Technical Manual

AUTOMATIC HALF BARRIERS AT LEVEL CROSSING

TELEPHONE SYSTEM

Ref. BRB CSTE/188-2-37

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C O N T E N T S

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1. INTRODUCTION

The system provides telephone communication between a half-barrier level crossing and its controlling signal box.

One telephone is provided in the signal box and, at the level crossing, two BARRIER, two EMERGENCY and normally two ROADSIDE telephones as shown in figure 1. Additional ROADSIDE telephones may be provided where required.

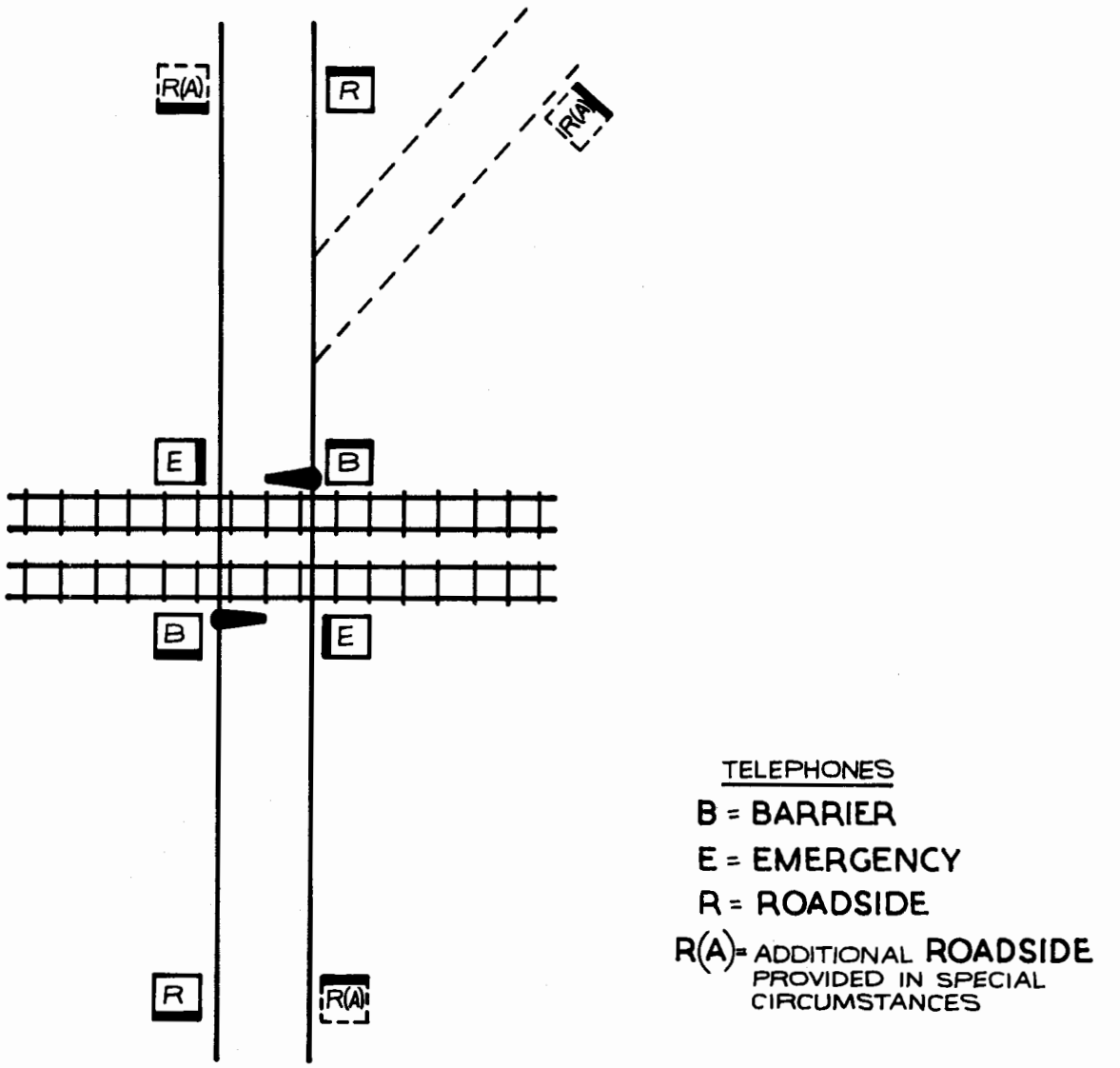


FIG. 1 Location of level-crossing telephones

Two relay sets are provided to supply power to the telephones in the signal box and at the level crossing, and control the signalling between them. One is mounted in the signal box or relay room and the other near the crossing.

