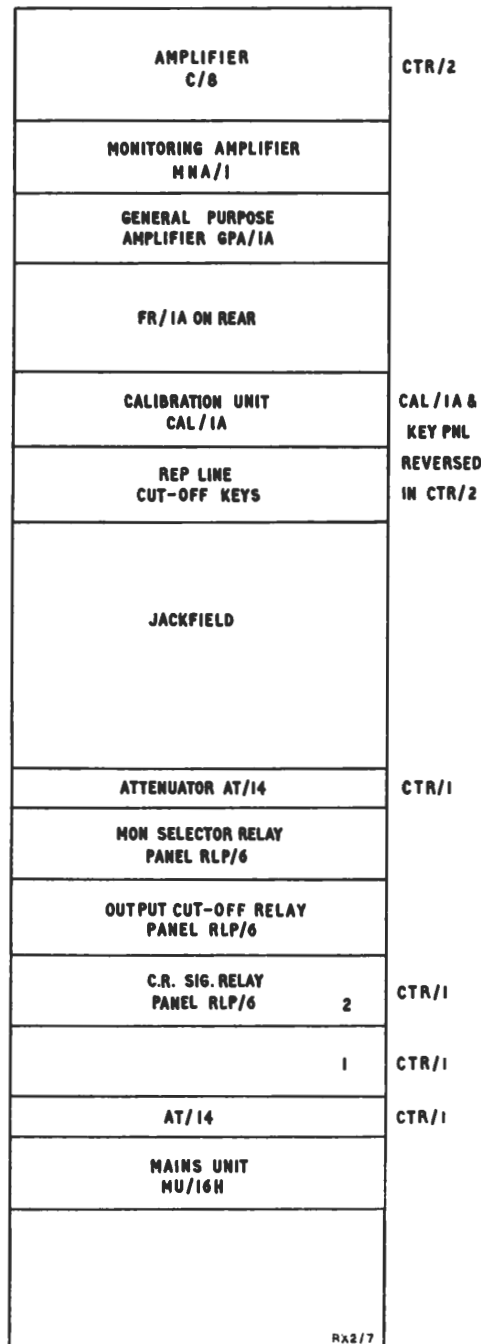


FIG. RX2.6 LISTENING CUBICLE APPARATUS BAY: LAYOUT
(CTR1 AND CTR2)
Drawings No. PID 3384.2.1C and 4320.2.1B

of boxes which, with the exception just mentioned, are screwed to the desk surface.

Above the desk is a talkback microphone, while on the wall are frequency and volt meters with a MAINTAINED/CONTROLLED SUPPLY change-over switch. Beneath the desk are two shelves for V.C.U.s; there is also a cupboard with a talkback amplifier and relay. Also in the cubicle are the apparatus bay described in 2.3.1 and an LSU/10 for monitoring.

The talkback microphone is operated by a key on the control panel, and is used with a loudspeaker in the machine room.

The inputs and outputs of the two V.C.U.s (when fitted) are connected via tie-lines to jacks on the cubicle bay. The bay jackfield carries programme and telephone circuits only; it can be used to insert a V.C.U. in any outgoing line, or in an emergency to connect the output of any machine directly to any line. So far as programme lines are concerned, this jackfield overrides the sockets on the machine-room distribution bay.

(b) TELEPHONE PANEL

This panel comprises a key-and-lamp unit KL/33 and is used in conjunction with an operator's telephone. In CTR1, where panel and operator's telephone are in the machine room, there is an extension telephone in the cubicle and the panel has 16 SPEAK/EXTEND keys with a common RING pushbutton. In CTR2, where panel and operator's telephone are in the cubicle, the panel has 16 SPEAK/RING keys and a second cubicle telephone is provided giving direct access to the left-hand telephones of all the consoles.

The keys and indicators are tied to the incoming telephone lines from the control room, operations room, bookings section, and elsewhere. Associated with the indicators in CTR1 and CTR2 is a buzzer unit which sounds for 20-30 seconds only (if not cancelled earlier by answering the call). At the end of this time a thermal relay operates, and any further ring on the same line recalls the E.M.X. operator in the control room, although the indicator lamps in the channel remain alight. An additional button on the telephone panel allows recording staff to recall the E.M.X. operator across the line.

On the side of each console telephone is a switch which can be raised to disconnect the internal bell.

(c) CONTROL PANEL

This embodies an indicator-panel with repeat REMOTE lamps, RECORD lamps and control-room red lights for all incoming lines, repeat amber READY and red START lamps for each machine, and switching arrangements for cancelling individual amber READY lights in the cubicle and the corresponding lights above the machines. The panel also carries a P.P.M. instrument with a NORMAL/AVERAGE switch, an HV/7C, a loudspeaker change-over key giving access either to the HV/7C or to the monitoring circuit selected on the right-hand panel, a loudspeaker volume control and a talkback key.

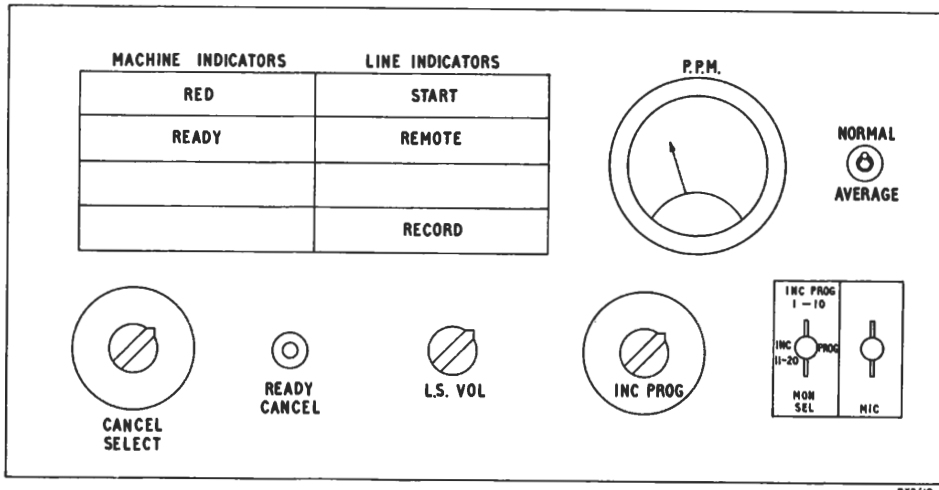


FIG. RX2.7 CUBICLE DESK: CONTROL PANEL
(BUSH HOUSE: CTR2)

(d) MONITOR SELECTOR PANEL

This panel carries two rows of self-cancelling pushbuttons for operating the monitor selectors, and a three-way change-over key. The selectors themselves are 8-bank 12-outlet digit-switches (Section 4.3.2), and are mounted on a panel Type RLP/6 on the cubicle bay as previously stated. The upper row of pushbuttons controls one selector, which gives access at different bank levels to the output and input of each machine; the lower row of buttons controls the other selector, which gives access to outgoing lines at the point

where they leave the recording room. Comprehensive-checking facilities between the three monitoring points thus simultaneously available are provided by the change-over key, labelled as in Fig. RX2.8.

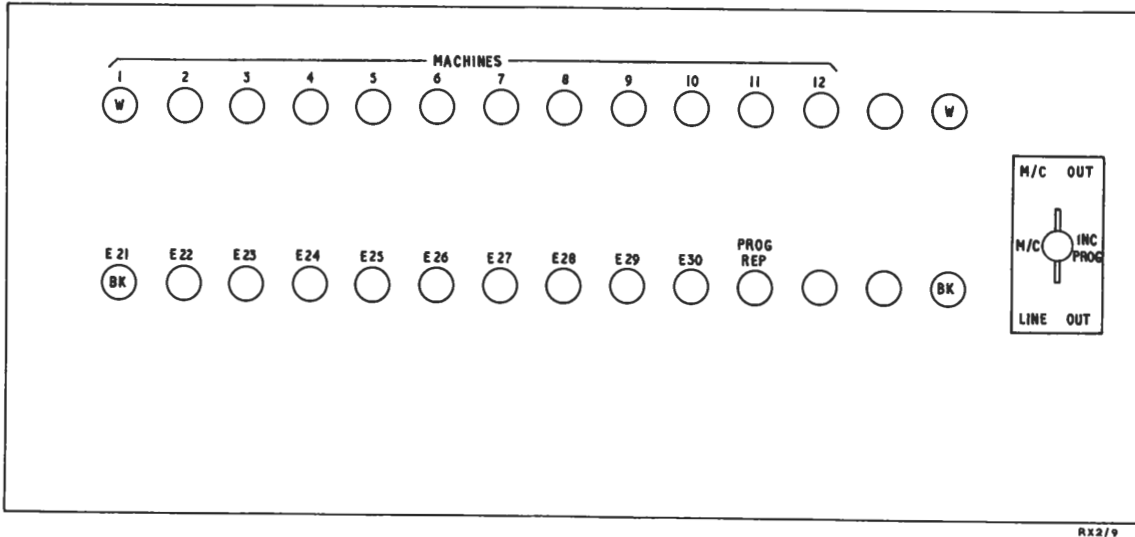


FIG. RX2.8 CUBICLE DESK: MONITOR SELECTOR PANEL
(BUSH HOUSE: CTR2)

2.4 POWER SUPPLIES (FIG. RX2.9)

The power supplies to the equipment are routed via recording supply cabinets feeding a maintained[⊕] supply to black sockets and wall-mounted signal-lamps and a choice of controlled or maintained[⊕] supplies to white sockets. These black or white sockets are a 3-pin type made by Dorman and Smith and are used with plugs of which one pin is a fuse.

WARNING:- The voltage between the line pins of the black and the white sockets respectively can vary between zero and twice the phase voltage, this variation occurring at twice the difference frequency of the maintained[⊕] and controlled supplies.

Every machine is fitted with two power cables, one plugged to a white socket and the other to a black; the drive motor and stroboscope neon can be switched at the machine to either socket, whereas the spooling motors and amplifiers are permanently connected

⊕ Non-maintained mains supply in CTRL.

to the cable from the black socket, and thus to the maintained[⊗] supply. Every console is plugged to a black socket.

In CTR1 the five sockets required for each console and its associated pair of machines are fed from a separate recording supply cabinet, Type RSC/1. This has two inputs controlled by a change-over-and-isolating switch and three outputs via individual miniature circuit-breakers as shown in Fig. RX2.9. In CTR2 the control apparatus is all mounted in one large wall cabinet, with toggle-switches for the change-over.

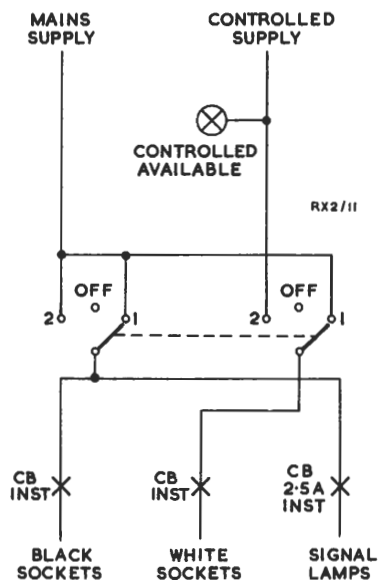


FIG. RX2.9 RECORDING SUPPLY CABINET RSC/1: SCHEMATIC DIAGRAM

The inputs in either instance are:-

1. Maintained[⊗] supply from mains or local diesel-driven generator[⊗].
2. Controlled supply from motor-generator set with stabilised voltage and frequency.

⊗ Non-maintained mains supply in CTR1.

The outputs are:

1. Feed to black sockets via instantaneous circuit-breaker.
2. Feed to white sockets via instantaneous circuit-breaker.
3. Feed to mains-voltage wall-mounted signal lamps via 2.5-amp instantaneous circuit-breaker.

The feeds of the maintained[⊗], controlled and signal-lamp supplies to the various RSC/1 cabinets or, in CTR2, the combined cabinet are routed via an isolating-switch and three further circuit-breakers in a master cabinet, Type RSC/2, mounted near the machine-room door. A fourth circuit-breaker in the RSC/2 connected on the incoming side of the isolator feeds the bay line-up tone oscillator (if fitted) directly from the supply; this arrangement allows the oscillator to be left permanently switched on, thus improving stability.

The power supplies in the monitoring cubicles are taken from black sockets fed via another cabinet, Type RSC/2B, fitted with an isolating-switch and circuit-breakers like the RSC/2 but differing from this latter in having no oscillator supply.

A complete description of cabinets RSC/1, RSC/2 and RSC/2B, together with further information on 'maintained' and 'controlled' supplies, is given in Instruction R.8, Sections 1 and 2.

⊗ Non-maintained mains supply in CTR1.

SECTION 3

CTR1 AND CTR2 MACHINE-ROOM BAY LINKING PANELS:

CIRCUIT ALLOCATIONS IN 15-WAY SOCKETS

3.1 GENERAL

Any of the BTR/2 machines may be connected singly, in pairs, or in parallel groups to any one of the available control room lines. These connections are made via the linking panel on the machine-room bay. The circuit allocations with respect to the pins of the linking-panel sockets are:-

<i>Pin</i>	<i>Function</i>	<i>Key Diagram</i>
1	Autofollow Receive	Fig. 2
2	Autofollow Send	Fig. 2
3-4	Telephone Line	Fig. 5
5-6	Reproducing Line	Fig. 1
7-8	Recording Line	Fig. 1
9	Start	Fig. 2
10	'Remote' Indicator	Fig. 2
11	Test Tone Switching	Fig. 2
12	'Single/Dual' Machine Linking	Fig. 2
13	Control Room Buzzer	Fig. 2
14	Telephone Indicator/Cancel	Fig. 5
15	Impedance Switching for Recording	Fig. 2

3.2 LOCAL CIRCUITS

Certain of the pin circuits are used only locally as a link between machines and are not extended to the cubicle indication system or to outgoing lines. Such circuits are:-

<i>Pin</i>	<i>Function</i>
1	Autofollow Receive
2	Autofollow Send
11	Test Tone Switching
12	'Single/Dual' Machine Linking

The corresponding pins on the CONTROL ROOM LINE sockets are not, therefore, wired.

3.3 'MACHINE' AND 'LISTEN' SOCKETS

The sockets designated MACHINE and LISTEN are wired in parallel on pins 1 - 14. Pin 15 of the LISTEN sockets is left unwired to prevent more than one machine 600-ohm load from being applied by R600 relays under recording conditions if machines are directly paralleled via their LISTEN sockets. The START RECORD and START REPRODUCE circuits of each machine are taken to the REC./REP. key above the corresponding LISTEN socket, and the START circuit from the MACHINE and LISTEN sockets is also taken to this key.

3.4 INTERDEPENDENCE OF CIRCUITS

Many of the circuits of the equipment are interdependent, and for convenience their functioning will be considered in relation to the connections established via each pin or group of pins on the 15-way sockets.

SECTION 4

THE PROGRAMME CHAIN IN CTR1 AND CTR2

4.1 RECORDING CHAIN (FIG. 1)

4.1.1 SINGLE MACHINE RECORDING (FIG. RX2.10)

For recording on one machine only, the control room line socket is plugged to a **MACHINE** socket by means of a 15-way double-ended cord, and the **REC./REP.** key operated to **RECORD**. (The recording line is also picked up when the key is not operated, although with different auxiliary circuits set up which facilitate the use of the line for receiving cue programme.)

Fig. RX2.10 shows the programme chain used for recording from control room with a single machine. The signal for recording is supplied at zero level from a 600-ohm amplifier in the control room via one of the recording lines. Both the line and the machine-room circuit are accessible on a jackfield mounted on the cubicle bay.

On the machine-room bay linking panel, pins 7 and 8 of the control room line socket and the **MACHINE** socket are connected via two conductors of the cord. Relays **RC2** and **R600.1** (or **R600.2**) are operated by a further circuit (Fig. RX2.22) established via the cord with the **REC./REP.** key on **RECORD**.

When relay **RC2** operates, **RC2-1/2** complete the direct circuit to pins 7 and 8 while **RC2-3/4** remove a 600-ohm load from the line. When relay **R600.1** or **R600.2** operates, its contacts restore the 600-ohm load. This loading is required across the input of the 8-dB pad inserted in the following circuit for single-machine operation and provides the correct receiving end impedance for the recording line; for dual-machine operation the relay remains unenergised and no loading resistance is introduced at this point.

Where reproduction is concerned and not recording, relays **RC2** and **R600.1** or **R600.2** are not operated, since no earth is available from the unoperated **REC./REP.** key. **RC2-1/2** connect the line to the separate-feed position of an **HV/7C** for cueing purposes, while **RC2-3/4** (and not **R600.1-1/2** or **R600.2-1/2**) terminate the line in 600 ohms.

From the **MACHINE** socket the signal is conveyed via contacts of the **BT** and **ST** relays to the monitor circuits and the recording input of the machine.

During single-machine recording, the **BT** relay remains unoperated,

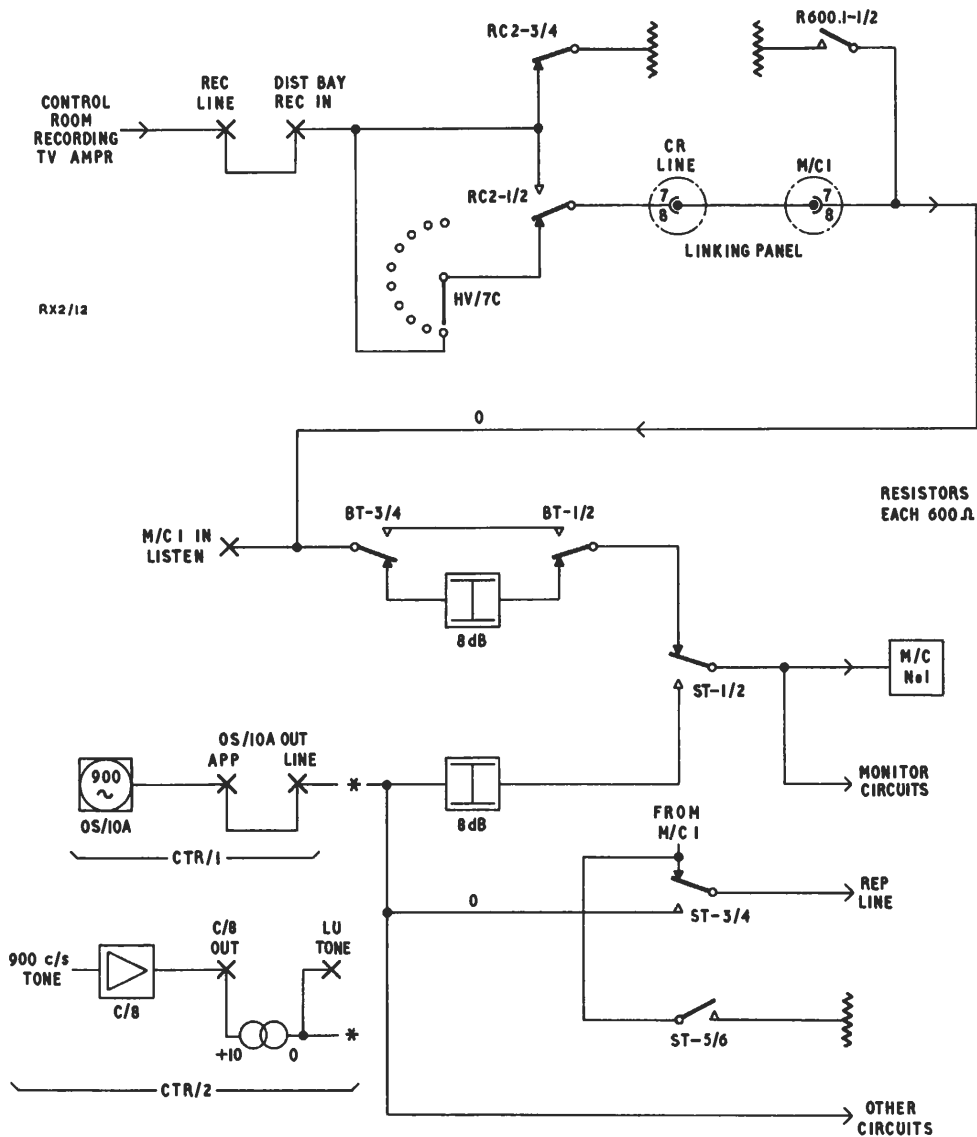


FIG. RX2.10 SINGLE MACHINE RECORDING: PROGRAMME SCHEMATIC

and an 8-dB loss is thus introduced by the pad between BT-3/4 and BT-1/2. For dual-machine recording the BT relay operates (Section 5.6) and removes the loss-pad from circuit, thus providing a control margin for the potentiometer Type PB/1L1 included in the dual-machine recording chain. (Fig. RX2.11.) For dual-machine reproduction the 8-dB pads of individual machines are replaced by a single pad. (Section 4.1.2.)

Tone at -8 dB can be applied to the recorder input via ST-1/2 by operating the SEND TONE/READY key (Section 5.9) to SEND TONE. Contacts ST-3/4 and ST-5/6 are concerned with the reproducing line. (Section 4.2.)

4.1.2 RECORDING WITH TWO LINKED MACHINES (FIG. RX2.11)

Fig. RX2.11 shows the linking circuit provided to permit recording with two machines. The input circuit preceding the CONTROL ROOM LINE socket and the output circuit beyond each MACHINE socket are shown in Fig. RX2.10 and described in Section 4.1.1.

The signal path is controlled by the RC and RT relays; when neither of these is operated, programme from control room at zero volume is attenuated by a nominal 8 dB before passing to the two machine inputs in parallel.

Relay RC operates when a machine is plugged to the MACHINE A or MACHINE B socket of the linking circuit and the appropriate REC./REP key is on RECORD, but does not operate if the key is on REPRODUCE. When RC operates it replaces the 8-dB pad by the recording control potentiometer and change-over key, which introduce the same loss as the pad.

The control potentiometer, Type PB/1L1, is a symmetrical balanced 600/600-ohm bridged-H attenuator having 21 studs with a loss ranging from zero on stud 20 to infinity on stud 0. The loss per stud between intermediate studs is:-

Studs	1-2	2-4	4-10	10-20
Loss	8 dB	6 dB	3 dB	2 dB

The recording change-over key allows either or both machines to be selected for recording. Three 1.2-kilohm resistors are associated with the key, in all positions of which two of the resistors are connected in parallel across the recording line; consequently a 600-ohm termination is always seen from the sending

(i.e. control room) end. The input impedance of a machine itself is high compared with 600 ohms.