The system provides for alternative modes of operation depending on whether the signal box is manned full-time or part-time. The particular mode is selected by strap insertion in the Signalbox Relay Control Unit at the time of installation.

The equipment is designed to use the existing line pair between the level crossing and the signal box, being able to work over a loop resistance of up to 2500 ohms.

Ring tone of the type used by the British Post Office is provided for the level-crossing telephones.

Emergency calls can be signalled at all times, overriding non-emergency signals between the level crossing and the signal box. Discriminating signals in the signal box provide immediate identification of emergency calls.

The main elements of the system are monitored continuously to ensure maximum reliability, and safeguards are provided against failure by misoperation.

2. FACILITIES

BARRIER and ROADSIDE telephones are provided with the same facilities; EMERGENCY and SIGNALBOX telephones each have different facilities, as detailed below. Fault-monitoring facilities are also listed.

2.1 BARRIER/ROADSIDE TELEPHONES

(a) pressbutton calling

(b) bell for each of two BARRIER and two (or more) ROADSIDE telephones.
(The sound level of the bells can be varied by a common volume control in the Barrier Control Relay Unit).

(c) interrupted ring tone immediately call is registered at the signalbox.

(d) continuity of conversation even if press button is kept pressed during the call.

(e) gives buzzer and steady lamp signal at signalbox.

2.2 EMERGENCY TELEPHONES

(a) pressbutton calling.

(b) interrupted ring tone immediately call is registered at the signalbox.

(c) priority signalling, even with the SIGNALBOX telephone handset off its rest.

(d) continuity of conversation even if pressbutton is kept pressed during the call.

(e) gives bell (or bells) and flashing lamp signals at the signalbox.

2.3 SIGNALBOX TELEPHONE

(a) pressbutton calling

(b) continuous ring tone while calling the level crossing.

(c) emergency call signals received even if the handset is not replaced on its rest.

(d) ring tone, bell and lamp signals given if an EMERGENCY telephone calls during an established conversation.

(e) REMOTE/ABSENT switch

REMOTE control is established over contacts of the signalbox 'block' switch to cover the circumstances where the signalbox closes but the railway remains open and the barrier telephones are switched through to an open signalbox.

ABSENT control is established over contacts of a special switch provided to meet the circumstances where the railway is closed and the barrier telephones are not switched through to another signalbox.

2.4 FAULT MONITORING

The following faults automatically give rise to an alarm.

(a) failure of communication power supply at level crossing.

(b) disconnection of EMERGENCY telephone cable or handset cord.

(c) disconnection, reversal or short circuit of the telephone line between the level crossing and the signalbox.

3. PHYSICAL DESCRIPTION

The main elements of the system are:

Level-crossing telephones

Signalbox telephone

Signalbox control relay unit

Barrier (level-crossing) control relay unit

Their physical characteristics are described below:

3.1 LEVEL-CROSSING TELEPHONES

The three types, BARRIER, ROADSIDE and EMERGENCY all derive from the basic weatherproof design shown in figure 2, but with detail differences in appearance. Their physical details are

FIG. 2 Basic Weatherproof Telephone

FEATURE	TYPE OF TELEPHONE		
	BARRIER	ROADSIDE	EMERGENCY
Mounting	In (or adjacent to) barrier mechanism	On post	On post on opposite side of road to barrier.
Case Colour	Yellow	Yellow	Yellow
Handset silhouette symbol (on reflective background	No	Yes, on door	Yes, on each side
Door? (spring loaded)	No, unless outside mechanism	Yes	Yes
Door faces	-	Along the approach road	Across the roadway
Self-illuminated instruction plate?	No	Yes	Yes
Self-illumination of pressbutton?	No	Yes	Yes
Bell?	Yes	Depends on location of telephone.	No

Table 1. Physical details of level-crossing telephones

3.2 SIGNALBOX TELEPHONE

A table telephone is provided; the telephone and its bell-and-buzzer box are shown in figure 3. A neon lamp is mounted in the handset handle and is visible when the handset is on its cradle.

The CALL (white) and FAULT (red) lamps mounted at the top of the telephone sloping front are 6V M.E.S. filament lamps. To replace them, unscrew the two screws in the handset cradle to release the telephone cover, removing it by first lifting it from the base at the rear and then drawing it forward over the toggle switch at the front. Grip the loose-fitting rubber lamp-surround to unscrew the lamp. To renew the lamp and re-fit the cover, reverse the above process.

FIG. 3 Signalbox telephone with bell-and-buzzer box

At the front of the handset cradle is a white 'call' button.

At the front of the telephone, near the base, is a two-position FAULT ACKNOWLEDGE toggle switch. It is labelled A and B; A is its normal position and B is the 'acknowledge fault' position.

The bell-and-buzzer box is connected to the telephone by a 4-foot cable and mounted where convenient. The cover is removed by unscrewing two screws. On re-fitting the cover ensure that the cable-entry grommet is correctly positioned between the cover and the base.

Note: In some instances the signalbox telephone is not provided in the form described above owing to the need to concentrate the facilities with other telephone circuits. The circuit, and audible and visual indications, provided in these special instances will however conform with the foregoing, and have been allowed for in the standard equipment.

3.3 SIGNALBOX CONTROL RELAY UNIT

This measures 12 x 14½ x 9¼ inches overall and consists of two units mounted together on anti-vibration mountings. The two units comprise (a) relay set and ringing generator, and (b) tone and pulse unit. Each has a separate push-on cover.

3.4 BARRIER CONTROL RELAY UNIT

This is housed in a cast aluminium box 18 3/8 in. high x 18 3/8 in. wide x 6 1/2 in. deep, mounted by four lugs. The cover is provided with a waterproof neoprene seal and is secured by eight triangular-headed screws. (**Note:** These screws can only be turned by the special triangular box spanner provided).

There are 10 cable-entry glands in the bottom of the box, accepting ¾" conduit.

The incoming cables are connected to screw terminals ('S' terminals) on two 30-way terminal blocks.

The relay set may be removed from the Barrier Control Relay Unit after removing the power-supply fuses, unplugging the 55-way plug and unscrewing four nuts.

4. OPERATING PROCEDURE

Making and receiving calls at the level-crossing telephones are very simple procedures. Instructions are placed on or near the telephones. For the SIGNALBOX telephone an operating instruction card is supplied; the instructions given are quoted in section 4.2.

4.1 OPERATION OF LEVEL-CROSSING TELEPHONES

To make a call from any one of the BARRIER, ROADSIDE or EMERGENCY telephones, lift the handset, press the button marked PRESS, and wait for the signalbox to answer.

To receive a call, signalled by the bells ringing, lift the handset to talk to the signalbox. (Note: The EMERGENCY telephones are not provided for the *receipt* of calls and therefore have no bell associated with them).

4.2 OPERATION OF SIGNALBOX TELEPHONE

The meaning of the various signals received in the signalbox, and the action to be taken, is detailed in table 2 and followed by the procedure for calling the level-crossing telephones.

Signal	Meaning	Action to be taken
Bell rings; white (CALL) and handset lamps flash.	EMERGENCY telephone is calling.	Lift handset and press white button momentarily. If the handset is already lifted, press the white button again momentarily.
Buzzer operates and white (CALL) lamp glows steadily	BARRIER or ROADSIDE telephone is calling.	Lift handset and press white button momentarily
Buzzer operates and red (FAULT) lamp glows steadily.	A fault has occurred.	Throw FAULT ACKNOWLEDGE switch to position B to silence the buzzer. Report the fault **immediately.**
Red (FAULT) lamp is extinguished; buzzer re-operates.	The fault has been rectified.	Restore the FAULT ACKNOWLEDGE switch to normal (position A).
White (CALL) lamp is glowing steadily after unstaffed period.	A call has been originated during the unstaffed period.	Lift handset and press white button momentarily. **Ensure there is nobody wishing to speak.** Replace handset.

Table 2. Signalbox Telephone Operation

Outgoing Call: Lift handset and press white button. The bells at the level crossing ring while the button is depressed. The white (CALL) lamp glows steadily while the handset is lifted.

If there is no answer, press the white button again.

5. FAULT DETECTION

The red FAULT lamp on the SIGNALBOX telephone glows continuously if any of the following faults occur:

(a) Failure of level-crossing communication power supply.

(b) Disconnection of the cable between the EMERGENCY telephone and the Barrier Control Relay Unit.

(c) Disconnection of the EMERGENCY telephone handsets.

(d) Disconnection, reversal or short circuit of the telephone line between level crossing and signalbox.

To localise the fault quickly, proceed as follows:

1. At the Barrier Control Relay Unit check the power supply by operating relay ACA momentarily. Bells ringing at the crossing indicate that the power supply has not failed.