Provision is made for applying zero-level 900-c/s tone to the

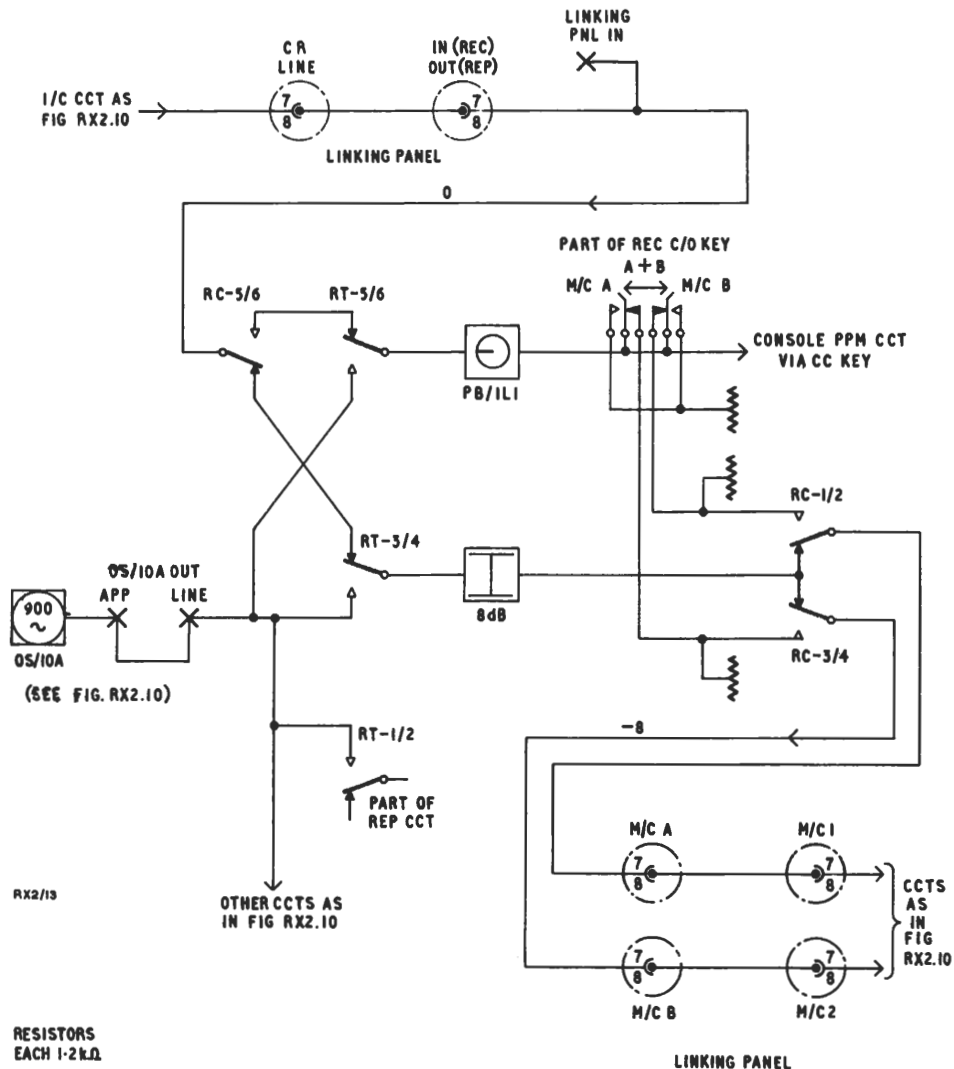


FIG. RX.2.11 LINKING CIRCUIT FOR RECORDING WITH TWO MACHINES

inputs of both the PB/1L1 and the 8-dB pad, via the contacts of relay RT. This relay is operated when the SEND TONE/TEST TONE key (Fig. RX2.25) is thrown to SEND TONE, always provided that neither of the two linked machines is set to DISTANT REMOTE.

4.2 REPRODUCING CHAIN (FIG. 1)

4.2.1 SINGLE MACHINE REPRODUCING (FIG. RX2.12)

For reproducing from one machine, the control room line socket is plugged to the MACHINE socket with the machine REC./REP. key on REPRODUCE. (With the key on RECORD, the reproducing line is also picked up, but with different auxiliary circuits.)

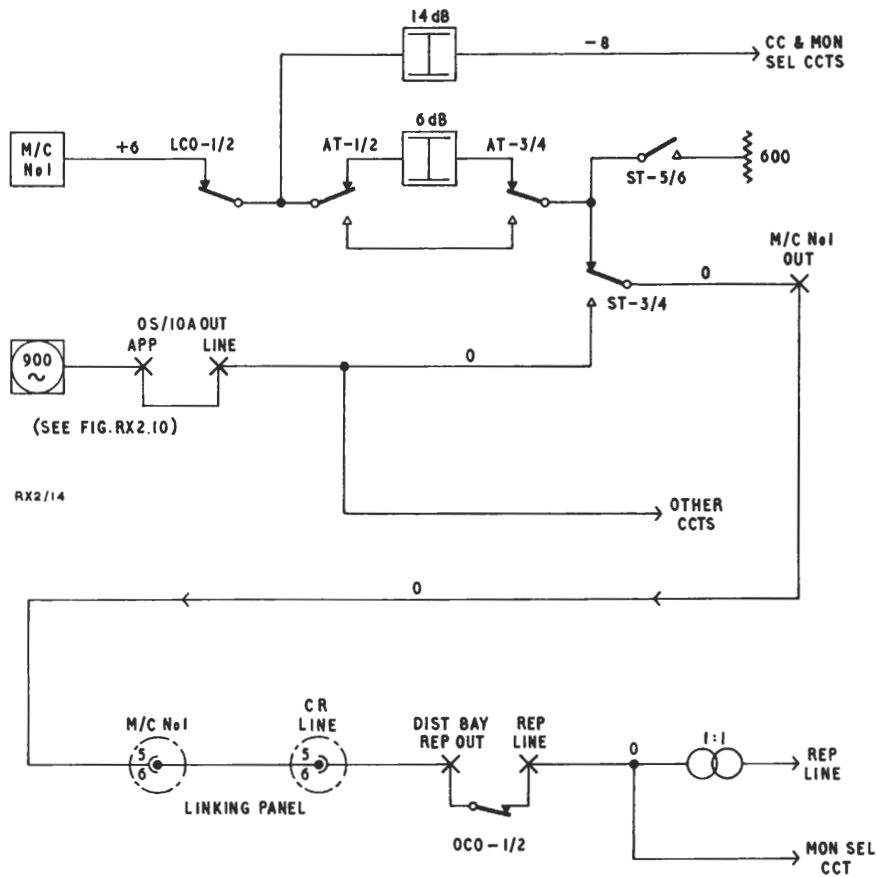


FIG. RX2.12 SINGLE MACHINE REPRODUCING: PROGRAMME SCHEMATIC

Fig. RX2.12 shows the chain used for reproducing programme to control room from a single machine. The machine reproducing circuit presents a source impedance of 600 ohms to the line. The output

level is +6 dB. The signal path is controlled by LC0-1/2, which open and interrupt the circuit as soon as the machine is switched to REMOTE, but reclose (after a delay of one or two seconds) when the red START light is switched on from the control room. This arrangement is intended as a precaution against broadcasting the run-up of the machine.

The circuit beyond LC0-1/2 is bridged by a 14-dB high-impedance pad connecting to the monitor selector system (Section 4.3) and machine comprehensive checking key. (Fig. RX2.14.) A further pad providing 6-dB of attenuation with 600/600-ohm terminations is connected in the programme chain via contacts of relay AT. During single-machine reproduction this relay remains unoperated, and a 6-dB loss is thus introduced by the pad between AT-1/2 and AT-3/4. For double-machine reproduction the AT relay operates (Section 5.6) and removes the loss-pad from circuit, thus compensating for a 6-dB loss introduced by the reproducing change-over key. (Section 4.2.2.)

Provision is made for supplying 900-c/s zero-level tone via contacts of relay ST, which operates when the machine SEND TONE/READY key on the linking console is thrown to SEND TONE, provided the machine is not set to REMOTE and the red light is not on. Contacts ST-3/4 cut programme and connect the output of the oscillator OS/10A (or amplifier C/8) to the outgoing circuits, while ST-5/6 connect a 600-ohm shunt across the 6-dB loss-pad to avoid disturbing the level in the machine-output monitoring circuits.

On the distribution-bay linking panel, pins 5 and 6 of the MACHINE socket and the control room line socket are connected via two conductors of a 15-way cord. Thence the signal passes at zero level to the reproducing line and line-monitor selector circuit.

The output to control room is routed via two break-jacks on the cubicle apparatus bay and the normally-closed contacts of relay OCO. This relay is provided to allow the reproducing line to be cut when two machines are recording in parallel, and thus to avoid an echo effect in the machine output circuits which, with Type-B control-room equipment, are also paralleled. The relay is operated by the REP. LINE OFF key on the cubicle bay, via contact RC2-6, which is closed when the key is set for recording. (Section 5.7.)

4.2.2 REPRODUCING WITH TWO LINKED MACHINES (FIG. RX2.13)

Fig. RX2.13 shows the linking circuit for reproducing with two machines. The input circuit preceding each MACHINE socket and the

output circuit following the control room line socket are shown in Fig., RX2.12 and described in Section 4.2.1.

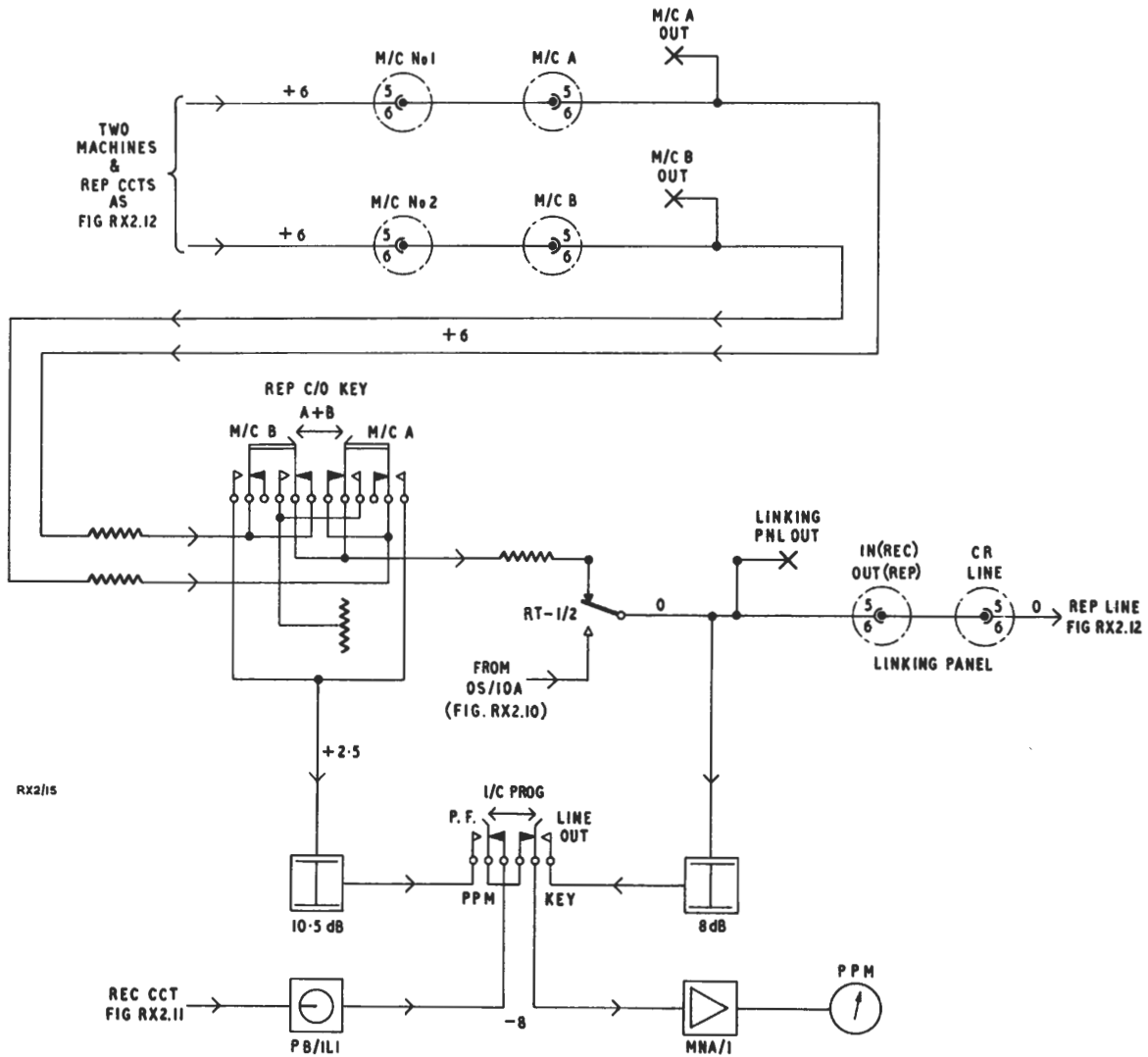


FIG. RX2.13 LINKING CIRCUIT FOR REPRODUCING WITH TWO MACHINES

The signal path goes directly to the reproducing change-over key. This is provided with a network having a constant input and output impedance of 600 ohms and a fixed loss of 6 dB for all positions of the key. According to the key setting, the output of either or both machines can be sent to line.

Tone at zero level can be sent to line instead of programme

by throwing the SEND TONE/TEST TONE key (Fig. RX2.25) to SEND TONE, provided neither machine is switched to DISTANT REMOTE and no red light is on. Relay RT then operates and RT-1/2 switch from programme to tone.

4.3 MONITORING CIRCUITS

4.3.1 GENERAL (FIGS. RX2.13, RX2.14 AND RX2.15)

Figs. RX2.13 and RX2.14 show the connections of the monitoring circuits to the programme chain. Comprehensive monitoring is provided at the input and output of each machine, as well as on each outgoing line to the control room. Each machine is fitted with its own P.P.M., for use when the machines are operated singly.

Fig. RX2.13 shows the MNA/1 amplifier and P.P.M. meter provided for each linking console. The P.P.M. can be switched between LINE OUT, INCOMING PROGRAMME AND PREFADE by means of a key. (The implications of these designations are:- reproducing line, recording line and the other machine.)

Referring to Fig. RX2.14, the machine inputs at -8 dB and the machine outputs attenuated from +6 dB to -8 dB are taken to the loudspeakers above the individual machines and in parallel to the monitor selectors. (Section 4.3.2.) The machine loudspeakers are controlled by changeover-and-off keys, which are followed by modified high input-impedance amplifiers Type PFL/4B. (Instruction S.3.)

The monitoring connections from the control room lines, fed at 0 dB, are taken to monitor selectors only. The output from the monitor selectors is routed via a high input-resistance loss-pad and a GPA/1A amplifier to visual and aural monitoring equipment in parallel. (Fig. RX2.15.) Visual monitoring is effected by means of an MNA/1 amplifier feeding the cubicle P.P.M. instrument via a slugging switch which allows the P.P.M. to be used for reading 'average' peaks. (Instruction S.4, page 64.) Aural monitoring is by means of the cubicle loudspeaker, the circuit of which includes the desk volume control and contacts of two keys; one of the keys allows the loudspeaker input to be taken either from the monitor selectors or from the desk HV/7C, while the other key, which is that controlling the talkback microphone, cuts off the cubicle loudspeaker when this microphone is live.

The talkback circuit itself is controlled by a relay operated via another contact of the key. The talkback microphone is connected

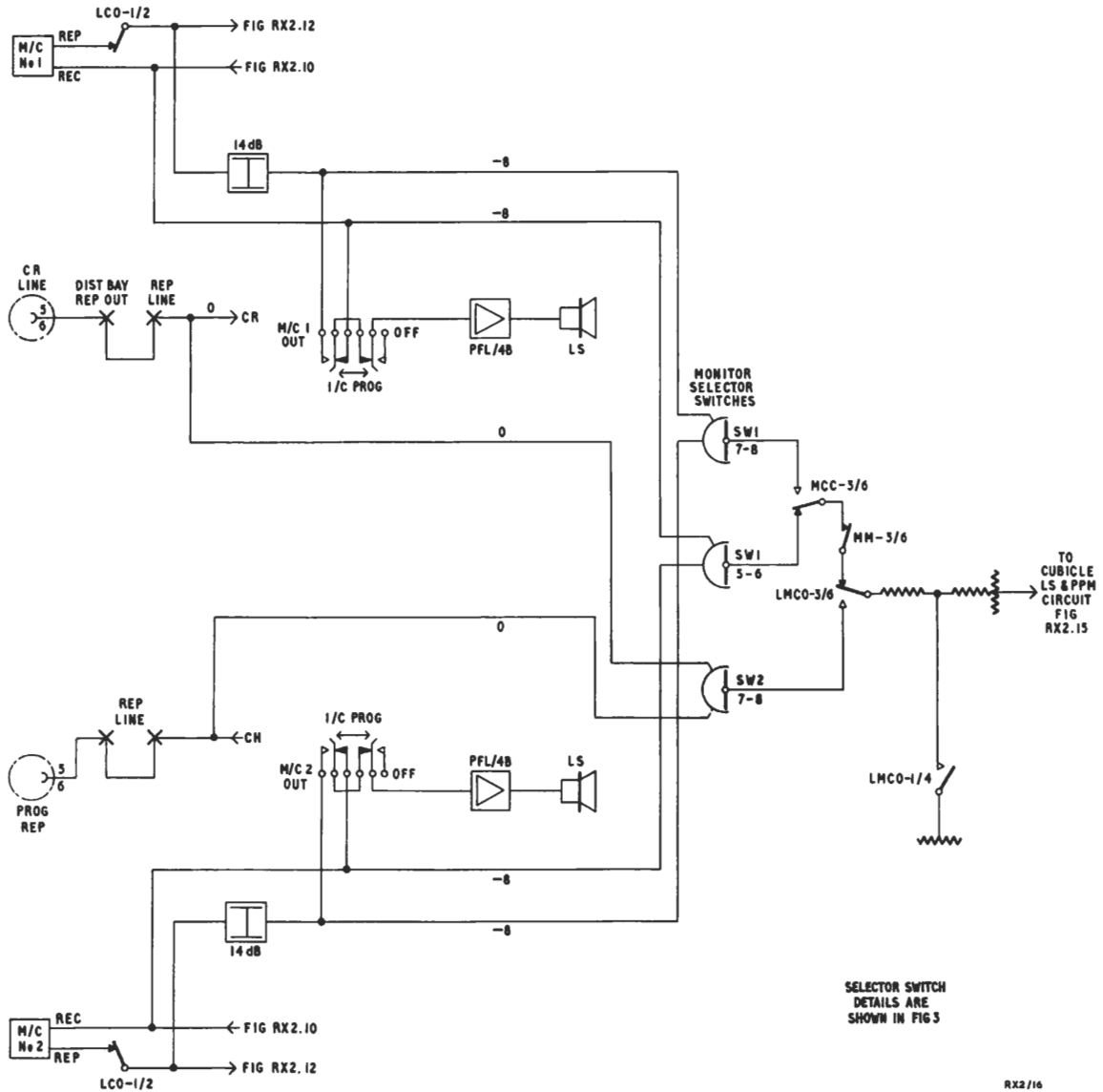


FIG. RX2.14 MONITORING SYSTEM

via the relay and an amplifier to a loudspeaker in the machine room. The amplifier is described in Section 5.11 and shown in Fig. 4.

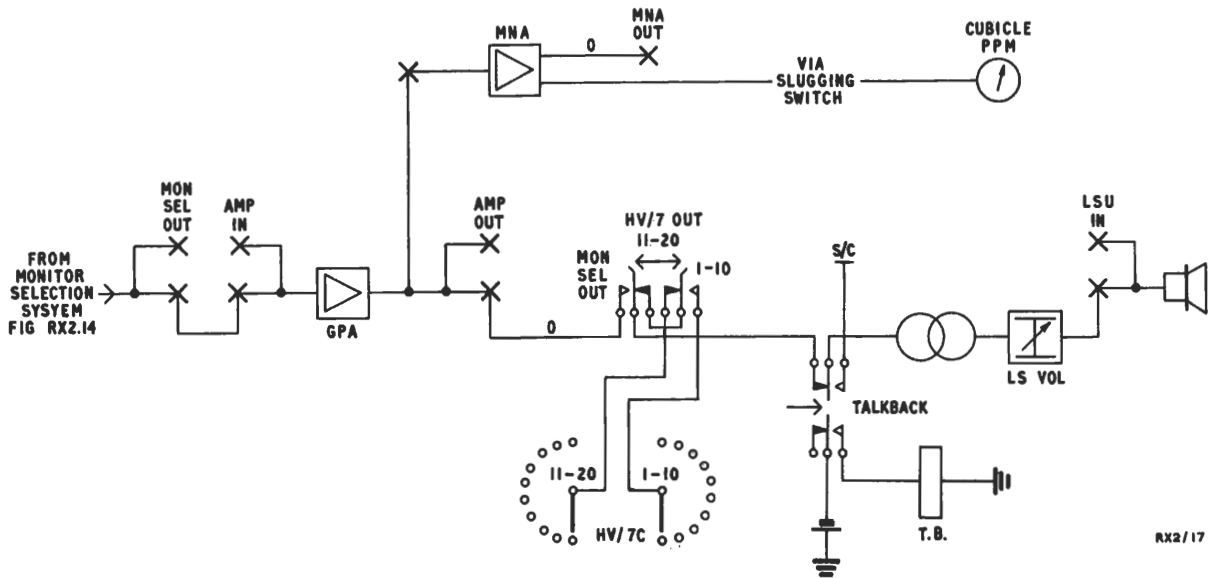


FIG. RX2.15 CUBICLE LOUDSPEAKER AND P.P.M. CIRCUIT

4.3.2 MONITOR CHECK SELECTOR SYSTEM (FIG. 3)

The monitor check selectors are telephone-type rotary digit switches having eight contact levels with 12 contacts per level, and are actuated by an electromagnet via a ratchet drive. A break contact in series with the operating coil opens during each stroke of the mechanism, so releasing the armature in preparation for the next. The release of the armature re-establishes the circuit, and the switch thus continues to drive as long as power is supplied.

Two selectors are provided, mounted on a relay panel on the cubicle apparatus bay. Selector 1 is controlled by the upper row of pushbuttons on the monitor selector panel while selector 2 is controlled by the lower row of pushbuttons. Fig. 3 shows details of the system. The sketch in the top left-hand corner of the diagram represents the programme levels of the two selectors.

Levels 5, 6, 7 and 8 of switch SW 1 are used for monitoring the inputs and outputs of machines, while levels 7 and 8 of switch SW 2 are used for monitoring outgoing lines.

The lower sketch on the left of Fig. 3 shows level 1, the control or 'marking' level of each of the two selectors. The contacts at this level are wired to earth via the pushbuttons in the lower right-hand part of the diagram.

The upper right-hand sketch shows the contacts of marking relays TA and TB, the windings of programme-switching relays MM, LMC0, and MCC, the two selector-operating coils and the comprehensive-checking key.

On each selector, all the marking contacts but one are earthed via the non-operated pushbuttons and traveller buswire of the row appropriate to the selector, the buswire itself being earthed via the operated pushbutton. The contact wired to the operated pushbutton is open-circuited, and on this the marking-level wiper normally rests, since the selector drives when an earth is applied to the wiper, and stops its search when an open-circuited contact is reached.

Any pushbutton pressed locks itself in, at the same time releasing the button previously depressed. The contact springs of the released button earth the selector contact on which the marking-level wiper is standing, causing the marking relay to operate and apply battery negative to the selector operating coil. The selector then drives round until the searching wiper picks up the open-circuited (or 'marked') contact corresponding to the button just pressed.

The comprehensive-check key has three positions, MACHINE INCOMING PROGRAMME, MACHINE OUT and LINE OUT. With the key at MACHINE INCOMING PROGRAMME, the listening circuit is switched as shown in Fig. 3 to the machine inputs at levels 5 and 6 of SW 1.

Setting the key to MACHINE OUT operates relay MCC, making MCC-3/6 change over to the machine outputs connected at levels 7 and 8 of the selector. Setting the key to LINE OUT operates relay LMC0, when LMC0-3/6 switch the listening circuit to SW 2, while at the same time LMC0-1/4 increase the attenuation in circuit to compensate for the higher level (i.e. zero level) received from the line.

Relay MM, which is operated by TA, is a search muting relay for SW 1. TB when operated de-energises LMC0 and so mutes the searching of SW 2. (Note:- The purpose of 'search muting' is to suppress the

noise produced as the wipers pass rapidly over contacts carrying programme.)

The 200-ohm resistors and 1- μ F capacitors across the selector operating coils and series contacts are supplied to quench sparking across these contacts.

SECTION 5

NON-PROGRAMME CIRCUITS IN CTR1 AND CTR2

5.1 TELEPHONE CIRCUIT

5.1.1 GENERAL

A brief description of the telephone system used appears in Section 2.3.2(b). The telephone lines employ pins 3 and 4 of the 15-way sockets on the machine-room distribution bay, while the indicator/cancel circuits employ pin 14. The circuit of one console and pair of machines is given in Fig. 5; it will be seen that when two machines are linked their telephone sets are paralleled.