2. Again at the Barrier Control Relay Unit, check the EMERGENCY telephone connections by observing relays HSA and HSB. Both should be operated. If either is released, check the associated EMERGENCY telephone handset.cord. If relays HSA and HSB are both operated:

3. Make a call from any level-crossing telephone to the signalbox to check the telephone line.

To diagnose more complex faults, an understanding of normal operation of the circuits is needed.

An outline of circuit operation is given in section 6, and details of relay and contact functions in section 7.

6. CIRCUIT OPERATION OUTLINE

The following outline description should be read in conjunction with the circuit diagrams of the Barrier Control Relay Unit (BCRU) 207487, and the Signalbox Control Relay Unit (SCRU) 207488. These are to be found in Sections 4 and 8 respectively of this manual; Section 8 also contains the circuit diagrams of the other units.

With the system serviceable and fault-free, but not being used, the following relays are operated.

In the BCRU: HSA HSB BCA
1 ECA 2ECA.

In the SCRU: FL and, if the signalbox has the 'remote/absent' facility and is manned, RS.
If the signalbox is unmanned and the 'absent' facility is in use (section 6.5.1), relay FL only is operated; if 'remote switching' is in force (section 6.5.2), no relay is operated.

6.1 FAULT MONITORING

Relays HSA and HSB in the BCRU are normally operated via their respective EMERGENCY telephone handset cords. Battery is fed from retard FT via the telephone line pair (L1, L2) to hold relay FL operated in the SCRU.

Should the battery become disconnected, relay FL releases. Contact FL1 operates relay FLA. Contact FLA1 prepares the FLA locking circuit, FLA2 operates relay FB, and FLA3 lights the FAULT lamp. Contact FB1 starts the ringing generator, and FB2 operates the buzzer.

Throwing the FAULT ACKNOWLEDGE key to position B releases relay FB and hence silences the buzzer and stops the ringing generator.

When the fault is rectified relay FL reoperates and FL1 releases relay FLA. Contact FLA2 re-operates relay FB, and FB2 operates the buzzer. The release of FLA3 extinguishes the FAULT lamp. The restoration of the FAULT ACKNOWLEDGE key to position A releases relay FB and silences the buzzer.

6.2 A BARRIER/ROADSIDE TELEPHONE CALLS THE SIGNALBOX

When the handset is lifted relay MT operates in the BCRU. Contact MT4 prepares the operate circuit for relay BC.

When the call button is pressed relay BC operates. Contacts BC1 and BC2 reverse the applied potential to the line (L1, L2) operating relay CA in the SCRU. Relay BCA in the BCRU is normally operated; contact BC4 releases it, and BCA2 and BCA3 disconnect the calling battery and complete the line circuit until BC releases; i.e. until the call button is released.

Contact CA1 in the SCRU operates relay RT. Contact RT1 operates relay BA, and RT2 prepares the interrupted ring-tone circuit. Contact BA1 starts the tone, interrupter and ringing generator units. BA2 operates the buzzer, BA3 completes the interrupted ring-tone circuit, BA4 locks RT and BA5 provides a hold circuit for relay BA. BA6 prepares the operate circuit for relay AN and BA7 lights the CALL lamp.

When the SIGNALBOX telephone handset is lifted relay SP operates. Contacts SP1 and SP2 complete the speech circuit to the line, SP3 prepares the operate circuit for relay AN, and SP4 prepares to keep the CALL lamp lit independently of contact BA7. SP5 provides a hold circuit for relay RT independent of BA4.

When the white answer/call button is pressed, relay AN operates via SP3, EM2 and BA6. Contact AN3 releases relay BA. BA2 silences the buzzer and BA3 disconnects ring-tone.

The call is now established.

When the SIGNALBOX handset is replaced, relay SP in the SCRU releases, Contact SP4 extinguishes the CALL lamp and SP5 releases relay RT.

Contact RT2 disconnects relay TR from the line, and re-connects relays FL and CA to it.

6.3 AN EMERGENCY TELEPHONE CALLS THE SIGNALBOX

When the handset is lifted relay MT in the BCRU operates. Contacts MT2 and MT3 prepare the operate circuits for relays 1EC and 2EC. MT1 prepares the ringing generator start circuit.

When the call button on EMERGENCY telephone No. 1 is pressed relay 1EC operates. (Note: Relay 2EC would operate if the call was from EMERGENCY telephone No. 1A). 1ECA (and 2ECA) are normally operated. Contact 1EC1 completes the ringing generator start circuit and 1EC3 and 1EC6 apply 25 Hz a.c. to the line (L1, L2) to operate relay CA in the SCRU.

Contact CA1 operates relay RT. Contact RT1 prepares the operate circuit for relay EM, and RT2 completes the circuit for relay TR, which operates to the incoming 25 Hz a.c. Contact TR2 operates relay EM via RT1 and AN3.

In the BCRU, contact 1EC5 releases relay 1ECA, and contacts 1ECA2 and 1ECA3 disconnect the calling a.c. and complete the line circuit until 1EC releases; i.e. until the call button is released.

When relay EM operates in the SCRU, contact EM1 starts the tone, interrupter and ringing-generator units. Contact EM2 prepares the operate circuit for relay AN, EM3 holds relay EM, and EM4 completes the interrupted ring-tone circuit when TR releases. Contact EM5 operates relay W, EM6 prepares the CALL lamp flashing circuit and EM7 holds relay RT. Relay W pulses and contact W2 flashes the CALL lamp; W1 flashes the handset neon lamp and causes interrupted ringing of the bell(s).

When the SIGNALBOX telephone handset is lifted, relay SP operates in the SCRU. Contacts SP1 and SP2 complete the speech circuit to the line, SP3 prepares the operate circuit for relay AN, and SP4 prepares to keep the CALL lamp lit independently of contact EM6. Contact SP5 prepares to hold relay RT.

When the white answer/call button is pressed, relay AN operates. Contact AN3 releases relay EM.

Contact EM5 releases relay W. Contact W2 stops the CALL lamp flashing (it now glows steadily) and W1 disconnects the neon lamp and bell(s).

The call is now established.

When the SIGNALBOX handset is replaced, relay SP in the SCRU releases. Contact SP4 extinguishes the CALL lamp and SP5 releases relay RT. Contact RT2 disconnects relay TR from the line and reconnects relays FL and CA to it, restoring the circuit to normal.

6.4 THE SIGNALBOX TELEPHONE CALLS THE LEVEL CROSSING

When the SIGNALBOX telephone handset is lifted, relay SP operates in the SCRU. Contacts SP1 and SP2 complete the speech circuit to the line, SP3 prepares the operate circuit for relay CB, SP4 lights the CALL lamp and SP5 operates relay RT. Contact SP6 disconnects the operate circuit of relay BA.

When the white call/answer button is pressed, relay CB operates. Contact CB1 starts the tone unit and ringing generator, and CB2 and CB4 extend 25 Hz a.c. to line (L1, L2) to operate relay AC in the BCRU. Contact CB3 completes the continuous ring tone circuit.

Relay contact AC1 closing in the BCRU operates relay ACA. Contact ACA1 starts the ringing generator and ACA3 completes the circuit to the bells.

When the white call/answer button is released and the level crossing answers, the call is established.

6.5 'ABSENT' SWITCHING (LINE CLOSED) and 'REMOTE SIGNALBOX' SWITCHING (BLOCK CLOSED)

The circuit operation described in sections 6.1 to 6.4 applies while the signalbox is manned. Two other modes of operation are permitted, one when the signalbox is unmanned and the railway line is closed to traffic, the other when the signalbox is unmanned and has transferred control of the railway line to a remote signalbox.

The 'remote' and 'absent' modes of operation are instituted by throwing the REMOTE/ABSENT switch in the signalbox to release the normally operated relay RS. (Note: Where the remote/absent facility is **not** provided, the six 'make' contacts of relay RS are short-circuited by straps).

6.5.1 'Absent' condition is in force (Line closed)

(Note: To allow this mode of operation, relay contact RS7 is strapped out, but the others are not).

A BARRIER or ROADSIDE telephone call to the signalbox is ineffective because relay BA in the SCRU is disconnected at contact RS8. Notices in the ROADSIDE telephone direct the user to the EMERGENCY telephone if no reply is received at the ROADSIDE telephone. An EMERGENCY telephone call causes the operation of relay CA in the SCRU as described in section 6.3. Relays RT, TR and EM operate as before.

(Relay W does not operate, since contact RS5 is open, so the bell and flashing neon do not operate. Also, the CALL lamp glows steadily instead of flashing).

Interrupted ring tone is returned to the caller.

The call will remain registered, and the CALL lamp lit, until the signalman clears it by restoring the REMOTE/ABSENT switch to normal and pressing the white call/answer button on re-entering the signalbox.

6.5.2 'Remote'Switching' condition is in force (Block closed)

(Note: To allow this mode of operation **none** of the RS relay contacts is strapped out).

With the REMOTE/ABSENT switch thrown and hence relay RS released, contacts RS2 and RS6 divert the level-crossing telephone line (L1, L2) from the BCRU in the local signalbox to an identical one in the remote signalbox.