Each machine telephone is provided with a RING key which connects the 17-c/s supply to the line. The left-hand (i.e., odd-numbered) telephone on each console is also provided with a SPEAK/RING key for communication with the cubicle. These keys are operative only in CTR2.

The supervisory key-and-lamp panel (in cubicle or machine room) connects via break-jacks with each incoming telephone line in parallel with the CONTROL ROOM LINE sockets on the distribution bay. Each panel circuit has a key and a lamp indicator working in conjunction with a common buzzer.

Before extension to a machine the telephone circuits on the panel are complete in themselves and the indicators are cancelled by selecting the appropriate line, operating the key to SPEAK and lifting the panel handset.

When a machine is connected, the line and the cancel circuit are both extended, the cancel circuit also feeding the machine indicator relay; the machine and panel indicator circuits are then in parallel, as are also the machine and panel cancel circuits; a call may thus be answered from the panel or the machine. An E.M.X. recall facility is provided on the panel, but not extended to machines.

5.1.2 CIRCUIT OPERATION

The telephone circuit between the recording room and the source or destination point is set up by control room simultaneously with the programme chain. As soon as the circuit is established, the E.M.X. line cancel relay (LC) operates and makes the E.M.X. line relay (L) inoperative. Successful through calls between the recording room and the programme source or destination are not therefore indicated on the E.M.X. board.

(a) **INCOMING CALLS**

A ring incoming energises recording room line relay L.

Relay L operates

- L-1 (a) holds in relay L.
- (b) lights the panel **CALL** lamp.
- L-2 (a) operates the buzzer.
- (b) energises thermal delay relay **TH**, which begins to heat up, preparatory to operating.
- (c) operates machine telephone relay **MT** via pin 14 if the circuit is extended to a machine. Relay **MT** operates the machine-telephone wall signal-lamp relay.

Answering the call by lifting the panel handset and throwing the key for the line to **SPEAK + RECALL** puts an earth on relay L winding; this relay falls out and cancels the **CALL** indication. Alternatively, lifting the machine telephone handset operates telephone line cancel relay **TLC**; contact **TLC-1** closing applies an earth to relay L via pin 14 and similarly cancels the indication.

If the call is not answered, relay **TH** continues to heat up, and operates after some seconds delay. When relay **TH** operates:-

TH-1 de-energises relay **TH** and operates pilot relay **P**.

P-1 changes over and prepares a circuit for operating relay **TT**.

P-2 holds in relay **P**.

TH-1 operates relay **TT** after a short interval, during which relay **TH** cools down and restores to normal. (Taking into account the operate and release delays of the **TH** relay, the interval between the operation of relay **L** and that of relay **TT** is about 20 seconds.)

TT-1 de-energises relay (**LC**), which releases and prepares a circuit for operating relay (**L**).

TT-2 cancels the buzzer.

Next time the caller rings in, relay (L) is energised by rectified a.c.

Relay (L) operates

(L)-1 holds in relay (L).

(L)-2 operates the E.M.X. CALL side-chain, thereby bringing in the E.M.X. operator.

Any further calls incoming on the line are indicated at once on the E.M.X. board. Meanwhile, the recording-room indicator-lamps remain alight although the buzzer is disabled by TT-2. When the recording-room finally answers, all operated relays clear down, while relay (LC) operates again and makes relay (L) inoperative.

(b) OUTGOING CALLS

These may be made from the panel or CTR1 cubicle extension or from any connected machine telephone. Ringing tone is available at all positions.

(c) E.M.X. RECALL

The E.M.X. may be called across any line by throwing the panel CALL E.M.X. key in conjunction with a 'SPEAK + RECALL' key and thus energising recall line relay RL.

Relay RL operates

RL-1 energises relay (LC) and makes the self-hold circuit of relay (L) inoperative.

RL-2 energises relay (L), which operates a CALL side chain in the E.M.X.

5.2 AUTOFOLLOW CIRCUIT (FIG. RX2.16)

The autofollow circuit enables a metal strip attached near the end of a tape being played on one machine to start another machine automatically. Where reproduction is concerned, provided that the tape on the second machine has been correctly set up, the two then run in synchronism, so that a convenient butt or overlap change-over

can be made. At the time this Instruction was written, however, the autofollow facility had not been brought into use for programme purposes by the BEC.

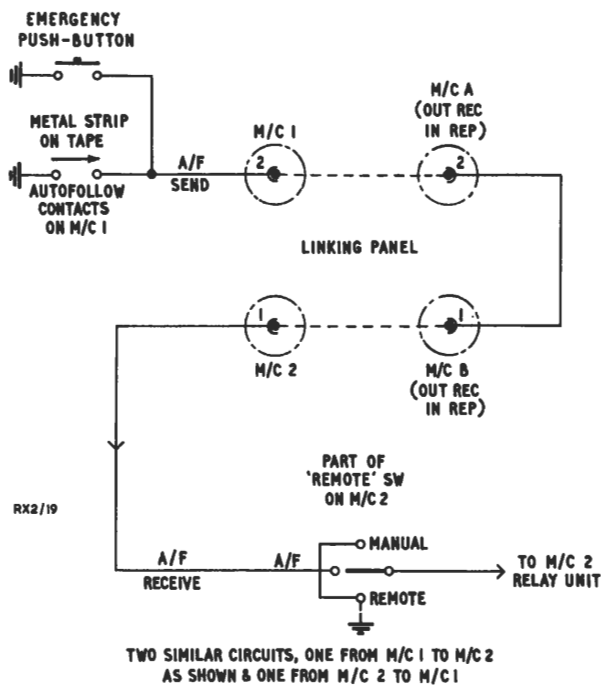


FIG. RX2.16 AUTOFOLLOW CIRCUIT

Fig. RX2.16 shows the general circuit arrangement, which employs pins 1 and 2 of the 15-way sockets on the distribution bay.

The method of operation is as follows. The metal strip on the end of the tape on one machine bridges the autofollow contacts as it passes and thus puts a momentary earth on the autofollow send circuit, which is plugged via the distribution bay to the autofollow receive circuit of the other machine. If the REMOTE switch (S2) on the second machine is set to AUTOFOLLOW, the earth received is passed on to the relay unit and the machine at once commences to drive. Each machine has both a send and a receive circuit, so that continuous operation with automatic starting at every change-over can be obtained.

An emergency pushbutton wired in parallel with the autofollow contacts is mounted to the left of the head unit of each machine and is available for use if the machine taking over the programme fails to start automatically. This pushbutton is also sometimes convenient for normal starting of the second and subsequent reels of any multi-reel programme, since its use makes it easier for the operator to watch for the end of the reel on the active machine.

Further details of the autofollow arrangements may be found in the manufacturer's Instruction Manual for the E.M.I. Recorder Type BTR/2, pages 8.2 and 8.4.

5.3 'START RECORD' CIRCUIT

5.3.1 SINGLE MACHINE (FIG. RX2.17)

The START RECORD circuit employs pin 9 of the 15-way sockets. This pin is wired to the individual machine RECORD circuit via the machine REC./REP. key.

When a recording is to be started from the control room, the machine REMOTE switch, S2, must be set to the REMOTE position shown in Fig. RX2.17. Relays LCO and RZ are then energised via S2A and earth loops for operating the machine relay unit are prepared via S2C and S2D.

Relay LCO operates

LCO-1/2 cut the machine output circuit. (Fig. RX2.12.)
This is a precaution against broadcasting the run-up of the machine on reproduction, but has no particular significance for recording.

Relay RZ operates

RZ-1 is used in the SEND TONE circuit. (Fig. RX2.25, Section 5.9.)

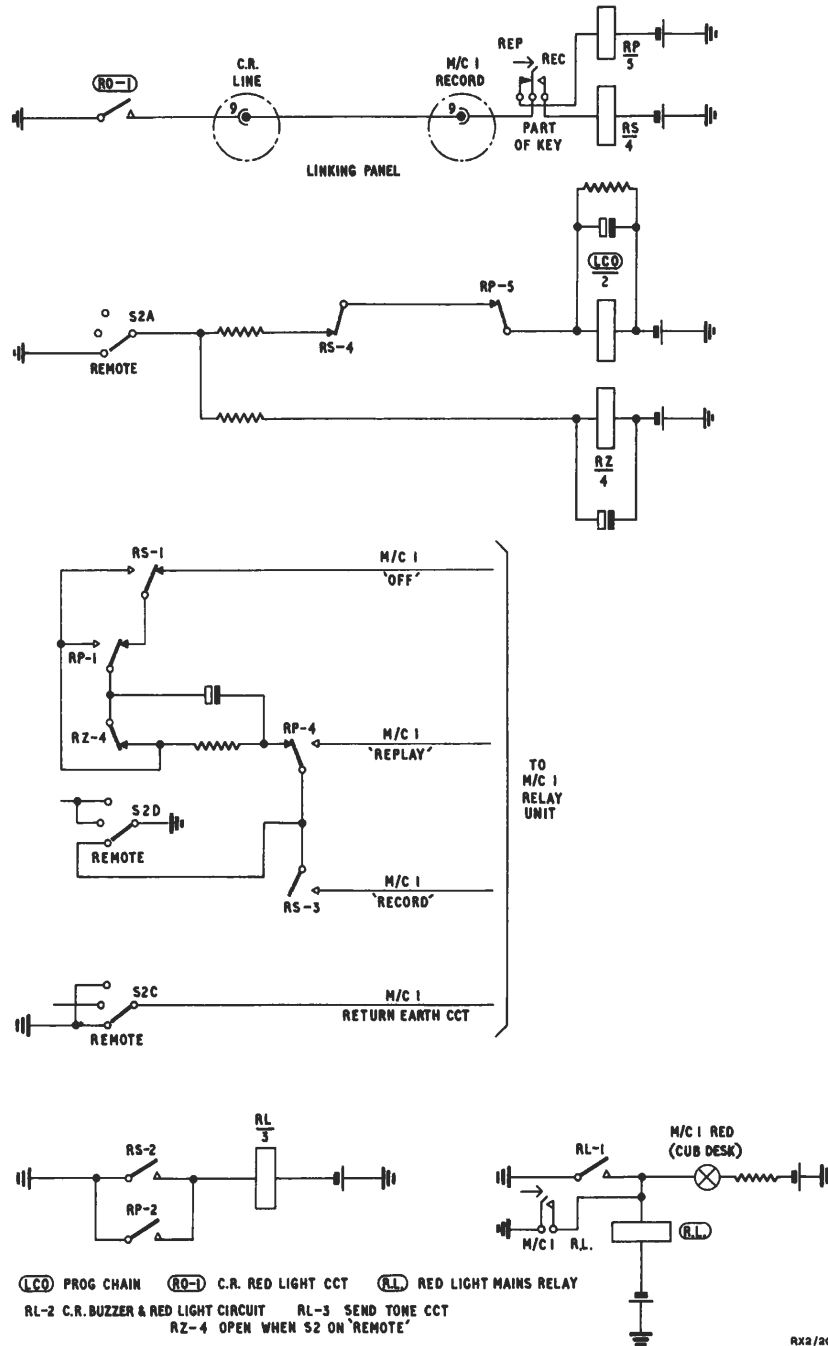
RZ-2 is used in the REMOTE indicator control room circuit. (Figs. RX2.23 and RX2.24, Section 5.8.) RZ-2 is also used in the START RECORD and START REPLAY machine-linking circuit. (Fig. RX2.18, Section 5.3.2.)

RZ-3 is used in the control room buzzer circuit. (Fig. RX2.19, Section 5.5.1.)

RZ-4 opens and, the capacitor shown in Fig. RX2.17 having been discharged, is now ready to stop the machine when required by pulsing the machine OFF relay via this capacitor. (See Instruction RX.1, Section 2.7.2; also Section 8 of the maker's Instruction Book for the BTR/2.)

When the MACHINE socket is plugged to the control room line and the REC./REP. key operated, a circuit is prepared for operating relay RS via contact RO-1 of relay RO in the control room red light circuit. (Section 5.5.) As soon as the control room red light key is operated, RO-1 closes and energises the RS winding.

INSTRUCTION RX.2
Section 5



RX2/20

FIG. RX2.17 'START RECORD' AND 'START REPLAY' CIRCUIT

Relay RS operates

RS-1 removes the capacitor from the MACHINE OFF line.

RS-2 energises relay RL.

RS-3 puts an earth on the RECORD line to the machine relay unit, so that the machine starts up with all amplifiers, including the recording amplifier, switched on, and with erase and bias currents applied to the heads as required for recording.

RS-4 interrupts the energising circuit of LCO, which is slow to release owing to a resistance and capacitance across its winding.

Relay RL operates

RL-1 (a) lights a red indicator-lamp on the cubicle desk control panel.

(b) energises the red light mains relay, which in turn operates the wall-mounted red light above the machine.

Note that the red cubicle-desk and wall lamps can also be operated via the machine RED LIGHT key, although this is intended for local starting only.

RL-2 is used in the control room buzzer circuit. (Fig. RX2.19, Section 5.5.)

RL-3 is used in the SEND TONE circuit. (Fig. RX2.25, Section 5.9.)

Relay LCO releases when the machine is up to speed

LCO-1/2 restore the machine output circuit (Fig. RX2.12), so allowing monitoring of the recording.

5.3.2 LINKED MACHINES (FIG. RX2.18)

Fig. RX2.18 shows the START RECORD circuit for linked machines. With a MACHINE START key set to LOCAL, and the REC./REP. key on RECORD, recording on the machine may be started by closing the START A or START B switch as appropriate. Relay RS is then energised via RZ-2, which is closed as already stated in Section 5.3.1 when switch

S2 on the machine itself is on REMOTE (The REMOTE indicator-lamp for the machine concerned is also lit when RZ-2 is closed.)

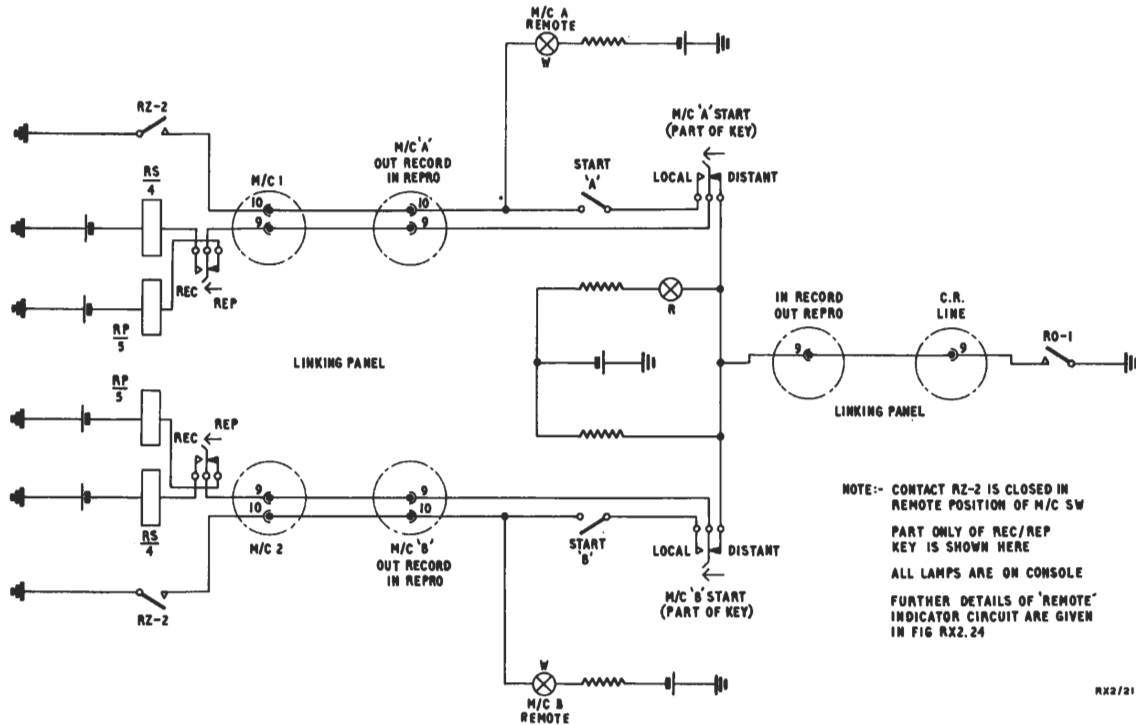


FIG. RX2.18 'START RECORD' AND 'START REPLAY' MACHINE LINKING CIRCUIT

When remote operation is required, the MACHINE START key of the machine selected to record first must be thrown to DISTANT, and the MACHINE START key on the other machine must be left on LOCAL until the change-over point is reached. When the remote point starts the recording, the red indicator-lamp on the console panel (Fig. RX2.18) is lit via contact RO-1, which is closed as described in Section 5.3.1.

5.4 'START REPLAY' CIRCUIT

5.4.1 SINGLE MACHINE (FIG. RX2.17)

The START REPLAY circuit also employs pin 9 of the 15-way sockets on the distribution bay. This pin is wired to the machine

REPRODUCE circuit via the REC./REP. key. Fig. RX2.17 shows the operating circuit of the START REPLAY relay, RP, together with other related circuits.

When a reproduction is to be started from control room, the machine REMOTE switch, S2, must be set to REMOTE as shown. Relays LCO and RZ then operate in the way described in Section 5.3.1.

When the MACHINE socket is plugged to the control room line with the REC./REP. key in the REPRODUCE position, a circuit is prepared via contact RO-1 of relay RO in the control room red light circuit (Section 5.5) for operating relay RP. When the red light key in the control room is operated, RO-1 closes, energising RP.

Relay RP operates

RP-1 removes the capacitor from the MACHINE OFF line.

RP-2 energises relay RL.

RP-3 is a guard contact in the tone switching circuit.

RP-4 earths the REPRODUCE line to the machine relay unit, making the machine start up in the reproducing condition.

RP-5 interrupts the LCO energising circuit. Relay LCO is slow to release as mentioned in Section 5.3.1.

Relay RL operates exactly as described in Section 5.3.1. Relay LCO similarly de-operates only when the machine is up to speed, thus avoiding the possibility of the sound of the tape run-up being sent to line.

Various guard contacts (including RP-3 already mentioned) are provided in the tone switching circuit (Fig. RX2.25, Section 5.9) to prevent tone from being sent to line while the red light is on.

5.4.2 LINKED MACHINES (FIG. RX2.18)

Fig. RX2.18 gives the START REPLAY circuit for linked machines, the machine REC./REP. key in the REPRODUCE position connecting pin 9 to the winding of relay RP. With the substitution of relay RP for relay RS, the circuit behaves as described in Section 5.3.2.

5.5 CONTROL ROOM BUZZER AND RED LIGHT CIRCUIT

The control room buzzer circuit uses pin 13 of the 15-way sockets, which is wired through the REC./REP. key for each machine. The red light circuit employs direct wiring.

5.5.1 SINGLE MACHINE (FIG. RX2.19)

(a) BUZZER CIRCUIT

The buzzer in the control room is pulsed by putting an earth on pin 13, normally by flicking the MACHINE BUZZ key. A momentary earth is also applied via S2B when switch S2 is set to REMOTE; immediately afterwards, however, RZ-3 opens due to the energising of RZ winding via S2A. (Fig. RX2.17.) By either means, the application of an earth energises relay GO.

Relay GO operates

GO-1 is not used.

GO-2 (make-before-break contact)

(a) completes the circuit of R0 via a resistor which does not allow enough current to pass to operate the relay, but passes enough to hold it if already operated.

(b) disconnects R0 from the control room line.

GO-3 removes a short-circuit from a capacitor, which then takes a finite time to charge up, so providing for the delayed operation of GC.

GO-4 (late make or 'y' contact) applies battery to the control room line after GO-2 has disconnected R0 from the line. The 'y' operation of GO-4 avoids a surge in the winding of R0 and ensures that this relay does not operate. The choke and 8- μ F capacitor shown in Fig. RX2.19 are anti-click components. The capacitor is wired with a rectifier in series in such a way that although fully charged by the sending of a buzz signal to control room it cannot discharge through the winding of R0 and send a spurious signal to the machine connected to it.

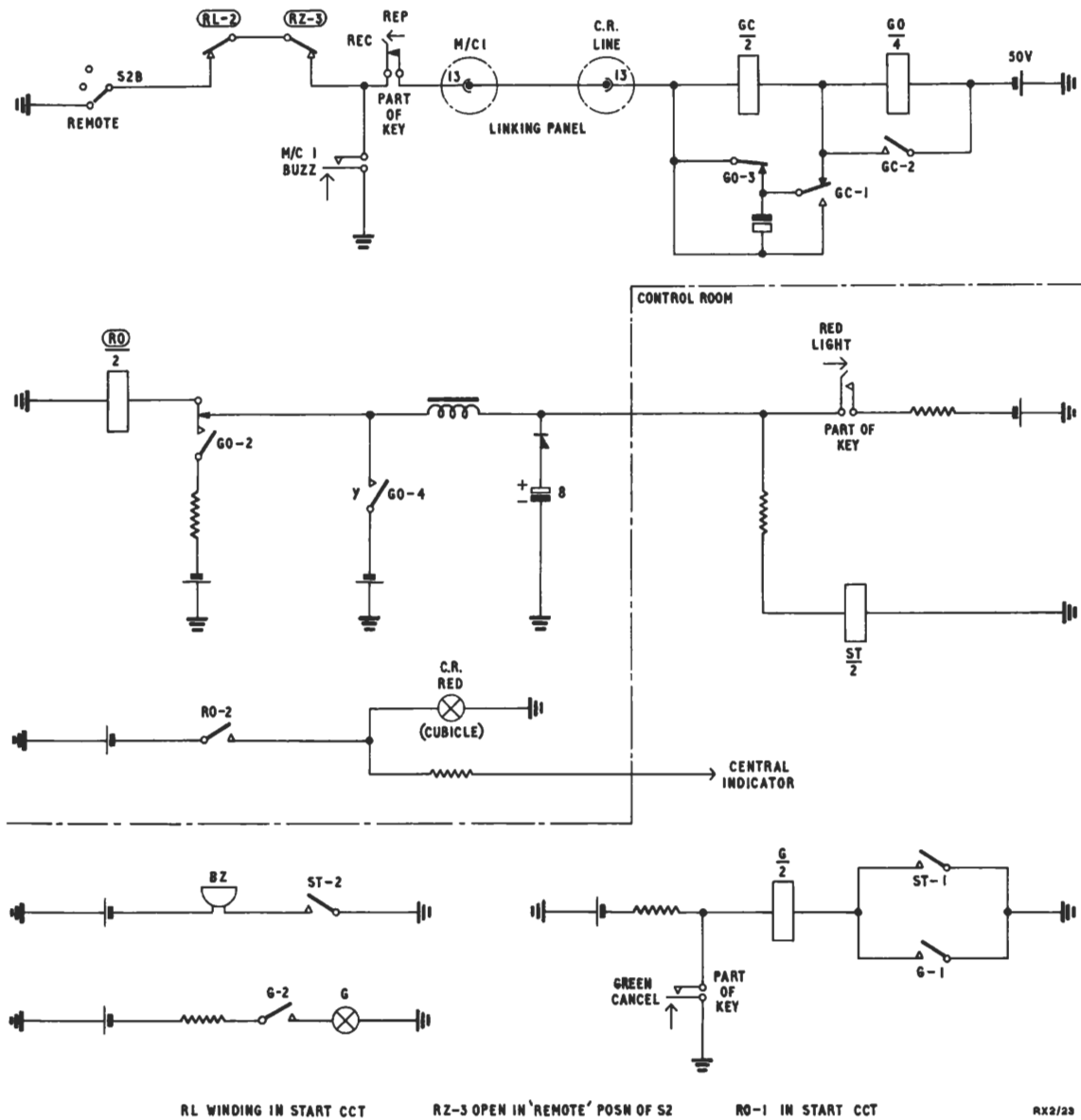


FIG. RX2.19 CONTROL ROOM BUZZER AND RED LIGHT CIRCUIT

The application of battery to the line energises relay ST in the control room. (Instruction S.7.)

Relay ST operates

ST-1 energises green lamp relay G.

ST-2 operates the control room buzzer.

Relay G operates

G-1 holds in G.

G-2 lights a green indicator lamp in the control room above the circuit signalling key.

The GC relay in the recording room remains quiescent for a period of some 500 milliseconds while the current taken by its winding is increasing toward the critical value. When this value is reached:-

Relay GC operates

GC-1 disconnects and short-circuits the capacitor across GC.

GC-2 short-circuits GO.

Relay GO releases, disconnecting battery from the control room line and from relay RO. Relay ST also releases, thus cancelling the control room buzzer.

(b) RED LIGHT CIRCUIT

When the appropriate red light key in the control room is operated, battery is applied via a resistance to the signalling line. Relays RO and ST are energised in parallel, but a series resistance reduces the current taken by ST below the operating value.

RO operates

RO-1 operates in the machine starting circuits. (Sections 5.3.1 and 5.4.1, Figs. RX2.17 and RX2.18.)

RO-2 lights the cubicle supervisory red lamp appropriate to the machine, with a repeat lamp on the control room central indicating panel.

(c) **BUZZ OUT**

When the recording room buzzes out at the end of a programme, GO and GC operate as before. Relay RO, which remains energised for the duration of the programme, is held in via the make-before-break contact GO-2 and its series resistor, since the current needed to keep the relay in is less than the current needed to operate it; RO-1 and RO-2 thus continue in the closed position, with all red lamps remaining alight. Relay ST is operated as previously via GO-4.

When the RED LIGHT key in the control room is restored to normal, the red light circuit releases. If the key is then flicked to GREEN CANCEL, relay G also releases and the green light goes out.

5.5.2 LINKED MACHINES (FIG. RX2.20)

Fig. RX2.20 shows the circuit provided for linking the control room buzzer circuits of two machines. The two linked machines are paralleled, but when either is switched to local starting the corresponding buzzer circuit is disconnected from the line by auxiliary contacts of the DISTANT/LOCAL 'START' key.

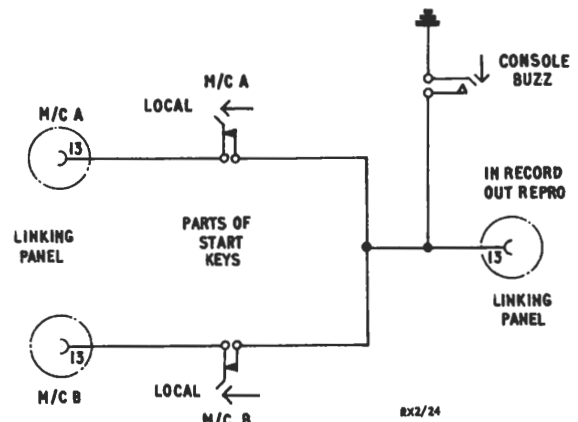


FIG. RX2.20 CONTROL ROOM BUZZER MACHINE LINKING CIRCUIT

5.6 'SINGLE/DUAL' MACHINE LINKING CIRCUIT (FIG. RX2.21)

This circuit, employing pin 12 of the 15-way sockets, operates when two machines are linked via the distribution bay. Pin 12 of the linking circuit is earthed, as shown in Fig. RX2.21, and the action of plugging the MACHINE sockets to the OUT RECORD/IN REPRODUCE sockets for any linking console automatically completes the energising circuits of relays AT and BT for each machine.

Relay AT operates

AT-1/2 and AT-3/4 for each machine remove a 6-dB pad from the reproducing chain to compensate for the loss introduced by the reproducing change-over key.

AT-5 operates in the impedance-switching circuit shown in Fig. RX2.22 and discussed in Section 5.7.

AT-6 replaces the individual tone-switching circuits of Fig. RX2.25(a) by the circuit of Fig. RX2.25(b).

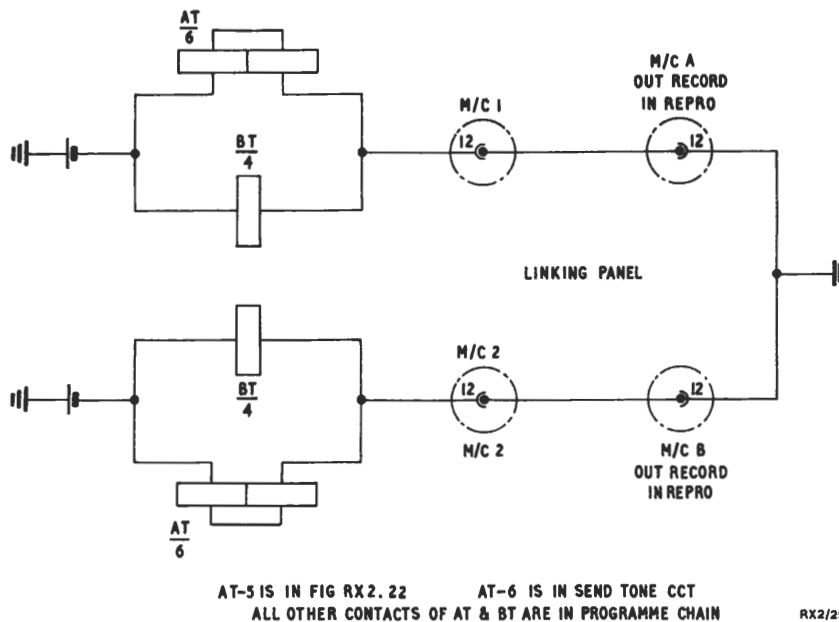


FIG. RX2.21 'SINGLE/DUAL' MACHINE LINKING CIRCUIT

Relay BT operates

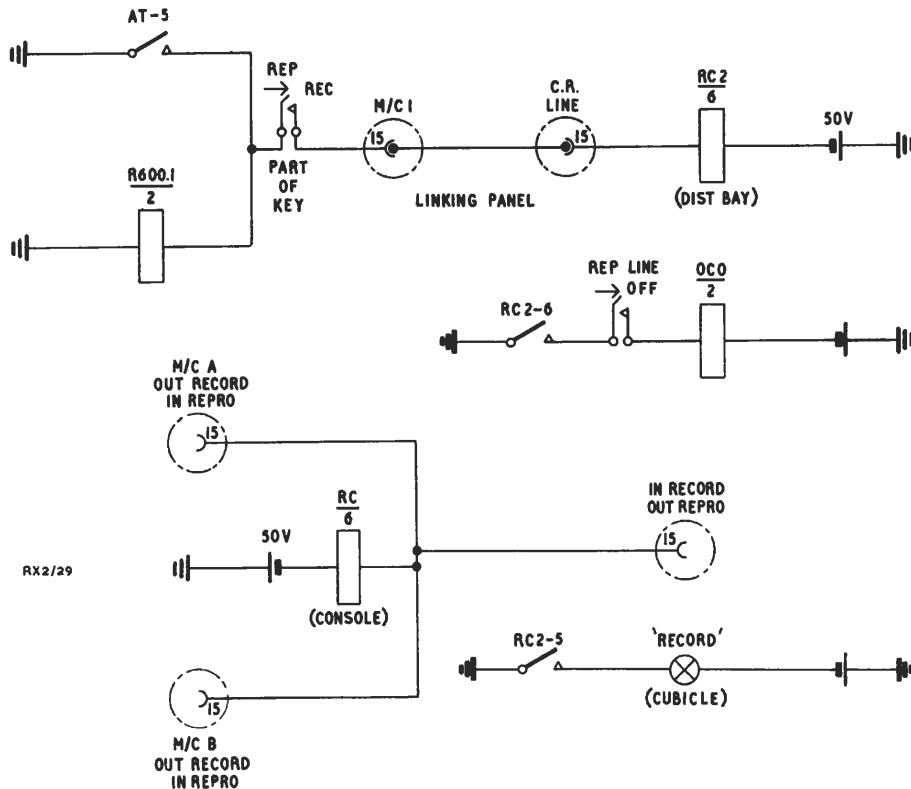
BT-1/2 and BT-3/4 for each machine remove an 8-dB pad from the recording chain to provide a control margin for the recording potentiometer, Type PB/1L1. (Figs. RX2.10 and RX2.11.) With dual-machine reproduction, a single pad (Fig. RX2.11) replaces those for the separate machines.

5.7 SWITCHING CIRCUITS FOR RECORDING (FIG. RX2.22)

These circuits, which use pin 15 of the distribution bay sockets, are for impedance and route switching in the recording programme

chain, with the REC./REP. key operated to RECORD. Note that the machine LISTEN sockets are not wired on pin 15.

When a single machine is plugged to the control room line, as shown at the top of Fig. RX2.25, relays R600.1 and RC2 are energised in series.



CONTACTS OF R600.1, RC AND OCO ARE IN PROGRAMME CHAIN, ALSO RC2 CONTACTS NOT SHOWN HERE
AT-5 IS CLOSED IN DUAL CONDITION

FIG. RX2.22 SWITCHING CIRCUITS FOR RECORDING

Relay R600.1 operates

R600.1-1/2 put a 600-ohm termination across the machine input at the point where it is plugged to the control room line.

Relay RC2 operates

RC2-1/2 switch the machine input from the HV/7C programme select-
or used on reproduction to the direct control room
line.

RC2-3/4 remove a 600-ohm termination from the line.

RC2-5 sends a signal to the light indicator on the cubicle
control panel.

RC2-6 closes the earth circuit to reproducing-line cut-off
relays OGO on the cubicle bay and enables the reproducing
line to be interrupted if required. (Section 4.2.1,
Fig. RX2.12.)

When a circuit is plugged for dual machine recording, AT-5 closes
since relay AT is energised as shown in Fig. RX2.21. RC2 operates as
before, but R600.1 is earthed and does not operate; consequently no
600-ohm loading is put across the machine socket to replace that re-
moved by RC2-3/4. However, the earth completes the battery loop of
relay RC, whose winding is picked up under the dual condition.

Relay RC operates

RC-1/2 and RC-3/4 connect the two machine inputs (Figs. RX2.11)
to the outputs of the recording change-over key.

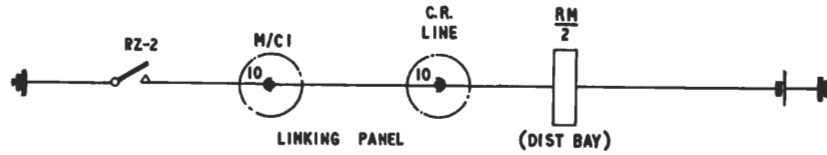
RC-5/6 connect the line to the recording control potentiometer
and the change-over key.

5.8 'REMOTE' INDICATOR CIRCUIT

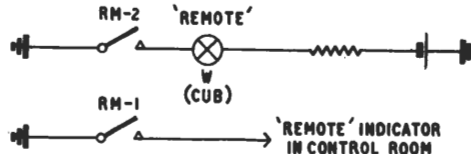
5.8.1 SINGLE MACHINE (FIG. RX2.23)

The REMOTE indicator-lamp circuit is wired via pin 10 of the 15-way
sockets on the distribution bay.

Setting machine switch S2 (Fig. RX2.17) to REMOTE energises relay
RZ. Contact RZ-2 (Fig. RX2.23) closes; relay RM on the distribution
bay then operates and lights the line REMOTE lamp in the cubicle and,
if connected through, in the control room, studio or continuity.
(Fig. RX2.27.)

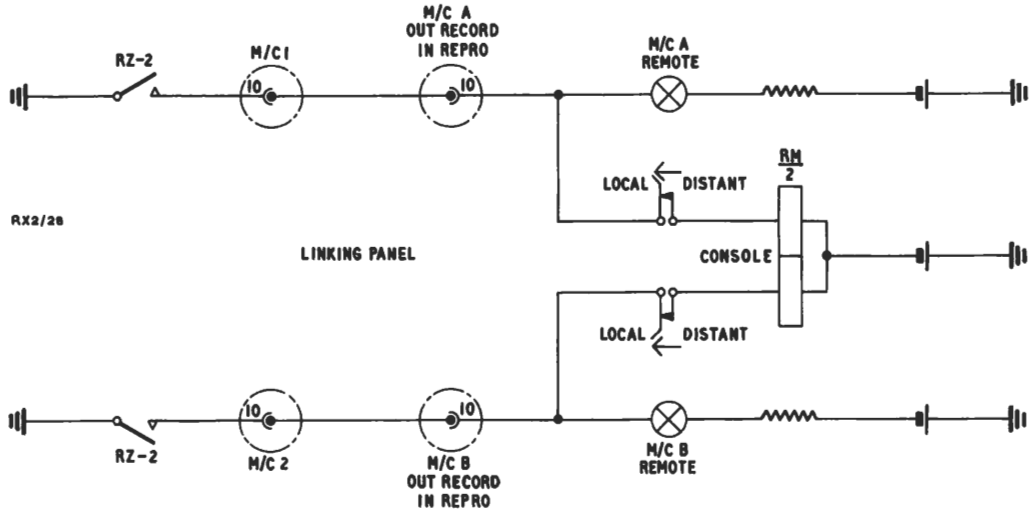


RX2/26

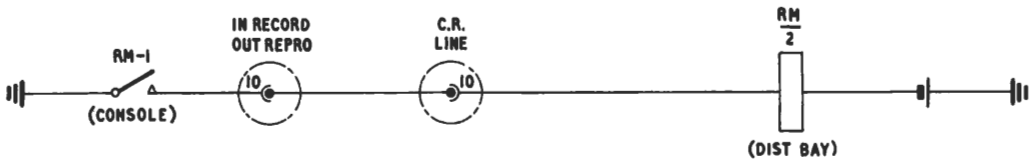
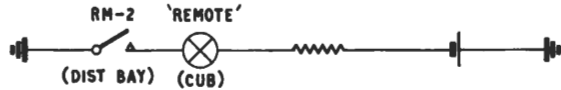


NOTE:- RZ-2 CLOSED IN 'REMOTE' POSITION OF M/C SWITCH S2

FIG. RX2.23 'REMOTE' INDICATOR CIRCUIT



RX2/26



RM-2 ON CONSOLE IS IN TONE CIRCUIT

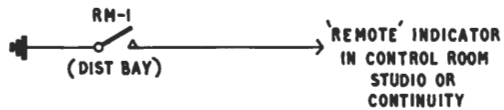


FIG. RX2.24 'REMOTE' INDICATOR LINKING CIRCUIT

5.8.2 LINKED MACHINES (FIG. RX2.24)

When two machines are linked as shown in Fig. RX2.24, an 'A' and a 'B' REMOTE indicator-lamp on the console show the switch position for each machine. If the console START key for either machine is set to DISTANT, double-wound relay RM on the console is energised.

Double-wound relay RM on console operates

RM-1 energises single-wound relay RM on the distribution bay.

RM-2 is in the tone-switching circuit, Fig. RX2.25, Section 5.9.

Single-wound relay RM on distribution bay operates

RM-1 operates a white REMOTE lamp-indicator in the control room, studio or continuity (Fig. RX2.27) if connected through.

RM-2 lights the appropriate white REMOTE supervisory lamp in the cubicle.

5.9 TONE SWITCHING CIRCUITS (FIG. RX2.25)

5.9.1 SINGLE MACHINE

The tone-switching circuit for a single machine is not routed through the 15-way sockets.

When a single machine is used, relay AT (Fig. RX2.21) is not operated, and AT-6 remains in the position shown in Fig. RX2.25. Provided that the control room red light circuit is not energised, contact RL-3 is closed, and provided that the machine switch S2 is not on REMOTE, contact RZ-1 is also closed. Under these conditions, throwing the SEND TONE/READY key for the machine to SEND TONE energises relay ST.

Relay ST operates

ST-1/2 switch the machine input from recording line to tone.
(Fig. RX2.10.)

ST-3/4 switch the reproducing line from machine output to tone.

ST-5/6 connect a 600-ohm resistor across the machine output to replace the input impedance of the disconnected line on the machine.

When the red light is on and/or switch S2 is in the REMOTE position, RL-3 and/or RZ-1 open, and relay ST cannot then be operated via the SEND TONE/READY key.

5.9.2 LINKED MACHINES

The tone-switching circuits for linked machines are taken to pin 11 of the MACHINE sockets and the console OUT RECORD/IN REPRODUCE sockets but not the console IN RECORD/OUT REPRODUCE sockets or to the sockets for the control-room lines.

When two machines are linked, relay AT operates (Fig. RX2.21), AT-6 changes over and relay ST then operates in the TEST TONE position of the TEST TONE/SEND TONE key. The relay operating circuit, however, is wired via the recording change-over key and contact RP-3, the connections being such that the ST relay for a machine is held off when a recording is being made from line on that machine.

Contact RP-3 opens when the machine REC./REP. key is at REPRODUCE and prevents accidental sending of tone while reproducing.

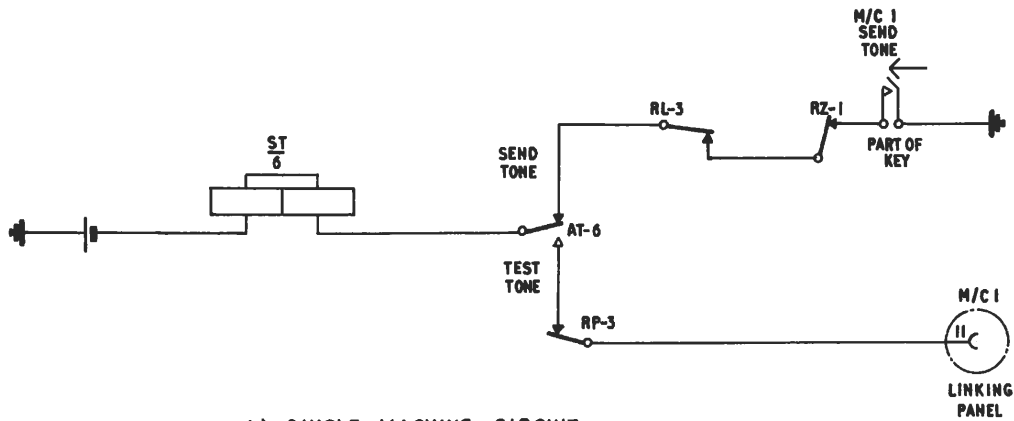
Throwing the TEST TONE/SEND TONE key to SEND TONE energises relay RT provided contact RM-2 of the console RM relay is closed. (The contact opens when either machine switch S2 is on REMOTE and the appropriate START key is on DISTANT.)

Relay RT operates

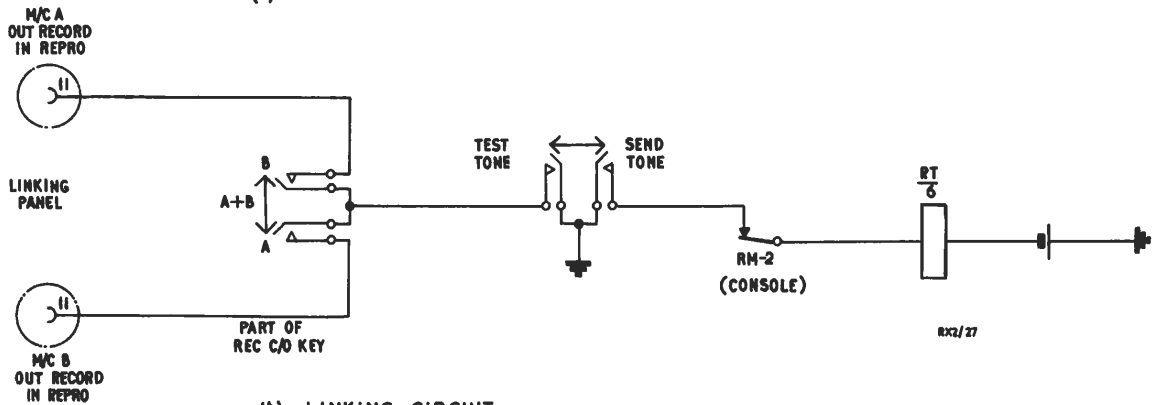
RT-1/2 switch the reproducing line from the output of the reproducing change-over key to tone. (Fig. RX2.13.)

RT-3/4 switch the cue feed from the recording line to tone. (Fig. RX2.11.)

RT-5/6 switch the recording control potentiometer from the recording line to tone. The contacts also apply tone to the console P.P.M. in the INCOMING PROGRAMME position of the console P.P.M. key.



(a) SINGLE MACHINE CIRCUIT



(b) LINKING CIRCUIT

- NOTES:-
1. AT WINDING IS IN SINGLE/DUAL CIRCUIT (FIG. RX2.21)
 2. RL WINDING IS IN 'START' CIRCUIT (FIG. RX2.17)
 3. RM WINDING IS IN 'REMOTE' INDICATOR LINKING CIRCUIT (FIG. RX2.24)
 4. RP WINDING IS IN 'START' CIRCUIT (FIGS. RX2.17 & 18)
 5. RT CONTACTS ARE IN PROGRAMME CHAIN (FIGS. RX2.11 & 13)
 6. RZ-1 IS OPEN IN 'REMOTE' POSITION OF S2 (FIG. RX2.17)
 7. ST CONTACTS ARE IN PROGRAMME CHAIN (FIGS. RX2.10 & 12)

FIG. RX2.25 'SEND TONE' AND 'TEST TONE' SINGLE MACHINE AND LINKING CIRCUITS

5.10 'READY' LAMP CIRCUIT (FIG. RX2.26)

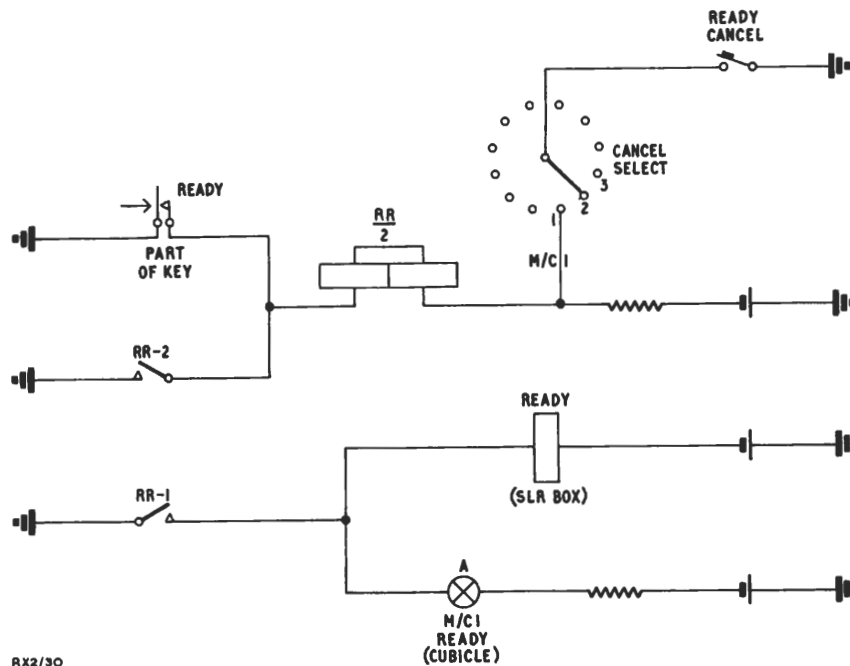
Throwing the SEND TONE/READY key for a machine to READY energises the appropriate RR relay.

Relay RR operates

RR-1 (a) operates a READY relay which lights a mains-energised amber READY lamp on the wall above the machine.

(b) lights a READY indicator-lamp in the monitoring cubicle.