The SCRU and the SIGNALBOX telephone in the local signalbox are therefore completely out of service, all the functions having been transferred to the remote signalbox, which operates as described in section 6.1 to 6.4.

DETAILS OF RELAY, CONTACT AND MISCELLANEOUS COMPONENT FUNCTIONS

Relays in the Barrier Control Relay Unit (BCRU) and the Signalbox Control Relay Unit (SCRU) are listed in alphabetical order, and their cause of operation and contacts' functions are described in detail (section 7.1). A second list (section 7.2) describes the functions of miscellaneous components: resistors, diodes and capacitors.

The circuit diagrams of the BCRU and the SCRU are contained Sections 4 and 8 respectively.

7.1 RELAY AND CONTACT FUNCTIONS

Relay AC (BCRU) is operated by 25Hz a.c. from the signalbox.

AC1 operates relay ACA after a brief delay (about 40 ms.)

AC2, AC3 prevent ringing current being extended to the level-crossing telephones or shunted through the bridge relays FT and MT.

Relay ACA (BCRU) is operated by contact AC1 after a brief delay (about 40 ms).
The delay prevents false operation by transient signals.

ACA1 starts the local ringing generator via lead ST.

ACA2 supplies d.c. to an extension bell (where fitted).

ACA3 supplies 25 Hz a.c. from the local ringing generator to the level-crossing telephone bells.

ACA4 is spare.

Relay AN (SCRU) is operated by the call/answer pressbutton, provided the handset has been lifted, via contact SP3 and either EM2 if an emergency call or BA6 if a non-emergency call.

AN1 holds relay AN via contact SP3 and the pressbutton, independently of EM2 and BA6.

AN2 prevents relay CB operating.

AN3 releases relay EM or BA, whichever is operated.

Relay BA (SCRU) is operated (after a delay of about 50 ms) via contacts AN3, RT1, EM3, TR2, SP6 and RS8 (or strap) on receipt of a non-emergency call. The delay prevents relay BA operating on receipt of an emergency call.

BA1 starts the tone and interrupter auxiliary unit, and the ringing generator.

BA2 connects the buzzer to the 25 Hz a.c. supply.

BA3 connects interrupted ring tone to the 'primary' winding of relay TR.

BA4 holds relay RT.

BA5 holds relay BA via contacts AN3, RT1 and RS8 (or strap).

BA6 selects relay AN instead of CB for operation by the call/answer pressbutton.

BA7 lights the CALL lamp via contact W2.

BA8 is spare.

Relay BC (BCRU) is operated by the call button of any BARRIER or ROADSIDE telephone if contact MT4 is closed, i.e. if a handset has been lifted.

BC1, BC2 reverse the potential applied to the telephone line (L1, L2) to call the signalbox.

BC3 holds relay BC operated after the handset is replaced, should the call button fail to release. This ensures that subsequent lifting of an EMERGENCY telephone handset does not simulate a BARRIER or ROADSIDE telephone call.

BC4 allows relay BCA to release after not less than 200 ms (delay imposed by diode D4). Holds relay BC until contact BCA1 opens, to ensure a calling signal of not less than 200 ms duration to operate the call circuit in the signalbox.

Relay BCA (BCRU) is normally operated. Released by contact BC4, after a delay of not less than 200 ms. This delay determines the duration of the reversed-battery calling signal fed via the line to the SCRU.

BCA1 holds relay BC until relay BCA releases. See contact BC4.

BCA2, BCA3 on release, disconnect the calling (reversed potential) battery used on a non-emergency call, and maintain the line connection until relay BC releases.

Relay CA (SCRU) is operated by reversed-battery or 25 Hz a.c. calling signals from the BCRU.

CA1 operates relay RT.

Relay CB (SCRU) is operated by the white call/answer pressbutton if the handset is lifted (contact SP3 closed) via contacts EM2, BA6 and AN2 normal to call the level crossing.

CB1 starts the tone and interrupter auxiliary unit, and the ringing generator.

CB2, CB4 extend 25 Hz a.c. to line (L1, L2) to ring the bells at the level crossing.

CB3 connects continuous ring tone to the SIGNALBOX telephone, by transformer action in relay SP.

Relay EM (SCRU) is operated via contacts AN3, RT1, EM3 and TR2 on receipt of a calling signal from an EMERGENCY telephone.

EM1 starts the tone and interrupter auxiliary unit and the ringing generator.

EM2 selects relay AN instead of CB for operation by the call/answer pressbutton.