RR-2 locks in relay RR.



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FIG. RX2.26 'READY' LAMP CIRCUIT

Pressing the READY CANCEL button on the cubicle desk earths the winding of any RR relay selected by the CANCEL SELECT switch. The self-holding circuit releases, causing the relay to de-operate and the relevant amber lamps to go out.

Note that, whereas the READY lamp for any machine can be switched

on only from the machine room, it can be cancelled only from the cubicle.

5.11 TALKBACK CIRCUIT (FIG. 4)

The talkback circuit from the monitoring cubicle to the machine room comprises a microphone, amplifier and loudspeaker. Switching is by means of the TALKBACK key shown in Fig. RX2.15. This cuts off and short-circuits the cubicle monitor loudspeaker and simultaneously energises the TB relay which switches the talkback microphone on.

The talkback amplifier, Pamphonic Type 600V, has three stages of gain, RC-coupled, with input and output transformers. It is intended for use with a 30-ohm microphone and is rated to deliver 10 watts of power into a loudspeaker. The equipment has a built-in supply unit incorporating an h.t.-rectifying valve and a mains transformer.

The microphone input transformer, T1, is connected to the first-stage amplifying valve, V1, which is coupled via gain control P1 and tone controls P3, P4, to the double-triode phase-splitter V3. This valve drives the push-pull stage V4, V5, feeding the output transformer, T2. Negative voltage feedback to V3 is provided by cathode injection from T2 primary winding.

An alternative input section for use with radio or gramophone circuits is provided by V2, but this has no application in central recording rooms.

SECTION 6

OPERATING INSTRUCTIONS: CTR1 AND CTR2

6.1 REPRODUCTION

6.1.1 SINGLE-REEL PROGRAMMES

- (i) Plug the **MACHINE** socket on the distribution bay to the selected line and set the **REC./REP.** key to **REP.**
- (ii) Set the **HV/7C** associated with this line to the appropriate programme, or if necessary request the programme as a separate feed on the recording line.
- (iii) Throw the machine **SEND TONE/READY** key to **SEND TONE**, thus connecting the source of line-up tone directly across the outgoing line and the machine input, while at the same time disconnecting the machine output from the line and terminating the former in 600 ohms.
- (iv) Set the machine **P.P.M.** key to **LINE IN**. The meter on the machine should now read 4. If it does not, adjust the **SENSITIVITY** control of the **P.P.M.** amplifier in the machine cabinet until a reading of 4 is obtained.

As soon as operation (iv) has been completed, the machine is ready for the normal pre-transmission tests, on the satisfactory completion of which the tape must be left set up ready for transmission; the machine must then be switched to **REMOTE**.

The **SEND TONE/READY** key must now be thrown to **READY**, when the wall-mounted amber light above the machine and the corresponding indicator-lamp in the cubicle will light.

When the machine is placed under remote control, the following events take place:-

- (a) A lamp lights on the cubicle control panel, showing that the selected line is connected to a machine switched to the **REMOTE** condition.
- (b) A lamp lights at the distant control point.
- (c) The **SEND TONE** facilities are automatically cancelled and a pulse is sent down the signalling line. This

pulse actuates a buzz-in relay and a green light, which give aural and visual indication at the distant point of the switch-over to the REMOTE condition.

- (d) The outgoing line is disconnected from the machine and terminated in 600 ohms. The relay performing this function is slow to release, so that when it is de-energised by the switching on of the red light, a delay occurs before the machine is re-connected to line. This delay prevents the machine run-up from being put on the line.

6.1.2 MULTI-REEL PROGRAMMES

- (i) Plug the outputs of the two machines to the A and B inputs of the console.
- (ii) Plug the console output to line.
- (iii) Select the appropriate programme on the HV/7C associated with the line, or if necessary ask control room for a separate feed.

Note that the action of plugging a machine to the console input automatically operates a relay which puts out a 6-dB pad, thus allowing the machine to feed +6 dB to the change-over key and maintaining the output from the key to line at zero level. When the two machines are plugged to the console their telephones are paralleled and either RING pushbutton may be used.

- (iv) Throw the SEND TONE/TEST TONE key on the linking panel to SEND TONE. This disconnects the console output from the outgoing line, at the same time applying tone to the line and to the inputs of both machines.
- (v) Set the machine P.P.M. keys to LINE IN. Both meters should now read 4. If they do not, adjust the SENSITIVITY controls on the respective P.P.M. amplifiers until readings of 4 are obtained.
- (vi) Set the machine P.P.M. keys to LINE OUT. Reproduce the tone which should be recorded at the beginning of the first two reels of the programme, at the same time adjusting the gain controls of the reproducing amplifiers as necessary until the meters again read 4.

- (vii) With the console P.P.M. key on LINE OUT, check that the console P.P.M. also reads 4, showing that the correct level is being sent to line.

The equipment is now ready for pre-transmission tests, following which the first two reels should be set up and the first machine switched to the 'distant remote' condition and the corresponding READY lamp switched on. Control of the other machine must be retained by the operator, since change-overs will continue to be carried out manually until such time as the use of the autofollow facility may be approved by the BBC.

6.2 RECORDING

6.2.1 SINGLE-REEL PROGRAMMES

- (i) Plug the MACHINE socket on the distribution bay to the appropriate line and throw the machine key on the bay to RECORD.
- (ii) Adjust the gains of the recording and reproducing amplifiers and set the bias as required for the tape in use.
- (iii) Throw the SEND TONE/READY key to SEND TONE, thus applying line-up tone to the machine input.
- (iv) Set the machine P.P.M. key to LINE IN. The meter should read 4. If it does not, adjust the SENSITIVITY control of the P.P.M. amplifier in the machine cabinet until a reading of 4 is obtained.
- (v) Set the machine recording gain control to 0 dB and the machine P.P.M. to RECORD. The meter should again read 4. If not, adjust the METER SET control (VR 9) on the recording amplifier.

Note that the machine P.P.M., when switched to RECORD, shows the signal sent to the recording head, and must not be regarded as providing an accurate indication of the programme level except at 900-c/s since the meter is inserted in the chain at a point subsequent to the recording equalisation.

- (vi) Restore the SEND TONE/READY key to normal, and the machine P.P.M. key to LINE OUT. Carry out the usual test recording. Run the tape back to the start and then record the prescribed period of 900-c/s tone.

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- (vii) Switch the machine to **REMOTE**. The sequence of events will now be the same as that listed in Section 6.1.1 under the reference letters (a), (b) and (c).
- (viii) Switch on the amber **READY** lamp above the machine.

6.2.2 MULTI-REEL RECORDING

- (i) Plug the two **MACHINE** sockets on the distribution bay to the A and B sockets of the console, plug the console to the selected line and throw the machine keys on the bay to **RECORD**.
- (ii) Adjust the gains of the recording and reproducing amplifiers and set the bias as required for the tape in use.
- (iii) Throw the **SEND TONE/TEST TONE** key to **SEND TONE**. This applies line-up tone to the machine inputs.
- (iv) Set the console **P.P.M.** key to **INCOMING PROGRAMME** and the recording gain control to 0 dB. The **P.P.M.** should now read 4. If it does not, adjust the controls on the **MNA/1**.
- (v) Set the main gain controls on the machines to 0 dB and align the machine **P.P.M.s** by carrying out operations (iv) and (v) described in Section 6.2.1. When the alignment is completed, check that while the machines are recording tone with their **P.P.M.s** reading 4 in the **LINE OUT POSITION**, the console **P.P.M.** also reads 4 if switched to **P.F.** with the reproducing change-over key in the appropriate position.
- (vi) Restore the **SEND TONE/TEST TONE** key to normal. Carry out the usual test recording on both machines. Then run the tapes back to the start and record on both the prescribed period of tone.
- (vii) Switch one machine to **REMOTE** and set the corresponding **REMOTE START** key on the console to **DISTANT**.
- (viii) Switch on the amber **READY** lamp above the machine.
- (ix) During the recording, as the end of each reel is

approached, make the change-over in the machine room.

- (x) To record tone on the third and subsequent reels, throw the SEND TONE/TEST TONE key to TEST TONE. Tone can then be recorded on the machine away from which the recording change-over key is switched.

6.3 PARALLEL OPERATION

The LISTEN sockets on the distribution bay are controlled by the machine REC./REP. keys in the same way as the MACHINE sockets. This means that if the LISTEN socket of one machine is plugged to the LISTEN socket of another, both keys must be operated to RECORD or both to REPRODUCE. The 'listen' facility cannot be used for copying from one machine to another, as the outputs of the two machines are paralleled.

SECTION 7

STUDIO EQUIPMENT

7.1 TYPE-B EQUIPMENT

The recording, reproducing, signalling, starting and telephone circuits from the recording room are routed to the studio via the control room switching equipment.

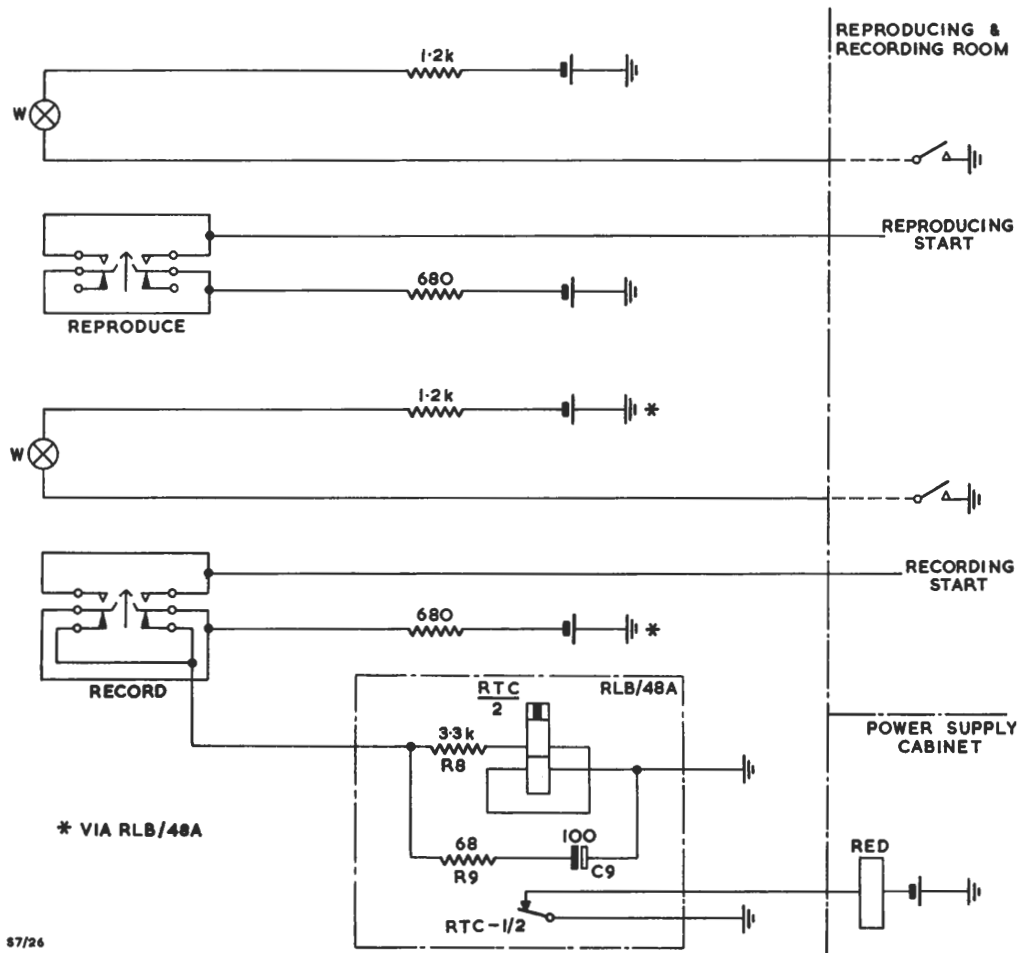


FIG. RX2.27 TYPE-B STUDIO EQUIPMENT: SIMPLIFIED REMOTE CONTROL CIRCUIT

Separate remote-starting keys are used for recording and reproduction as indicated in Fig. RX2.27.

For both recording and reproduction a signal-lamp is provided which lights when the machine starting circuit is placed under the control of the studio. The recording key further operates the studio red light relay, which has an RC delay network. The delay is to ensure that the recording machine reaches a steady speed before the red light comes on, a necessary precaution since this light may be used as a starting cue for studio performers.

7.2 OTHER EQUIPMENT

The remote-starting circuit employed at Broadcasting House London pending the installation of Type-B Equipment is shown in Fig. 8. The general principle of operation does not differ greatly from that shown in Fig. RX2.27, although at B.H. an earth instead of battery is put on the starting line.

SECTION 8**BROADCASTING HOUSE: TRANSMISSION REPRODUCTION ROOM H12****8.1 GENERAL**

This room is known as the 'Transmission Reproduction Room' because, unlike other central rooms, it is not equipped for recording. Accommodation is provided for 12 E.M.I. Type-BTR/2 machines and 6 control consoles, although the present installation comprises only 10 machines and 5 consoles. A distribution bay and a monitoring cubicle are also provided.

A maximum of 7 remotely controlled reproductions can be fed simultaneously to the control room using normal facilities, but an additional reproduction can be handled by using the control-room line from disk reproducing channel H9, which is routed via H12. A further 4 tie-lines to the control room are available, but as these are not equipped with remote-control or signalling facilities, they are normally used for closed-circuit playback only.

8.2 MACHINE-ROOM EQUIPMENT**8.2.1 DISTRIBUTION BAY**

This bay mounts the following equipment:-

OS/10A which feeds line-up tone to the whole of the lower Broadcasting House recording area, leaving the OS/10A in Cavendish Mansions feeding only the Cavendish Mansions recording area.

Talkback amplifier and loudspeaker operated from a microphone with talkback key in the cubicle.

Red light panel fitted with 8 red lights, one for each control room line including H9. (See iv below.) Corresponding red lights are provided in the control room.

Linking panel or 'master jackfield' comprising 15-way F. and E. sockets. Each socket connects the reproducing, cue and telephone lines, together with the signalling and miscellaneous technical control circuits concerned in the operation of the machines. The sockets are arranged in 5 rows as follows:-

- (1) The A and B console inputs.

- (ii) Machine outputs LISTEN.
- (iii) MACHINE outputs.
- (iv) Console outputs and, at the right-hand side, the line from disk channel H9, which is routed to control room via the transmission reproduction room.
- (v) 7 control room lines, together with one normally allocated to the circuits from channel H9. Also a test socket associated with 2 jacks mounted lower down on the bay.

A row of HV/7 switches, one for each control room line and one for the test jack. The switches permit the selection of cue programme from ring-main, any programme not available on ring-main being obtainable on the usual ninth line.

4 P.O.-type jacks, of which two give access to the pins of the test socket, one supplies line-up tone for test purposes, and the remaining one connects with a tie-line from the cubicle bay.

The distribution bay also carries 8 sets of signalling relays for the 8 control room lines, whilst at the bottom of the bay is an MU/16H mains unit supplying the OS/10A.

8.2.2 MACHINES

The BTR/2 machines in H12 are standard except that the recording amplifiers and, except on two machines (Nos. 11 and 12), the oscillator units, have been removed. The oscillator units of machines 11 and 12 are still in position, but can only be used to provide partial erasure as a remedy for printing effect if so required.

8.2.3 CONTROL CONSOLES

The control consoles in H12 are Type B, and are fitted with a control panel No. 98 with facilities for handling reproductions from either single machines or linked pairs. There is no peak programme meter, and of course no recording change-over switch or gain control.

8.3 LISTENING CUBICLE

The cubicle contains a control desk, a bay and a high-quality loudspeaker. A talkback microphone is provided for communication with the machine room, the talkback amplifier being mounted on the machine-room bay.

The apparatus on the control desk is similar to that in CTR2 except for the telephone controls. These use drop indicators on panels KI/3A instead of lamp indicators on a panel KL/33. Direct access to console telephones is provided by a key, labelled MACHINE ROOM, which is used with the cubicle operator's telephone. A further cubicle telephone with call pushbutton provides direct access to the control room. The E.M.X. recall facilities described in Section 2.3.2(b) are not fitted, and the telephone buzzer sounds for 5 - 10 seconds out of every 20 - 30 until answered.

8.4 POWER SUPPLIES

The power supplies in H12 are routed via recording supply cabinets as in CTR1. (Section 2.4.) The schematic diagram, Fig. RX2.9, of cabinet RSC/1 applies to H12 as well as to CTR1 except that H12 has a maintained supply.

8.5 CIRCUITS

8.5.1 GENERAL

The programme and control circuits in H12 itself resemble those of CTR1 and CTR2 (Sections 4 and 5) except for the absence of recording facilities including REC./REP. change-over keys and REP. LINE CUT-OFF keys; feeding cue programme is the only function of the recording circuits and relays RC2, R600.1 and R600.2 are not fitted. The control-room ends of H12 circuits are similar to those provided at the studio end for H18. (Section 9.) H12 telephone circuit is described in Section 8.5.2.

The circuit allocations with respect to the pins of the linking-panel sockets are:-

<i>Pin</i>	<i>Function</i>
1	Autofollow Receive
2	Autofollow Send
3-4	Telephone Line
5-6	Reproducing Line
7-8	Cue Line
9	Start
10	REMOTE Indicator
11	Not wired
12	Single/Dual Machine Linking
13	Control Room Buzzer
14-15	Not wired

8.5.2 TELEPHONE CIRCUIT

This circuit is shown in Fig. RX2.28. Pins 3 and 4 only of the 15-way sockets are used. Since drop indicators are provided on the cubicle telephone panel instead of lamps, cancellation must take place at the panel. In conjunction with the drop indicators, an intermittent buzzer employing an interruptor circuit is used; this arrangement is also adopted in H18.

The buzzer is made to sound for 5 - 10 seconds in each 20 - 30 by the circuit of Fig. RX2.29, incorporating relays R1, R2, T1 and T2. Relays T1 and T2 are thermally operated, and have 5 and 30 seconds delay respectively when starting from cold. The switching sequence is:-

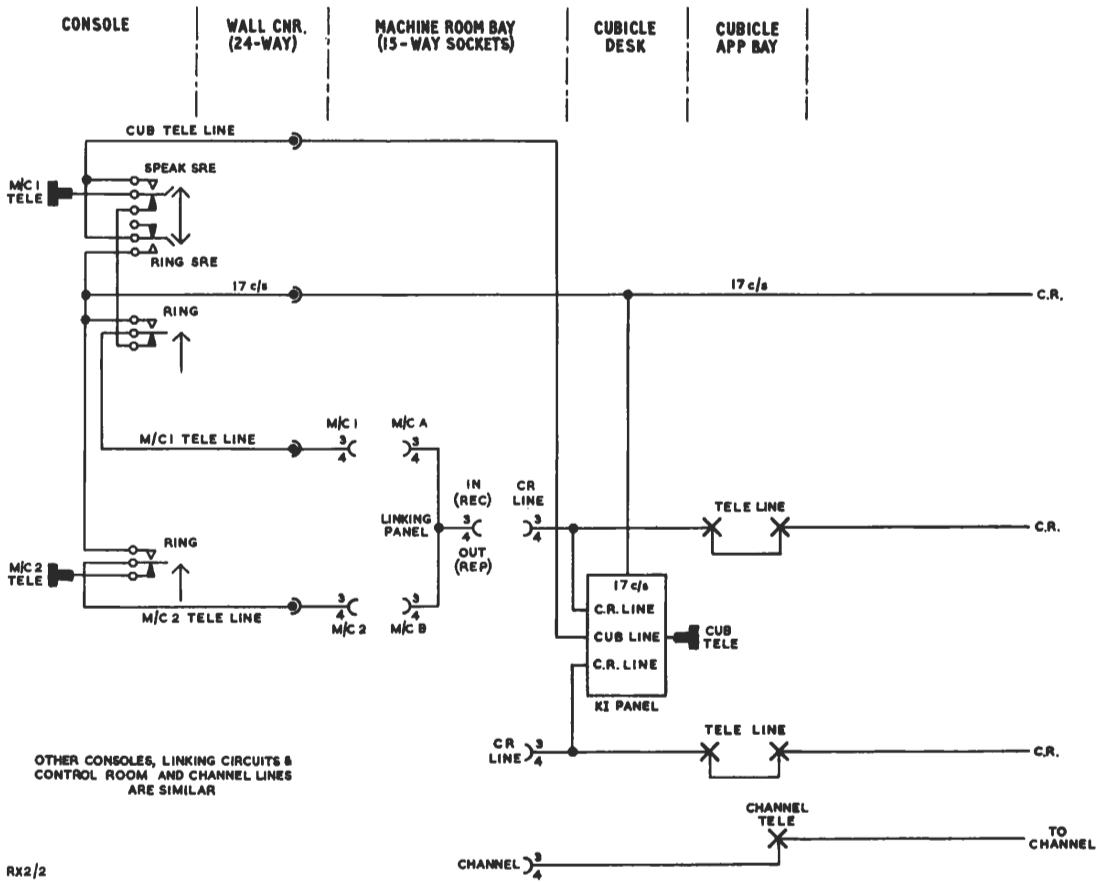


FIG. RX2.28 H12 TELEPHONE CIRCUIT

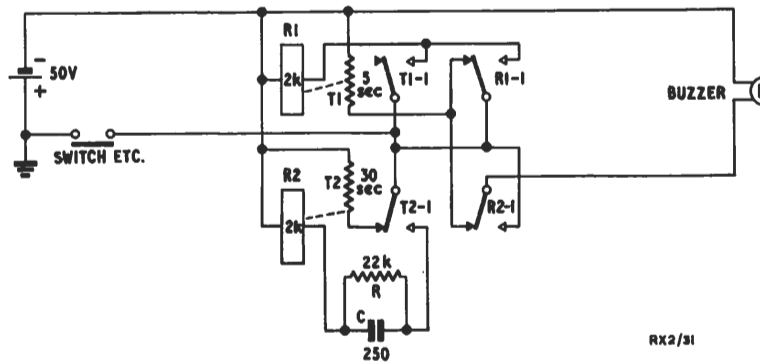


FIG. RX2.29 H12 AND H18 TELEPHONE BUZZER INTERRUPTOR CIRCUIT

	<i>Time</i>	<i>Operation</i>
(1)	0 sec	Circuit established. T1 heats via R1-1. T2 heats via T2-1. Buzzer operates via R1-1 and R2-1.
(2)	5 sec	T1 operates. R1 operates via T1-1. R1-1 holds in R1, stops buzzer and de-energises T1. T1 cools.
(3)	30 sec	T2 operates. T2-1 de-energises T2 and operates R2 via C and R. R2-1 operates buzzer. T2 starts to cool.
(4)	35 sec	When C is charged, R2 de-operates again. Buzzer stops.
(5)	50 sec	As T2 cools, T2-1 breaks, and re-makes in de-operated position. T2 heats.
(6)	60 sec	T2 operates. T2-1 operates R2 via C and R. Buzzer operates via R2-1 for 5 seconds.

Operations (4), (5) and (6) repeat indefinitely until battery is cut off by acknowledging the call.

SECTION 9

BROADCASTING HOUSE: CENTRAL RECORDING ROOM H18

9.1 GENERAL

9.1.1 EQUIPMENT

H18 accommodates 16 E.M.I. TR/90 machines, any of which may be coupled via the usual 15-pin sockets to any control-room or studio line. There are no consoles and, apart from LISTEN sockets, no machine-linking facilities. The 16 machines are mounted in pairs on eight 19-inch bays, and there are, in addition, an apparatus bay (Bay 1) and a distribution bay (Bay 2). A control and monitoring desk is provided in the room itself, and there are also two separate listening cubicles. Remote starting is provided at the desk for each control-room line.

9.1.2 FACILITIES

The installation allows the following operations to be carried out:-

- (i) Recording from any of 8 control room lines (circuits A to G), the machines being started in the recording room.
- (ii) Recording from any of 10 studios with remote starting by the studio.
- (iii) Playback on any of 8 control room lines (A to G), the machines being started in the recording room.
- (iv) Playback to any of the same 10 studios as in (ii) with remote starting from the studio.
- (v) Recording from the office of the traffic manager in Egton House, with remote starting by the traffic manager.
- (vi) Recording on additional Ferrograph machines of presentation announcements from the continuity studios of domestic services, with remote starting operated by the continuity studio microphone fader. (The details of this arrangement are outside the scope of this Instruction.)

9.1.3 MACHINES

The machines, Type TR/90, differ from the Type-BTR/2 machines used elsewhere, and in this connection the following points should be noted:-

- (a) Whereas the BTR/2 is stopped by a pulse applied to the OFF wire, the TR/90 is stopped by disconnecting the OFF wire from earth.
- (b) The BTR/2 is started for reproduction by a pulse on the PLAY wire, while the TR/90 also requires the OFF wire to be earthed.
- (c) The BTR/2 is started for recording (plus reproduction) by a pulse on the RECORD wire, but the TR/90 requires the RECORD and PLAY wires both to be pulsed and the OFF wire to be earthed as well.

9.1.4 CIRCUIT ALLOCATIONS

The circuit allocations on the 15-pin sockets are:-

<i>Pin</i>	<i>Function</i>	<i>Fig. No.</i>
1-2	Not wired	
3-4	Telephone Line	9
5-6	Reproducing Line	6
7-8	Recording Line	6
9	Start Circuit	8
10	REMOTE Indicator	8
11-12	Not wired	
13	Buzzer (not used)	8
14	Telephone Indicator	9
15	Local/Remote Switching	8

The MACHINE and LISTEN sockets are wired identically in parallel. The LISTEN sockets are therefore omitted from circuit diagrams.

9.2 THE PROGRAMME CHAIN (FIG. 6)

9.2.1 RECORDING CHAIN

The programme at zero level passes via break-jacks to pins 7 and 8 of the line and machine sockets; these are followed by relay contacts ST-1/2, and a loss-pad which reduces the volume reaching the machine to -8 dB. The loss-pad has a high input impedance, but a permanent 600-ohm load is connected across the line socket to ensure correct termination of the line. The MACHINE IN monitoring point is on the low-level side of the pad.

When relay ST is operated by throwing the SEND TONE key (Fig. 8, Section 9.7) ST-1/2 change over and the programme source is replaced by intermodulation test oscillator ITO/1. This is a modified and bay-mounted version of the PIT/1 (Instruction S.4). For a circuit diagram of the ITO/1, see Fig. 10.

9.2.2 REPRODUCING CHAIN

The machine reproducing circuit has a source impedance of 600 ohms and an output level of +6 dB. The signal path is controlled by LC0-1/2, which open when the machine is switched to remote, but re-close after a slight delay when the START lamp is switched on from the remote control point; this arrangement is a precaution against broadcasting the run-up of the machine. Contacts LC0-1/2 can also be opened by throwing the REP. LINE CUT key (Fig. 8), which is provided to allow the outgoing reproducing circuit of one machine to be cut off when two machines are connected together via their LISTEN sockets for parallel recording. (Section 9.9.)

The circuit beyond this point is bridged by a 14-dB high-impedance pad connecting to the MACHINE OUT monitoring point. A further pad providing 6 dB of attenuation with 600/600-ohm terminations carries the programme via tone-switching contacts ST-3/4 to pins 5 and 6 of the machine 15-way socket. The corresponding pins of the line socket connect via break-jacks with the outgoing line and a LINE OUT monitoring point. The sending level to line is 0 dB.

9.3 MONITORING SYSTEM (FIG. 7)

9.3.1 GENERAL

The monitoring system provides facilities for selecting any machine output at each of three locations:-

1. The Control Desk,
2. Listening Room 5,
3. Listening Room 6.

In addition, any machine input or any outgoing line may be selected for monitoring from the control desk and, if required, extended to listening room 5 only.

Machine and line selection is by non-locking pushbuttons and relays, together with comprehensive-checking keys.

In Fig. 7, the programme circuits appear at the top of the diagram and the control circuits underneath. The control circuits to the right of the centre-line (on panels RLP/19A) are used with the control desk, while those to the left (on panel RLP/31) are used with the listening rooms. The two panels RLP/19A and also panel RLP/31 are mounted on H18 apparatus bay.

9.3.2 CONTROL DESK

The desk loudspeaker and P.P.M. circuit is shown in the top right-hand corner of Fig. 7. The monitor selector panel on the desk has two rows of non-locking pushbuttons, one for machine inputs and outputs, and the other for outgoing lines. The choice between the three available monitoring points for a selected machine and a selected outgoing line is made by means of a comprehensive-checking key.

When a **MACHINE** pushbutton, e.g., K1(M), is pressed, the corresponding relay, M(1), is energised in series with high-speed relay MR, the common 'machine release' relay.

Relay MR operates first

MR-1 breaks the hold path of any previously selected M-relay, which is only just holding on its 1,500-ohm winding and releases before the newly selected relay M(1) has time to operate.

This arrangement prevents two machines from being paralleled onto the monitoring circuit, with resultant mixing of the two programmes either incoming to or outgoing from the machines.

Relay M (1) operates

M(1)-1/2 connect machine 1 output to the desk loudspeaker and P.P.M. circuit via MCO(1)-1/2 and LMC0(1)-1/2.

M(1)-3/4 prepare a circuit from machine 1 input to the desk loudspeaker and P.P.M. circuit via MCO(1)-1/2 and LMC0(1)-1/2.

M(1)-5 lights an indicator-lamp on the selector panel.

M(1)-6 prepares a hold path for relay M(1) via MR-1.

When pushbutton K1(M) is released, relay MR falls out before relay M(1), which has been energised via its 50-ohm winding, has time to de-operate. MR-1 completes the holding circuit of relay M(1) over M(1)-6 and the 1,500-ohm winding.

With the desk comprehensive-checking key on INC. PROG., the machine input is routed to the listening circuit via MCO(1)-1/2. When the key is thrown to MACHINE OUT, relay MCO(1) is energised.

Relay MCO (1) operates

MCO(1)-1/2 transfer the machine output to the listening circuit, in place of the machine input.

When a LINE pushbutton, e.g., K1(L), is pressed, the corresponding relay, L(1) is energised in series with the high-speed common 'line release' relay LR, which operates first, and releases any previously operated L relay.

Relay L (1) operates

L(1)-1/2 prepare a circuit from the selected outgoing line monitoring point to the loudspeaker and P.P.M. via an 8-dB pad and normally-open contacts LMC0(1)-1/2.

L(1)-3 lights an indicator-lamp

L(1)-4 holds in relay L(1) via LR-1 when K1(L) is released and relay LR de-operates.

When the comprehensive-checking key is set to LINE OUT, relay LMC0(1) is energised.

Relay LMC0 (1) operates

LMC0(1)-1/2 connect the outgoing line monitoring point through to the desk loudspeaker and P.P.M. circuit.

9.3.3 LISTENING ROOM 5

The loudspeaker listening circuit for this room is shown near the top left-hand corner of Fig. 7. The monitor selection controls provided comprise a series of pushbuttons together with two lever-keys. One key is used for change-over purposes to switch between the LOCAL MON. SEL. pushbuttons, the local HV/7 OUT and an H18 MON. SEL. key. The H18 MON. SEL. key itself connects the listening room loudspeaker to the control-desk monitoring circuit; its three positions are therefore labelled LINE OUT, INC. PROG. and MACHINE OUT, in agreement with the labelling of H18 control-desk comprehensive-checking key.

In the LOCAL MON. SEL. condition of the change-over key, there is pushbutton access to the outputs of individual machines via relays M(1A) to M(12A) and MCO(3). Pushbuttons K1 to K12 give access to machines 1 to 12 by operating M(1A) to M(12A) with MCO(3) unoperated. Buttons K13 to K16 give access to machines 13 to 16 via M(1A) to M(4A) with MCO(3) operated.

Pressing one of the first 12 machine buttons, e.g., K1, energises the corresponding machine relay, M(1A), in series with high-speed 'machine release' relay MRA, which operates first, and fulfils the same purpose as machine release relay MR. (Section 9.3.2.) The key contacts also break the holding circuit of MCO(3), which releases if already operated.

Relay M (1A) operates

M(1A)-1/2 connect machine 1 output to the listening circuit via non-operated contacts MCO(3)-1/2.

M(1A)-3/4 prepare machine 13 output circuit up to the 'make' side of MCO(3)-1/2, at which point the circuit is broken.

- M(1A)-5 lights the MACHINE 1 indicator-lamp via non-operated contact MC0(3)-3.
- M(1A)-6 holds in relay M(1A) via MRA-1 when K1 is released and MRA de-operates.

Pressing one of the buttons for machines 13 to 16, e.g., K16, energises relay MC0(3), and also M(4A), in series with MRA which operates first as before.

Relay MC0 (3) operates

- MC0(3)-1/2 prepare a path from the outputs of machines 13 to 16 to the listening circuit.
- MC0(3)-3 breaks the MACHINE 4 indicator-lamp circuit via M(4A)-5.
- MC0(3)-4 Prepares the MACHINE 16 indicator-lamp circuit up to M(4A)-5.

Relay M (4A) operates

- M(4A)-1/2 connect machine 4 output to MC0(3)-1/2, at which point the circuit is broken.
- M(4A)-3/4 connect machine 16 output to the listening circuit via MC0(3)-1/2.
- M(4A)-5 completes MACHINE 16 indicator-lamp circuit, previously prepared by MC0(3)-4, and thus lights the lamp.
- M(4A)-6 holds in relay M(4A) via MRA-1 when K16 is released and MRA de-operates.

Throwing the monitor change-over key from LOCAL MON. SEL. to H18 MON. SEL. operates relay LMC0(3), whose contacts LMC0(3)-1/2 connect listening room 5 loudspeaker to H18 control-desk monitor-selector circuit instead of to the listening-room local-selector system.

The key in the listening room labelled H18 MON. SEL. is arranged to operate by means of relays MC0(2) and LMC0(2), which select the required monitoring circuit in H18 itself. When the key is set to INC. PROG., neither of the relays is energised, and the machine-input monitoring circuit is selected via non-operated contacts LMC0(2)-1/2

and MC0(2)-1/2. When the key is set to MACHINE OUT, relay MC0(2) operates, and MC0(2)-1/2 change over to select the machine output monitoring circuit. With the key on LINE OUT, relay LMC0(2) operates, and LMC0(2)-1/2 changing over select the monitoring circuit for outgoing lines.

9.3.4 LISTENING ROOM 6

The equipment of this room comprises a loudspeaker listening circuit, together with machine-output selector pushbuttons, an HV/7 and a single change-over key. One position of the key gives access to the machine output selected by the push-buttons via 'machine' relays M(13A) to M(24A), and relay MC0(4). The other key position connects the output of the local HV/7.

The circuits of the 12 machine relays are similar to those of the corresponding relays used in listening room 5. (Section 9.3.3.) Relay MC0(4) performs the same functions as relay MC0(3). The 'machine release' relay MRB has the same function as relay MR (Section 9.3.2) and relay MRA (Section 9.3.3).

There is no access to H18 control-desk monitoring circuit, except by overplugging the normalled circuits at the jackfield on H18 apparatus bay.

9.4 'START' CIRCUIT (FIG. 8)

9.4.1 GENERAL

The START circuit uses pin 9. When a machine is linked to a control room line, the starting circuit is not extended, but is picked up at the control desk and brought out to a LOCAL START key. When a machine is linked to a studio, the machine starting circuit is controlled from the studio by a START RECORD or START REPLAY key.

9.4.2 MACHINE 'REMOTE' SWITCH

To make control from H18 desk or a studio possible, the REMOTE switch on the machine must be closed. Closing the switch provides an earth which:-

- (a) Prepares the START RECORD, START REPLAY and OFF circuits.
- (b) Breaks the buzzer circuit. (Not at present in use.)

- (c) Operates line cut-off relay LCO, whose contacts LCO-1/2 open. (Fig. 6, Section 9.2.2.)
- (d) Operates RZ, which in turn applies an earth to the REMOTE lamp circuit (Section 9.5) and makes the tone-switching circuit (Section 9.7) inoperative. A further contact of RZ disables the buzzer circuit.

9.4.3 REC./REP. KEY

A REC./REP. key for each machine is provided on the distribution bay. This key, when operated to RECORD, prepares the switching circuits for recording. When the key is not operated, the switching circuits are prepared for reproduction. Throwing the key:-

1. Prepares a circuit from pin 9 of the MACHINE socket to operate relay RS.
2. Lights a red indicator-lamp for the key.
3. Applies an earth to pin 15 of the MACHINE socket which operates an H18 RECORD lamp relay on a wall-mounted signal-lamp relay (S.L.R.) unit if the machine is plugged to control room, and also, if the machine is plugged to a studio, energises relay RC.

If relay RC operates (i.e., machine plugged to studio)

- RC-1 connects relay RL on the distribution bay to the studio START RECORD key instead of to the studio START REPLAY key.
- RC-2 operates in the REMOTE lamp circuit. (Section 9.5.)
- RC-3 brings up the STUDIO RECORD lamp relay for the machine.

9.4.4 LOCAL START FROM CONTROL DESK

Moving a LOCAL START key on H18 control desk from OFF to RUN puts an earth on pin 9 of the CONTROL ROOM LINE socket concerned, and on pin 9 of the MACHINE socket to which it is linked. The circuit from pin 9 goes via the REC./REP. key for the machine to relay RS or RP, according to the position of the key. The further sides of the windings of both relays are taken to battery.

(a) **RECORD CONDITION**

With the REC./REP. key operated to RECORD, operating the LOCAL START key on H18 desk to RUN energises relay RS.

Relay RS operates

- RS-1 extends an earth from the machine REMOTE switch (if operated) to the START RECORD circuit of the machine, thus preparing the machine for recording.
- RS-2 similarly extends an earth to the machine START REPLAY circuit, so preparing the machine for reproduction as well as recording.
- RS-3 earths the OFF circuit and starts the machine.
- RS-4 releases line cut-off relay LCO. (Sections 9.2.2 and 9.4.4(b).)
- RS-5 energises the RL relay at the machine position.

Machine-position RL relay operates

- RL-1 lights a red START lamp at the machine position.
- RL-2 opens in the buzzer circuit. (Not in use.)
- RL-3 disables relay ST.
- RL-4 breaks the START RECORD and START REPLAY circuits to the machine. (The machine internal circuits, once operated, are self-holding, until RS-3 opens and switches the machine OFF.)

(b) **REPLAY CONDITION**

If the REC./REP. key is not operated, operating the LOCAL START key on H18 desk to RUN energises relay RP.

Relay RP operates

- RP-1 prepares the machine for reproduction.
- RP-2 earths the OFF circuit and starts the machine.

RP-3 opens and releases line cut-off relay LCO after a short delay controlled by an adjustable RC circuit. The purpose of relay LCO and the object of the delay are explained in Section 9.2.2.

RP-4 energises relay RL at machine position. This relay operates as just described in (a).

9.4.5 REMOTE START FROM STUDIO

When a machine is connected to a studio, the machine-position starting circuits described in Section 9.4.4 under (a) and (b) are operated by an earth obtained via RL-1 on the distribution bay; the RECORD or REPLAY condition as required is pre-selected by the REC./REP. key.

(a) RECORD CONDITION

With the REC./REP. key on RECORD, relay RC is operated and RC-1 changing over connects the studio START RECORD key to relay RL on the distribution bay. Throwing the studio key then energises this RL relay; further contacts of the key switch on the studio red light via the studio RL relay.

Distribution-bay RL relay operates

RL-1 applies an earth to pin 9 of the STUDIO socket, and hence via the MACHINE socket to the starting circuit, as described in Section 9.4.4.(a).

RL-2 operates the STUDIO START lamp relay in H18.

(b) REPLAY CONDITION

If the REC./REP. key is not operated, the REPLAY condition obtains. Non-operated contact RC-1 connects the studio START REPLAY key to relay RL on the distribution bay. Throwing the studio key energises this relay.

Distribution-bay RL relay operates

RL-1 applies an earth via pin 9 and the REC./REP. key to the starting circuit, as described in Section 9.4.4(b).

RL-2 operates the STUDIO START relay in H18.

9.5 'REMOTE' INDICATOR CIRCUIT (FIG. 8)

The REMOTE indicator-lamp circuit is wired via pin 10 of the 15-way sockets. Closing the REMOTE switch on the recorder energises RZ, making RZ-2 put an earth on pin 10 of the MACHINE socket.

If a MACHINE and a CONTROL ROOM LINE socket are linked, the earth from RZ-2 lights an indicator-lamp on H18 control desk and also operates a wall-mounted H18 REMOTE relay and lamp.

If a MACHINE and a STUDIO socket are linked, the earth from RZ-2 lights the REMOTE RECORD or REMOTE REPLAY indicator-lamp in the studio via contact RC-2 of relay RC, which is controlled by the appropriate REC./REP. key as explained in Section 9.4.3. The earth reaching pin 10 of the STUDIO socket also operates a wall-mounted STUDIO REMOTE relay and lamp in H18.

9.6 'READY' LAMP CIRCUIT (FIG. 8)

The READY lamp circuit in channel H18 is similar in principle to those in channels CTR1 and CTR2. (Section 5.10.) The details of the arrangement can be seen from Fig. 8.

9.7 TONE SWITCHING CIRCUIT (FIG. 8)

The operating circuit of tone switching relay ST is via the SEND TONE key at the machine position and RZ-3 and RL-3. These contacts open and disable the circuit when the machine REMOTE switch is closed or a red START light is on. (Sections 9.4.2 and 9.4.4(a).)

If the machine REMOTE switch is open, and neither the H18 START lamp nor the STUDIO START lamp is on, throwing the SEND TONE key energises relay ST.

Relay ST operates

ST-1/2 switch the machine input from recording line to ITO/1.
(Fig. 6.)

ST-3/4 switch the reproducing line from machine output to ITO/1.

Tone from the ITO/1 is applied to the machine input at -8 dB and is sent to line at zero level.

9.8 TELEPHONE CIRCUIT (FIG. 9)

H18 telephone circuit is broadly similar to that of CTR2 (Fig. 5), but without the complications of control-room automatic switching. Calling lamps are provided on the wall-mounted 'S.L.R.' unit, as well as at the control desk and machine positions. All such lamps are cancelled by answering a call from either the desk or a machine position, the desk having a SPEAK/RING key for each incoming telephone line. A buzzer, with interrupter circuit (Fig. RX2.29), is also provided.

The machine position telephone is connected to the control-room or studio line via pins 3 and 4 of the 15-way sockets on the distribution bay. Pin 14 extends the calling-lamp cancel circuit from the desk to the machine position.

The general arrangement is shown in Fig. 9. Self-holding relay MT lights a white calling lamp at the machine position, while relay RT1, also self-holding, lights the white calling lamp provided on the S.L.R. unit for the particular incoming line; further contacts of RT1 light the corresponding control-desk calling lamp and supply an earth to operate the buzzer interrupter circuit comprising thermal relays T1 and T2. (Section 8.5.2.)

9.9 USE OF 'LISTEN' SOCKETS

Recording or reproduction on two machines in parallel may be carried out if necessary via the machine LISTEN sockets. Since the input impedance of the machines is high, on recording there is no loss of level. The output impedance of a machine is, however, only 600 ohms, and on reproduction there is a 3-dB loss when two machines are paralleled.

The REP. LINE CUT key (Section 9.2.2, Fig. 8) allows the outgoing reproducing circuit of one of the machines to be cut off when two machines are connected together via their LISTEN sockets for parallel recording.

SECTION 10

MODIFICATIONS UNDER SCHEME B

Scheme B covers the introduction of new equipment in studio and control room areas. The new equipment includes provision for centralised source and destination switching by means of numbered punching keys controlling motor-driven uniselectors. These selectors switch not only the music lines, but also the associated 'services', a term denoting lamp and buzzer signalling and telephone circuits.

When Scheme B comes into operation at any studio premises, all the lines between the recording area and the control room and studios are re-routed via the selector multiples. The circuit arrangements for the various 'services' (in particular, the telephones) must therefore be modified slightly in conformity with the requirements of the new method of selection.

As the installation at Bush House of CTR2 took place at the same time as the application of Scheme B, this room from the first incorporated the revised signalling and telephone systems, whereas CTR1 required modification.

The application of Scheme B to Broadcasting House London will similarly be accompanied by circuit changes affecting the provision of 'services' in H12 and H18.