EM3 holds relay EM via RT1 and AN3, and disconnects relay BA.

EM4 connects interrupted ring tone to the 'primary' winding of relay TR.

EM5 starts relay W pulsing

EM6 prepares the CALL lamp flashing circuit.

EM7 holds relay RT.

Relay FB (SCRU) is operated by contact FLA2 (operated) via the normal contacts of the FAULT ACKNOWLEDGE key, or vice versa.

FB1 starts the ringing generator and the tone and interrupter auxiliary unit.

FB2 connects the buzzer to the 25 Hz a.c. supply.

Relay FL (SCRU) is normally operated. Released by reversal or disconnection of battery from the BCRU, to detect faults.

FL1 on release, operates relay FLA after about 50 ms via RS5 (or strap) and RT3.

Relay FLA (SCRU) is operated after about 50 ms by the release of relay FL. (See FL1). The delay covers the re-operate time of relay FL on cleardown.

FLA1 holds relay FLA via contacts RT3 and RS5 (or strap).

FLA2 operates relay FB. (See above).

FLA3 lights the FAULT lamp.

Relay FT (BCRU) is a battery-feeding retard and has no contacts.

Relay HSA (BCRU) is normally operated. Released if a discontinuity occurs in the handset cord or the cable of EMERGENCY telephone No. 1.

HSA1, HSA2 disconnect the positive and negative potentials on lines L1 and L2 to operate the fault circuit in the SCRU.

Relay HSB (BCRU) has the same function as HSA but for EMERGENCY telephone No. 1A.

Relay MT (BCRU) is operated when the handset of any of the level crossing telephones is lifted. Provides microphone current for the level-crossing telephones.

MT1 prepares the ringing generator start circuit.

MT2, MT3 if the call is from an EMERGENCY telephone, operate relay 1EC or 2EC when the call button is pressed.

MT4 if the call is from a ROADSIDE or BARRIER telephone, operates relay BC when the call button is pressed.

Relay P (SCRU) is pulsed at the interrupted ring tone cadence (400/200/400/2000 ms) by the ring tone interrupter circuit.

P1 connects continuous ring tone from the tone unit, breaking it into the cadence shown above, to the 'primary' winding of relay TR which acts as a tone transformer.

P2-P4 are spare.

Relay RS (SCRU) is normally operated **if a REMOTE/ABSENT switch is provided.**

Released by throwing the REMOTE/ABSENT switch into the 'signalbox unmanned' position.

(Note: Where no REMOTE/ABSENT switch is provided, all the RS-relay contacts except those marked * are short circuited by straps on the terminal block).

RS1 on release, allows the CALL lamp to operate only at reduced brilliance by removing the short circuit from across the 500-ohm resistor R1.

RS2, RS6 * normally provide fault-monitoring potentials via resistors R4 and R5 to hold relay FL in the SCRU of the remote signalbox. When released, extend the level-crossing telephone line through to the remote signalbox.

RS3, RS4 — on release, disconnect the SIGNALBOX telephone A and B lines.

RS5 — on release, disconnects positive battery to relays FLA, W and FB.

RS7 — on release, disconnects the incoming-signal detection circuits from the line.

RS8 — on release, disconnects the operate circuit for relay BA.

Relay RT (BCRU) is a retard acting as a choke in the negative battery lead to the ringing generator. It has no contacts.

Relay RT (SCRU) is operated initially, on an incoming call by contact CA1, or, on lifting the SIGNALBOX telephone handset, by contact SP5.

RT1 — operates relay EM on receipt of a call from an EMERGENCY telephone, or relay BA if a ROADSIDE or BARRIER telephone calls.

RT2 — transfers the level-crossing L1 line connection from relays FL and CA to relay TR to prepare for the receipt of EMERGENCY-telephone ringing current from the line, or the connection of interrupted ring tone to it.

RT3 — disconnects the operate circuit of relay FLA, but holds FLA via contact FLA1 if it is already operated.

Relay SP (SCRU) is operated by the SIGNALBOX telephone-line loop when the handset is lifted. It provides microphone current to the SIGNALBOX telephone.

SP1, SP2 — extend the speech circuit to the level-crossing line.

SP3 — prepares the operate circuit of the 'call' and 'answer' relays CB and AN for operation by the white call/answer button on the SIGNALBOX telephone.

SP4 — lights the CALL lamp.

SP5 — operates (or holds) relay RT.

SP6 — breaks the operate circuit of relay BA.

Relay TR (SCRU) is operated by the burst of ringing current which is received from the BCRU when an EMERGENCY telephone call button is pressed.