G.H. 0159

CIRCUIT DIAGRAMS

LOCATION TABLE: FIG. 1

CONTACT	LOC	CONTACT	LOC
AT-1/2	C2	R600.1-1/2	O3
	C14	R600.2-1/2	P15
AT-3/4	E2	RC-1/2	E10
	E14	RC-3/4	E11
BT-1/2	D2	RC-5/6	F13
	D15	RC2-1/2	N7
BT-3/4	E2	RC2-3/4	O6
	E15	RT-1/2	H9
LC0-1/2	C1	RT-3/4	F11
	C13	RT-5/6	E12
LMC0-1/4	T12	ST-1/2	C2
LMC0-3/6	T11		C15
MCC-3/6	T9	ST-3/4	F2
MM-3/6	T10		F14
OC0-1/2	R5	ST-5/6	E1
			E13

Facing Fig. 1

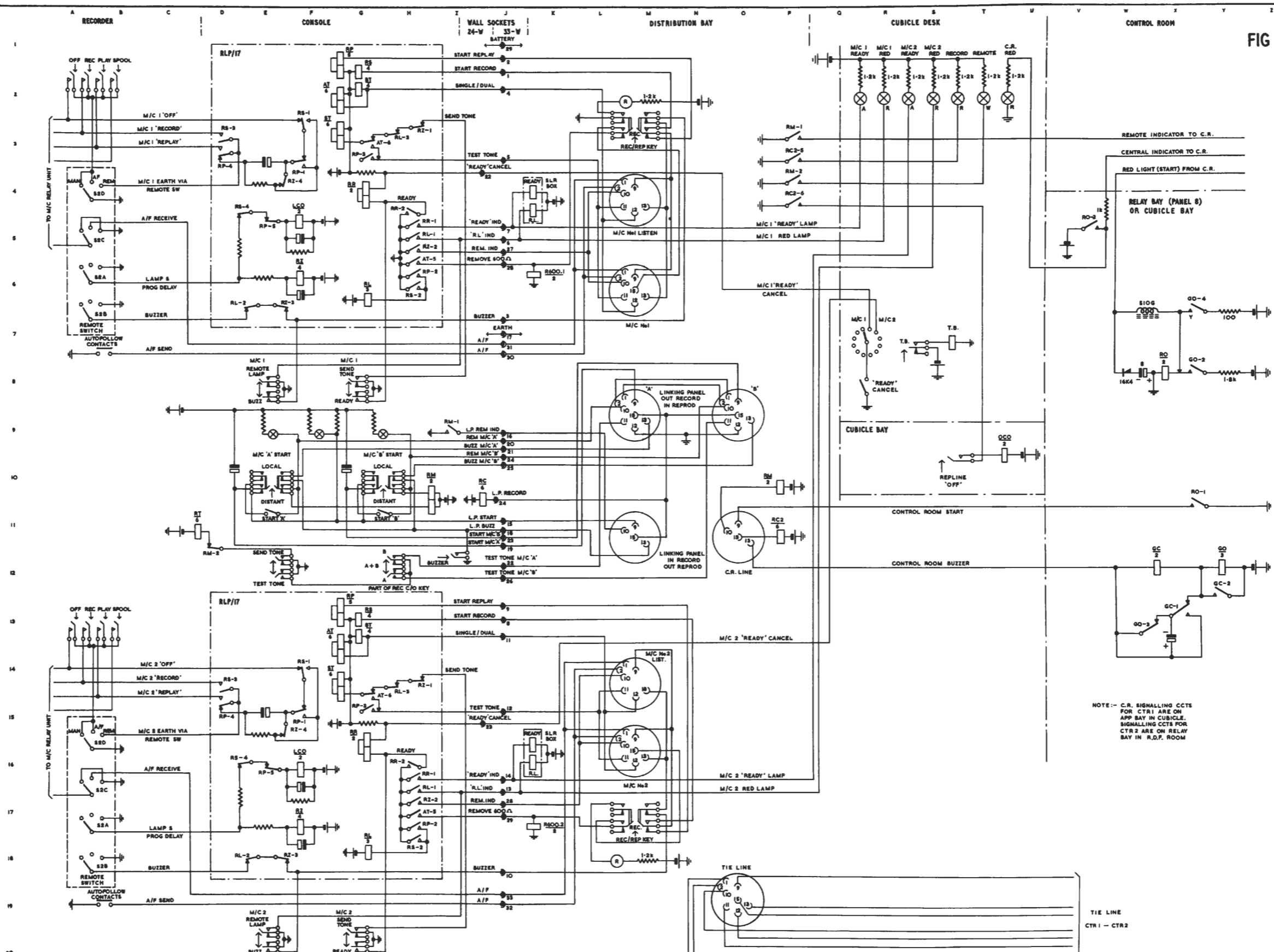
INSTRUCTION RX.2

LOCATION TABLE: FIG. 2

RELAY	LOC.	CONTACT	LOC.	CONTACT	LOC
AT	F2	AT-5	H5	RP-2	H6
	F13		H17		H17
BT	G2	AT-6	G3	RP-3	G3
	G13		G14		G15
GC	X12	GC-1	X13	RP-4	D3
GO	Y12	GC-2	Y12		D15
LC0	F4	GO-2	X8	RP-5	E5
	F16	GO-3	X13		E16
OC0	U9	GO-4	Y6	RR-1	H5
RC	J10	RC2-4	P10		H16
RC2	P11	RC2-5	P3	RR-2	H4
READY	K4	RC2-6	P4		H16
	K16	RL-1	H5	RS-1	F2
RL	G6		H17		F14
	G18	RL-2	D7	RS-2	H6
R.L.	K4		D18		H18
	K16	RL-3	H3	RS-3	D3
RM	P10		H14		D14
RO	X8	RM-1	I9	RS-4	D4
RP	G1		P3		D16
	G12	RM-2	D11	RZ-1	H3
RR	G4		P3		H14
	G15	RO-1	Y11	RZ-2	H5
RS	G1	RO-2	V5		H17
	G13	RP-1	F3	RZ-3	F6
RT	D11		F15		F18
RZ	F6			RZ-4	E4
	F17				E15
R600.1	K6				
R600.2	K17				
ST	F2				
	F14				
TB	S7				

Facing Fig. 2

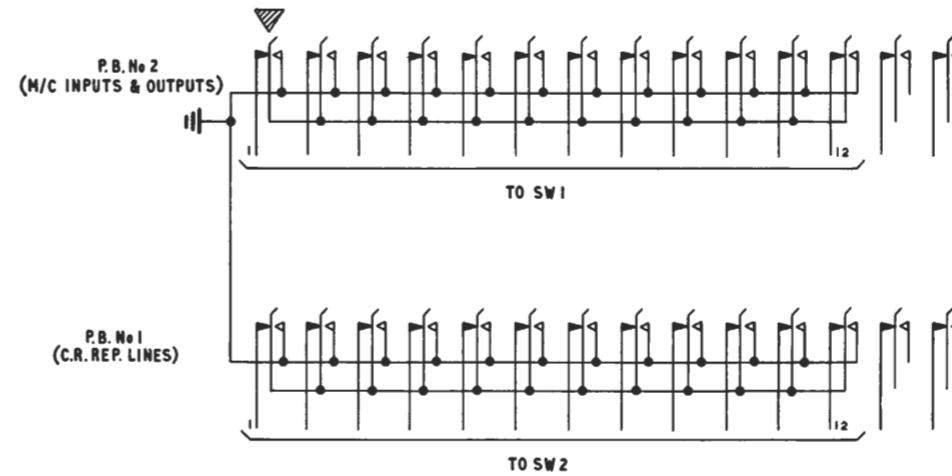
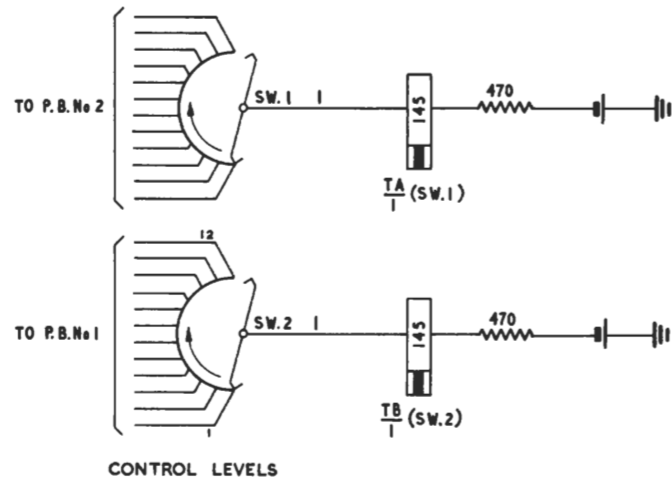
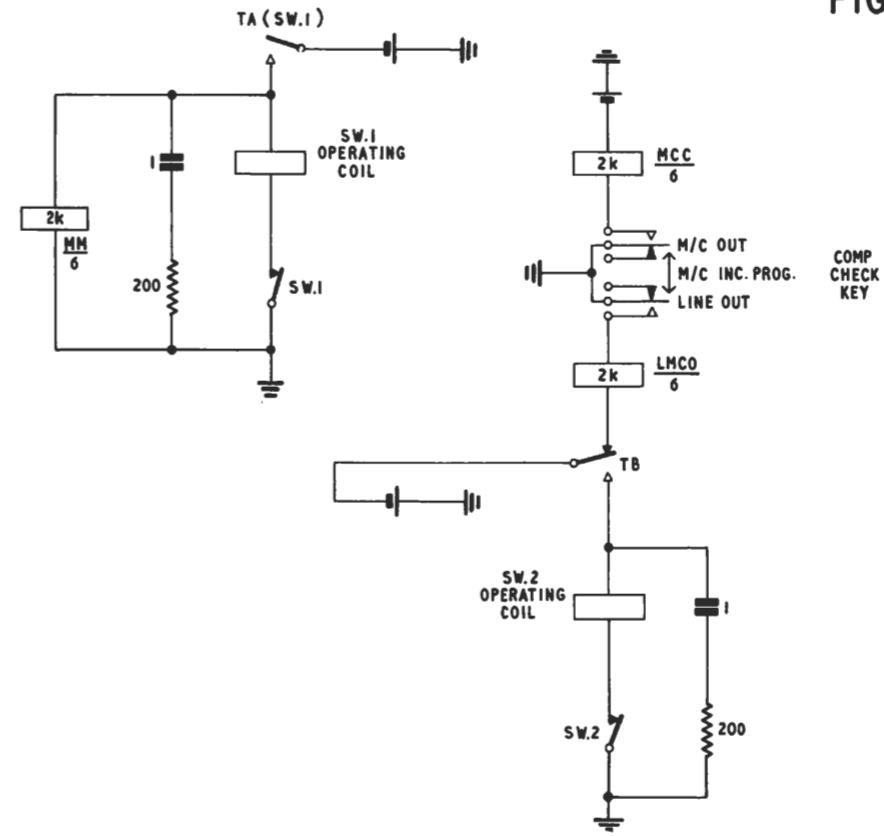
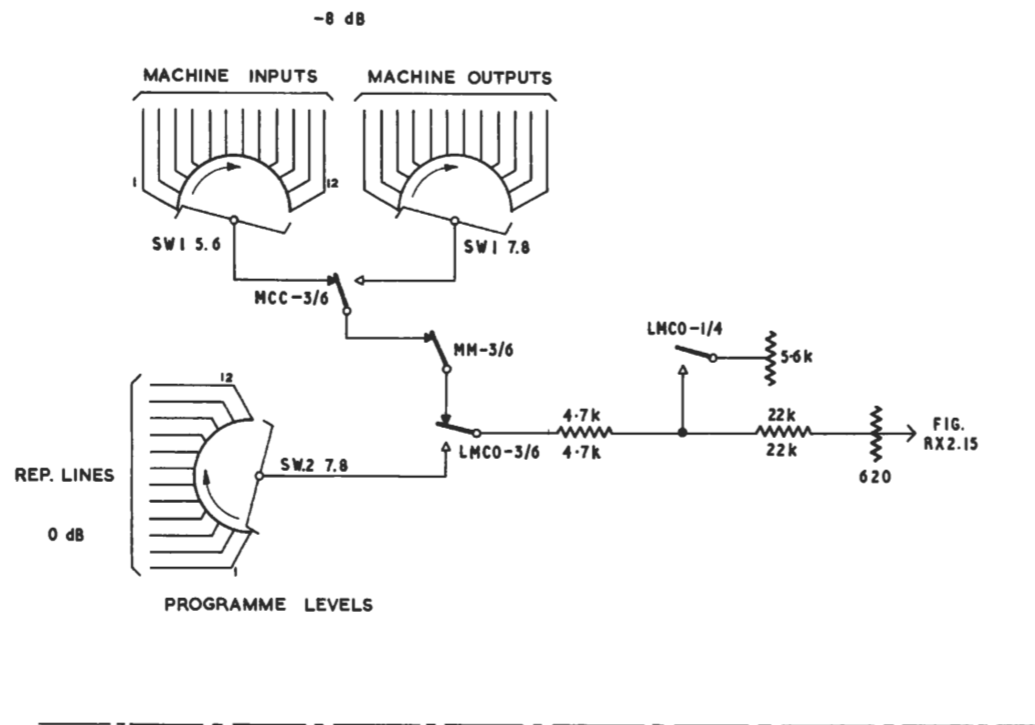
FIG 2



OPERATING & SIGNALLING CIRCUIT: CTR1 & CTR2

NOTE:- C.R. SIGNALLING CCTS FOR CTR1 ARE ON APP BAY IN CUBICLE. SIGNALLING CCTS FOR CTR2 ARE ON RELAY BAY IN R.D.F. ROOM

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CONTACTS ARE EARTHED VIA PUSHBUTTONS
EXCEPT WHEN 'MARKED' BY OPEN CIRCUIT

MONITOR CHECK SELECTOR SYSTEM SCHEMATIC: CTR1 & CTR2

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COMPONENT TABLE: FIG. 4

COMP	LOC	TYPE	TOLERANCE PER CENT
C1	C5	350 V tubular	
C2	C4	25 V electrolytic	
C3	C7	25 V electrolytic	
C4	E3	250 V tubular	
C5	E6	250 V tubular	
C6	E2	350 V tubular	
C7	E5	350 V tubular	
C8	G7	350 V tubular	
C9	H5	350 V tubular	
C10	J5	350 V tubular	
C11	M7	350 V tubular	
C12	M3	350 V tubular	
C13	M6	350 V tubular	
C14	N4	25 V electrolytic	
C15	N7	25 V electrolytic	
C16	Q1	350 V electrolytic	
C17	R1	450 V electrolytic	
C18	N8	350 V tubular	
C19	N8	350 V tubular	
C20	H1	350 V electrolytic	
L1	R1	HC 111	
P1	E3	log pot	
P2	E7	log pot	
P3	G5	lin pot	
P4	H5	lin pot	

Table: Fig. 4

COMP	LOC	TYPE	TOLERANCE PER CENT
R1	B7	0.25 W	± 20
R2	C6	0.25 W	± 20
R3	C7	0.25 W	± 20
R4	D1	0.25 W	± 20
R5	D5	0.25 W	± 20
R6	D5	0.25 W	± 20
R7	D4	0.25 W	± 10
R8	D7	0.25 W	± 10
R9	D1	0.25 W	± 20
R10	E5	0.25 W	± 20
R11	F3	0.25 W	± 20
R12	F7	0.25 W	± 20
R13	H7	0.25 W	± 20
R14	J6	0.25 W	± 20
R15	K2	0.25 W	± 5
R16	K7	0.25 W	± 10
R17	L2	0.25 W	± 5
R18	L6	0.25 W	± 5
R19	L6	0.25 W	± 20
R20	N3	0.25 W	± 5
R21	N4	2 W ww	± 5
R22	N6	0.25 W	± 5
R23	N7	2 W ww	± 5
R24	O8	0.25 W	± 5
R25	O8	0.25 W	± 5
R26	N1	0.25 W	± 10

COMP	LOC	TYPE	TOLERANCE PER CENT
R27	03	0.25 W	<u>+20</u>
R28	06	0.25 W	<u>+20</u>
R29	P2	0.25 W	<u>+20</u>
R30	P3	0.25 W	<u>+20</u>
R31	P5	0.25 W	<u>+20</u>
R32	P6	0.25 W	<u>+20</u>
R33	K6	0.25 W	<u>+5</u>
T1	B3		
T2	Q4	HC 112	
T3	U4	HC 113	

FIG 4

A B C D E F G H J K L M N O P Q R S T U V W



V1,2
EF86



V3
ECC83

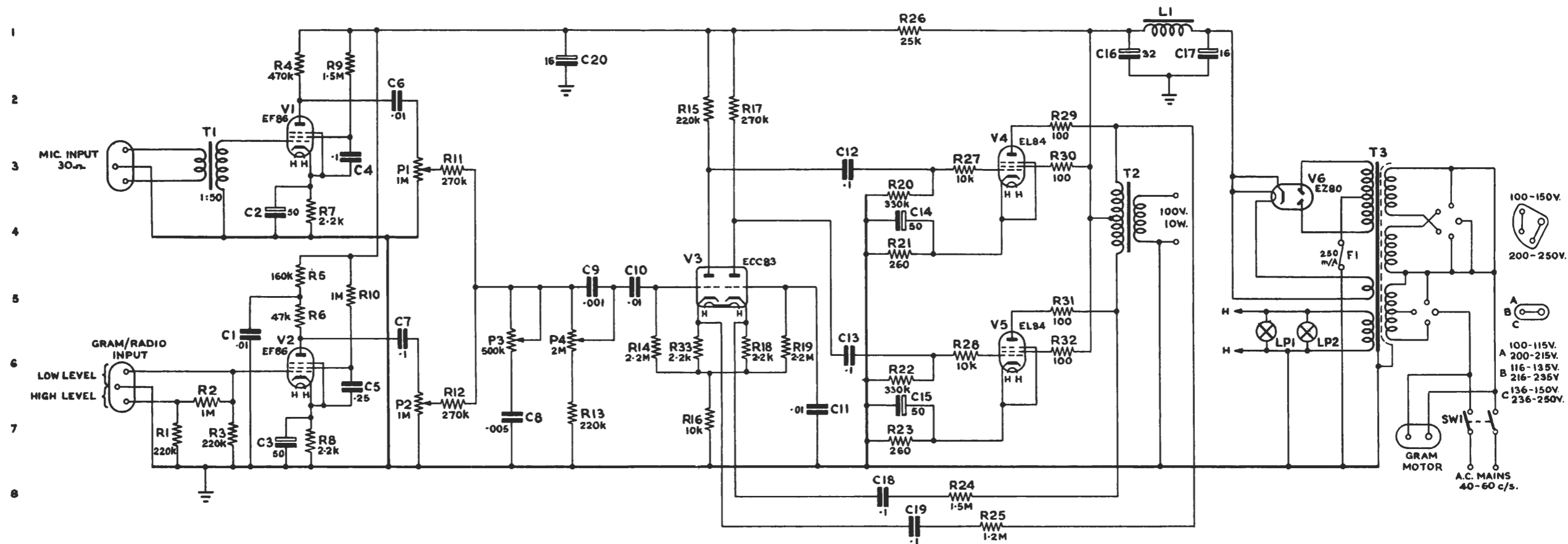


V4,5
EL84



V6
EZ80

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TALKBACK AMPLIFIER : CIRCUIT

PAMPHONIC 10-W AMPLIFIER TYPE 600V

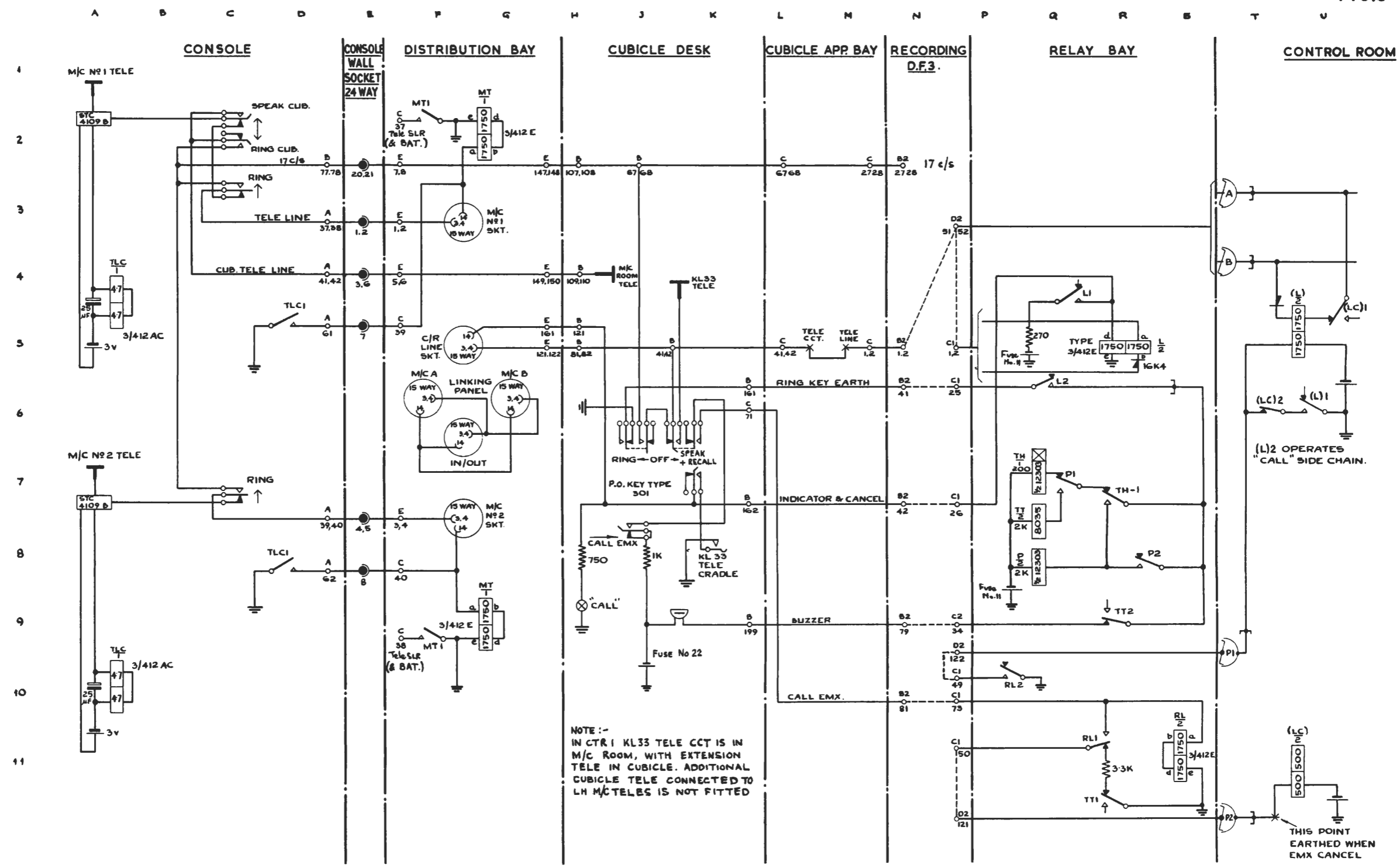
LOCATION TABLE: FIG. 5

RELAY	LOC
L	R5
(L)	T5
(LC)	T11
MT	G1
	G10
P	P8
RL	S11
TH	Q7
TLC	A4
	A10
TT	P7

CONTACT	LOC
L-1	Q4
(L)-1	U5
L-2	Q5
(LC)-1	U4
(LC)-2	T6
MT-1	F2
	G9
P-1	Q7
P-2	R8
RL-1	Q10
RL-2	P10
TLC-1	D5
	D8
TH-1	Q7
TT-1	R11
TT-2	R9

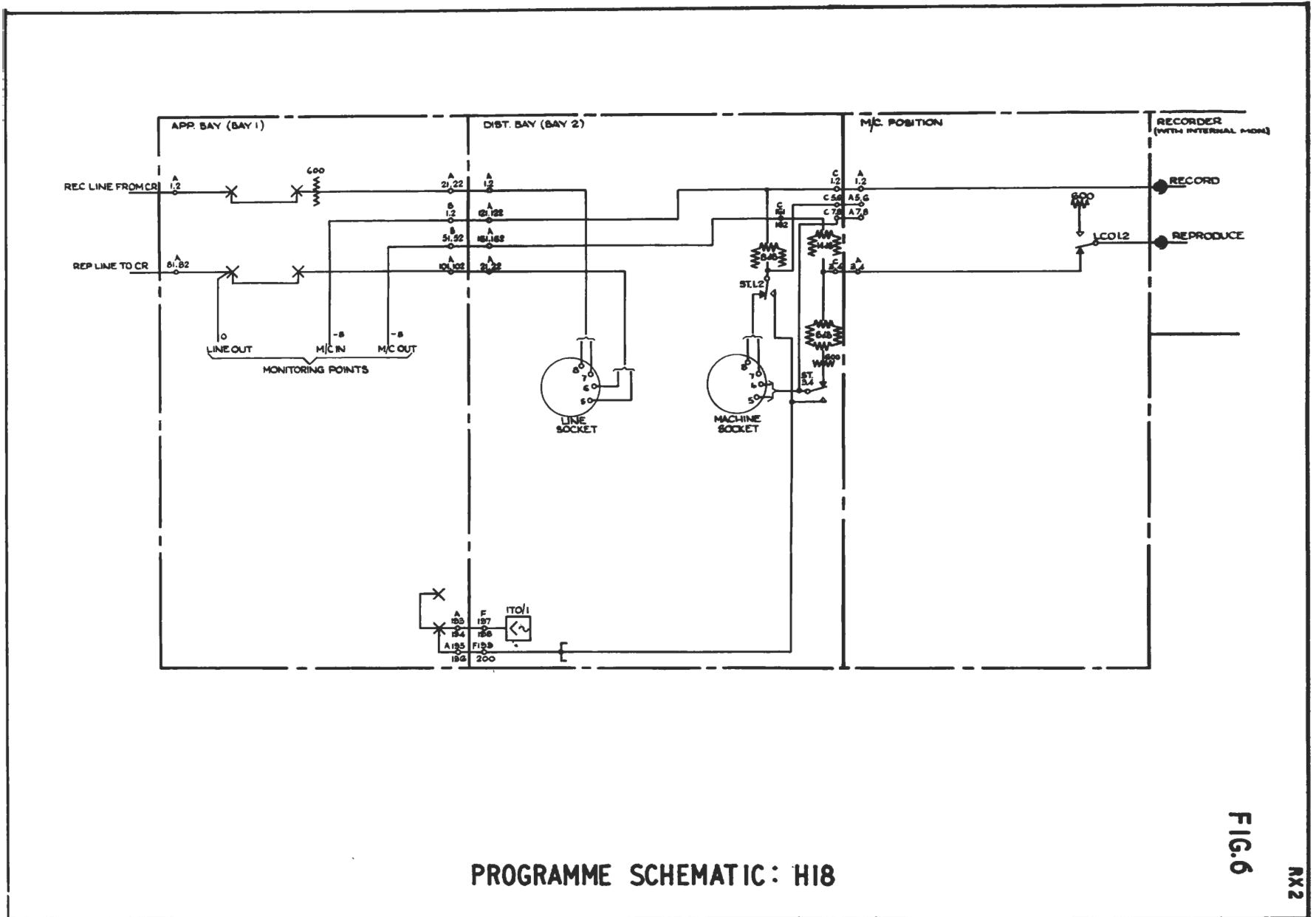
Facing Fig. 5

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TELEPHONE CIRCUIT : CTR 2

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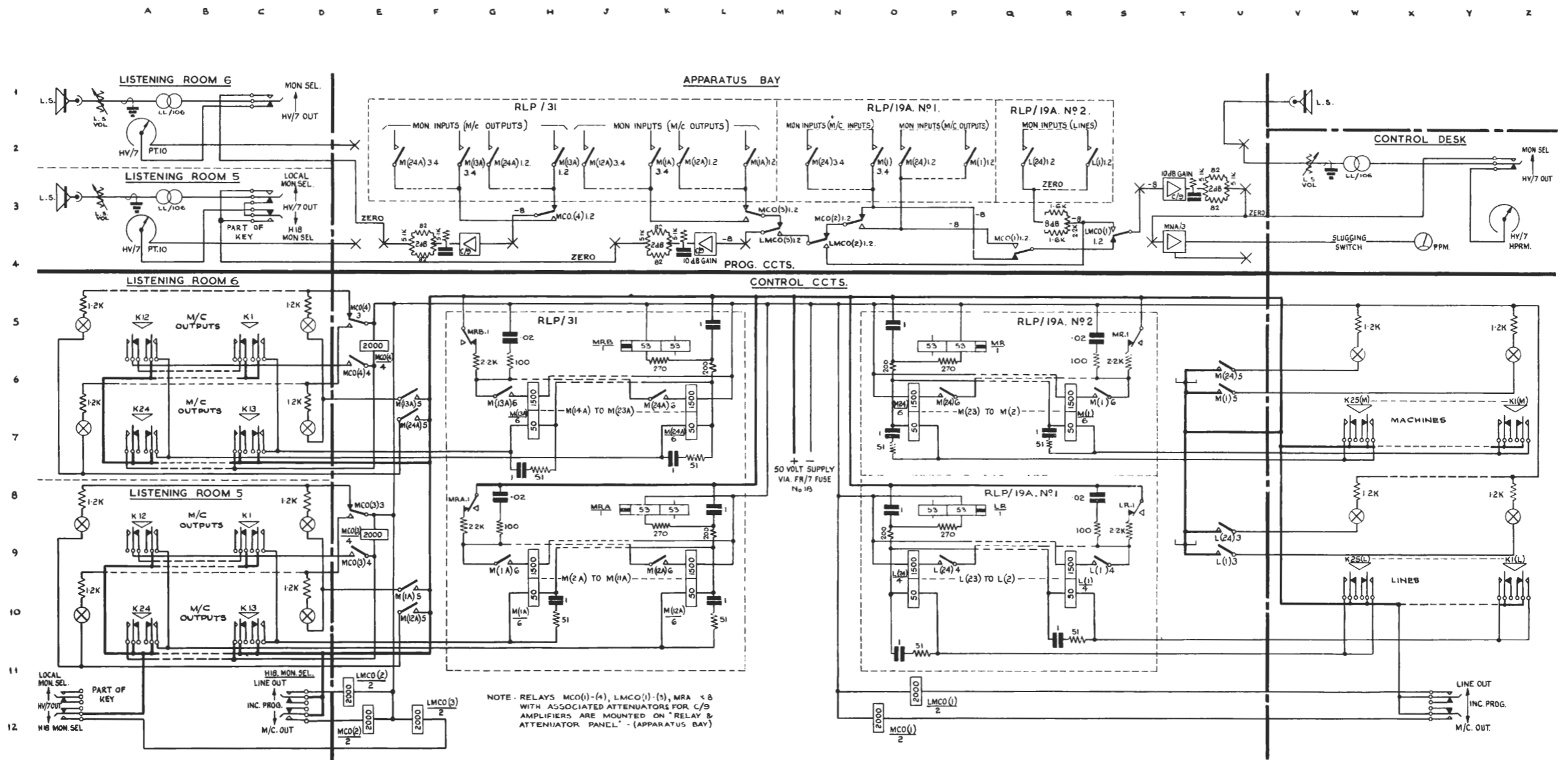
PROGRAMME SCHEMATIC: H18

FIG.6

LOCATION TABLE: FIG. 7

RELAY	LOC	CONTACT	LOC	CONTACT	LOC
L(1)	R9	L(1)-1/2	R2	M(13A)-3/4	F2
L(24)	O9	L(1)-3	U8	M(13A)-5	E6
LMC0(1)	O11	L(1)-4	R8	M(13A)-6	G6
LMC0(2)	E11	L(24)-1/2	Q2	M(24)-1/2	O2
LMC0(3)	F12	L(24)-3	U8	M(24)-3/4	E2
LR	P8	L(24)-4	P9	M(24)-5	U5
M(1)	R6	LMC0(1)-1/2	R4	M(24)-6	P6
M(1A)	H10	LMC0(2)-1/2	N4	M(24A)-1/2	G2
M(12A)	K10	LMC0(3)-1/2	M4	M(24A)-3/4	E2
M(13A)	G7	LR-1	S8	M(24A)-5	E6
M(24)	O6	M(1)-1/2	P2	M(24A)-6	K6
M(24A)	L7	M(1)-3/4	O2	MC0(1)-1/2	R3
MC0(1)	O11	M(1)-5	U6	MC0(2)-1/2	N3
MC0(2)	E12	M(1)-6	R7	MC0(3)-1/2	M3
MC0(3)	E9	M(1A)-1/2	L2	MC0(3)-3	E9
MC0(4)	E5	M(1A)-3/4	K2	MC0(3)-4	E9
MR	P5	M(1A)-5	E10	MC0(4)-1/2	H3
MRA	K8	M(1A)-6	G9	MC0(4)-3	D5
MRB	K5	M(12A)-1/2	K2	MC0(4)-4	D6
		M(12A)-3/4	J2	MR-1	S5
		M(12A)-5	E10	MRA-1	G8
		M(12A)-6	K9	MRB-1	F1
		M(13A)-1/2	H2		

ISS	CHANGE
2	ALL RELAYS ON PANELS RLP/19A & RLP/31 WERE DRAWN AS HIGH-SPEED TYPES



MONITORING SCHEMATIC : H18

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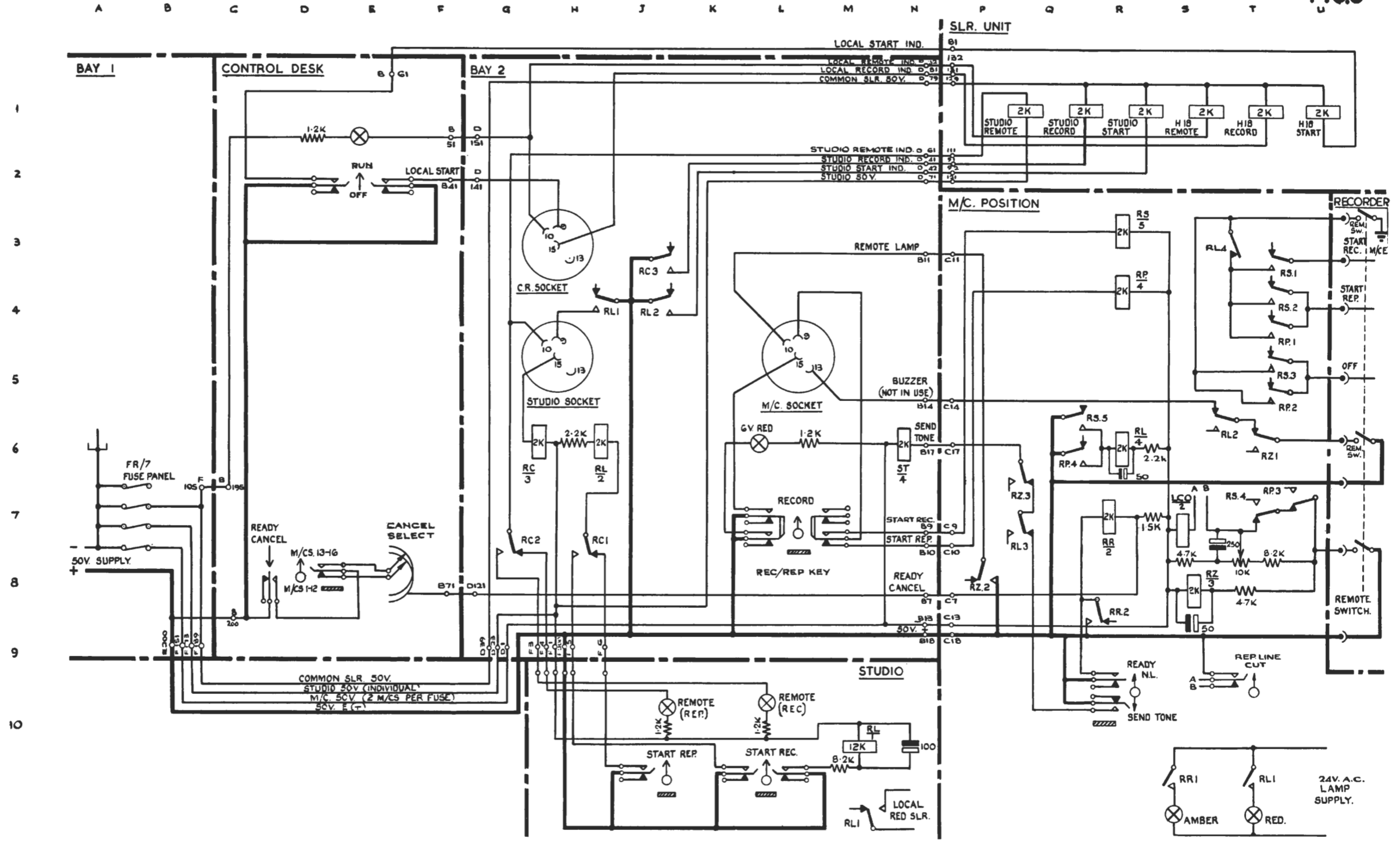
INSTRUCTION RX.2

LOCATION TABLE: FIG. 8

RELAY	LOC
RC	G6
RL	H6
	M10
	R6
RP	R3
RR	R6
RS	R2
RZ	S8
ST	N6
LCO	S7
STUDIO RECORD	R1
STUDIO REMOTE	Q1
STUDIO START	S1
H18 RECORD	T1
H18 REMOTE	T1
H18 START	U1

CONTACT	LOC
RC-1	H7
RC-2	G7
RC-3	J3
RL-1	H4
	M10
	T10
RL-2	J4
	S5
RL-3	Q7
RL-4	T3
RP-1	T4
RP-2	T5
RP-3	T6
RP-4	Q5
RR-1	S10
RR-2	R8
RS-1	T3
RS-2	T3
RS-3	T5
RS-4	T7
RS-5	Q5
RZ-1	T6
RZ-2	P8
RZ-3	Q6

Facing Fig. 8



OPERATING & SIGNALLING CIRCUIT: H18

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INSTRUCTION RX.2

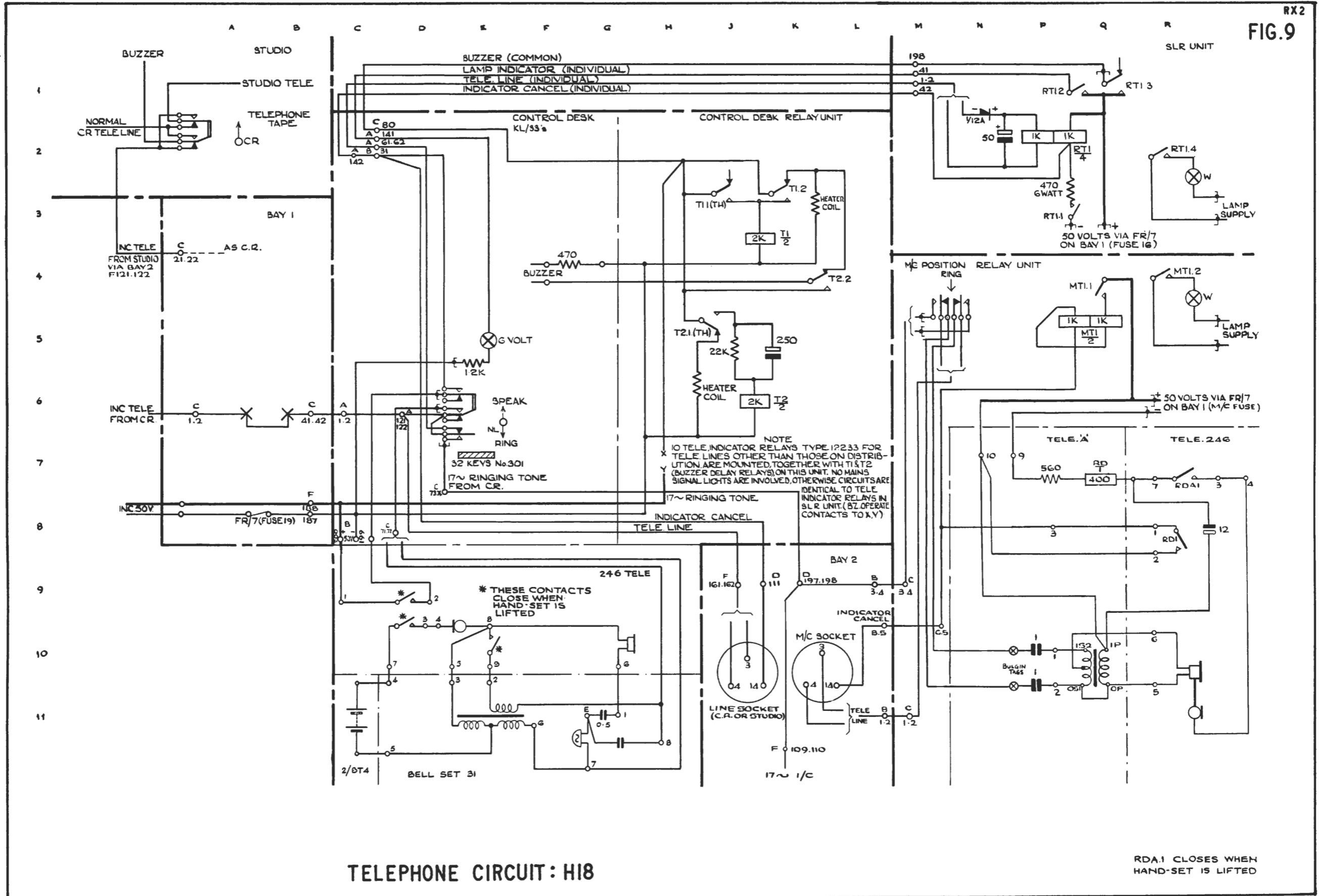
LOCATION TABLE: FIG. 9

RELAY	LOC
MT1	Q4
RD	Q7
RT1	P2
T1	J3
T2	J6

CONTACT	LOC
MT1-1	Q4
MT1-2	R4
RD-1	R8
RDA-1	R7
RT1-1	P3
RT1-2	Q1
RT1-3	Q1
RT1-4	R2
T1-1 (TH)	J3
T1-2	K3
T2-1 (TH)	H5
T2-2	K4

Facing Fig. 9

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TELEPHONE CIRCUIT: H18

RDA.1 CLOSES WHEN HAND-SET IS LIFTED

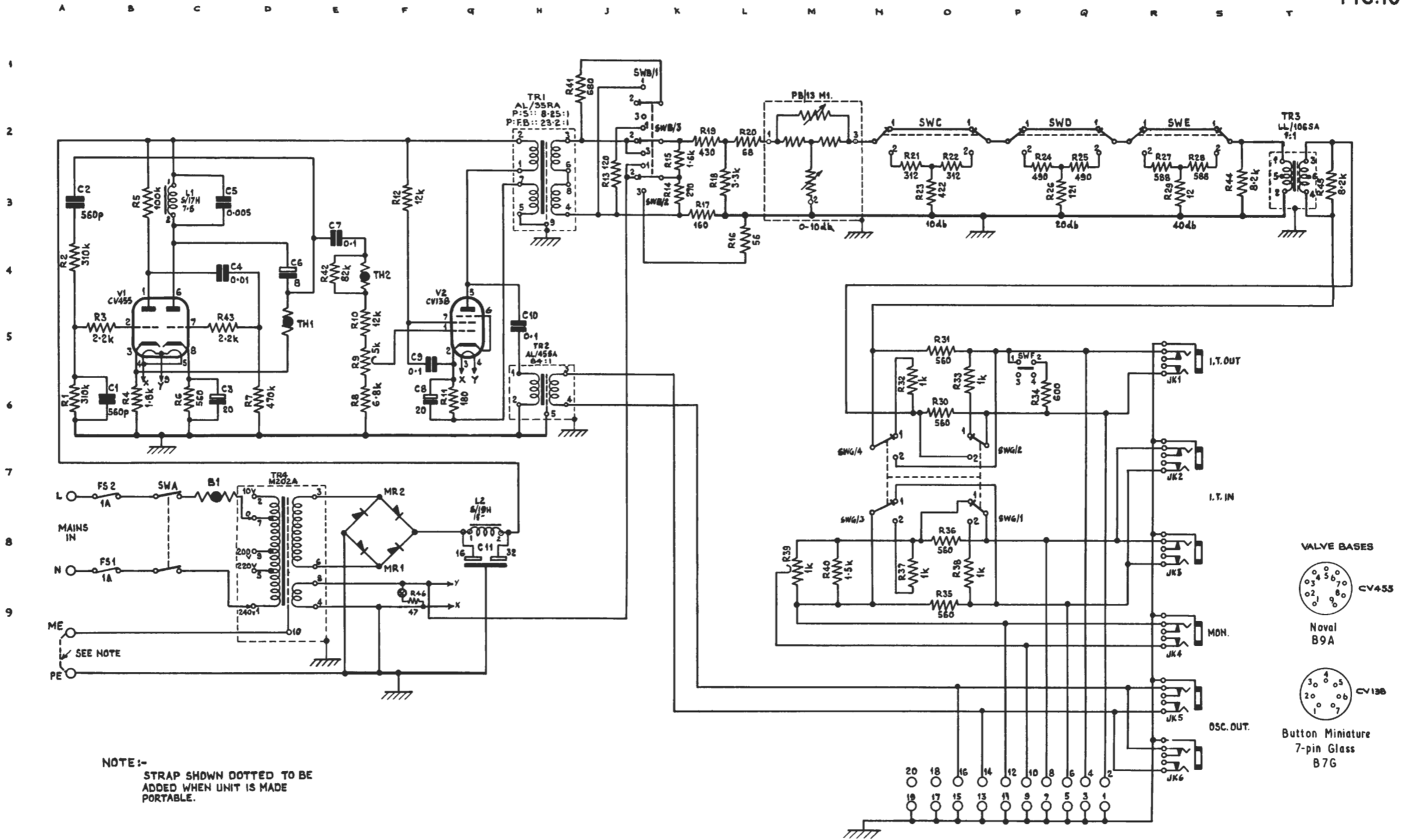
COMPONENT TABLE: FIG.10

COMP	LOC	TYPE		TOLERANCE PER CENT
B1	C7	S.T.C.	Brimistor C23	<u>+1</u>
C1	B6	T.C.C.	CSM20N	<u>+1</u>
C2	A3	T.C.C.	CSM20N	<u>+1</u>
C3	C6	T.C.C.	SCE70B/PVC	+50 -20
C4	C4	T.C.C.	CP32N/PVC	<u>+25</u>
C5	C3	Hunt	B815	<u>+20</u>
C6	D4	Plessey	CE808/1	+50 -20
C7	E4	T.C.C.	CP37N/PVC	<u>+20</u>
C8	F6	T.C.C.	SCE70B/PVC	+50 -20
C9	G5	T.C.C.	CP37N/PVC	<u>+20</u>
C10	H5	T.C.C.	CP37N/PVC	<u>+20</u>
C11	G8	Plessey	CE911/1	+50 -20
L1	C3		S/17H	
L2	G8		S/17H	
R1	A6	Erie	108	<u>+1</u>
R2	A4	Erie	108	<u>+1</u>
R3	B5	Erie	16	<u>+10</u>
R4	B6	Erie	109	<u>+2</u>
R5	B3	Erie	9	<u>+10</u>
R6	C6	Erie	9	<u>+10</u>
R7	D7	Erie	9	<u>+10</u>
R8	F6	Erie	109	<u>+2</u>
R9	E5			
R10	E5	Erie	109	<u>+2</u>

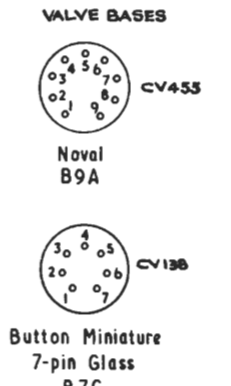
COMP	LOC	TYPE		TOLERANCE PER CENT
R11	G6	Erie	9	<u>+10</u>
R12	F3	Erie	9	<u>+10</u>
R13	J3	Erie	9	<u>+10</u>
R14	K3	Erie	109	<u>+2</u>
R15	K2	Erie	109	<u>+2</u>
R16	L4	Erie	9	<u>+10</u>
R17	K3	Erie	109	<u>+2</u>
R18	L3	Erie	109	<u>+2</u>
R19	K2	Erie	109	<u>+2</u>
R20	L2	Erie	109	<u>+2</u>
R21	H2	Erie	109	<u>+2</u>
R22	O2	Erie	109	<u>+2</u>
R23	O3	Erie	109	<u>+2</u>
R24	P2	Erie	109	<u>+2</u>
R25	Q2	Erie	109	<u>+2</u>
R26	Q3	Erie	109	<u>+2</u>
R27	R3	Erie	109	<u>+2</u>
R28	S3	Erie	109	<u>+2</u>
R29	R3	Painton	P406	<u>+1</u>
R30	O6	Erie	109	<u>+2</u>
R31	O5	Erie	109	<u>+2</u>
R32	H6	Erie	109	<u>+2</u>
R33	O6	Erie	109	<u>+2</u>
R34	P6	Erie	108	<u>+2</u>
R35	O9	Erie	109	<u>+2</u>
R36	O8	Erie	109	<u>+2</u>
R37	H9	Erie	109	<u>+2</u>

COMP	LOC	TYPE		TOLERANCE PER CENT
R38	08	Erie	109	+2
R39	M8			+10
R40	M8	Erie	109	+2
R41	J1	Erie	9	+10
R42	E4	Erie	9	+10
R43	C5	Erie	16	+10
R44	S2	Erie	109	+2
R45	T3	Erie	109	+2
R46	F9	Painton	P406	+1
SW A	C8	N.S.F.	8373/B145	
SW B	K1	N.S.F.	'DM' (S)	
SW C	02	N.S.F.	'TL2' (S)	
SW D	Q2	N.S.F.	'TL2' (S)	
SW E	R2	N.S.F.	'TL2' (S)	
SW F	P5	Painton	310211	
SW G	07	N.S.F.	TG3 (S)	
TH 1	D5		A5412/100	
TH 2	E4		A2541/100	
TR 1	H3		AL/35 RA	
TR 2	H6		AL/45 SA	
TR 3	T2		LL/106 SA	
TR 4	D8		M202 A	

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NOTE:-
STRAP SHOWN DOTTED TO BE
ADDED WHEN UNIT IS MADE
PORTABLE.



INTERMODULATION TEST OSCILLATOR ITO/I : CIRCUIT