TR1 — disconnects interrupted ring tone while ringing current is being received from the BCRU.

TR2 — disconnects the operate circuit of relay BA and operates 'emergency' relay EM.

TR3 — disconnects line L1 from A to prevent ringing current from passing to the SIGNALBOX telephone, should its handset be lifted.

Relay W — (SCRU) is self-interacting at about 3 p.p.s. when connected to the battery supply via contacts EM5 and RS5 (or strap).

W1 — intermittently connects ringing current to the SIGNALBOX telephone bell and the handset neon lamp.

W2 — flashes the CALL lamp on the SIGNALBOX telephone.

W3 — together with relay W and capacitor C5, constitutes the self-interacting circuit.

Relay 1EC — (BCRU) is operated via contact MT2 when the CALL button of EMERGENCY telephone No. 1 is pressed.

1EC1 — starts the ringing generator by connecting positive battery via contact 1ECA1 (normally closed) and MT1.

1EC2 — holds relay 1EC operated after the handset is replaced, should the call button fail to release. This ensures that subsequent lifting of a BARRIER or ROADSIDE telephone handset does not simulate an EMERGENCY telephone call.

1EC3 } 1EC6 } — connect ringing current via contacts 1ECA2 and 1ECA3, and the line (L1, L2) to the SCRU.

1EC4 — holds relay 1EC until contact 1ECA1 opens, to ensure a calling signal of not less than 200 ms duration to operate the call circuit in the signalbox.

1EC5 — allows relay 1ECA to release after not less than 200 ms (delay imposed by diode D5).

Relay 1ECA — (BCRU) is normally operated. Released by contact 1EC5 after a delay of not less than 200 ms. This delay determines the duration of the burst of ringing current fed via the line to the SCRU.

1ECA1 — holds relay 1EC until relay 1ECA releases. (See contact 1EC4). On release, contact 1ECA1 stops the ringing generator.

1ECA2 } 1ECA3 } — on release, disconnect the ringing-current call signal and maintain the line connection until relay 1EC releases.

Relay 2EC — (BCRU) is similar to relay 1EC but for EMERGENCY telephone No. 1A.

Relay 2ECA — (BCRU) is similar to relay 1ECA but for EMERGENCY telephone No. 1A.

7.2 MISCELLANEOUS COMPONENT FUNCTIONS

Capacitors in BCRU:

C1, C2, C3	provide d.c. blocking.
C4	with retard RT, decouples the ringing generator battery supply.
C5	smoothes the power supply.

Capacitors in SCRU:

C1, C2, C4	provide d.c. blocking.
C3	attenuates induced transient ringing current.
C5	determines the pulsing frequency of relay W.
C6	with resistor R10, decouples the ringing generator power supply.

Diodes in BCRU:

D1, D2	rectify the 25 Hz a.c. to operate relay AC.
D3	with R4, provides a discharge circuit for capacitor C3.
D4	imposes 200 ms (minimum) release delay on relay BCA.
D5, D6	impose 200 ms (minimum) release delay on relays 1ECA and 2ECA.

Diodes in SCRU:

D1, D2	allow relay FL or CA to operate to d.c. depending on its direction, and CA to operate to 25 Hz a.c.
D3	rectifies the 25 Hz a.c. to operate relay TR.
D4	safeguards the output transistor in the Ring Tone Interrupter circuit against back e.m.f.

Resistors in BCRU:

R1	sets lower limit of ringing voltage (if volume control is connected).
R2,R3	limit d.c. to protect the battery against line short circuit.
R4	via D3, discharges capacitor C3.
R5A/B/C	form part of the ringing generator circuit.
R6	drops voltage applied to the ringing generator.
RV1	variable resistor. If connected, it controls the 25 Hz ringing voltage applied to the level-crossing telephone bells.

Resistors in SCRU:

R1	reduces the current through the CALL lamp under 'absent' conditions.
R2, R3	drop battery voltage from 50V to 6V to operate FAULT and CALL lamps.
R4, R5	limit the current fed to the SCRU in the remote signalbox, protecting the battery against line short circuits.
R6	maintains a low current through the CALL lamp during the 'off' phase of flashing to prolong lamp life.
R7, R8	provide 'wetting' current for relay contacts.
R9	discharges capacitor C4.
R10	with capacitor C6, decouples the ringing generator power supply.
RX1	is a non-linear resistor which prevents spurious operation of relay TR by transient telephone-line signals.

8. CIRCUIT DIAGRAMS

Diagrams 2-9 relating to the various units of the system are contained in this section in the order shown below.

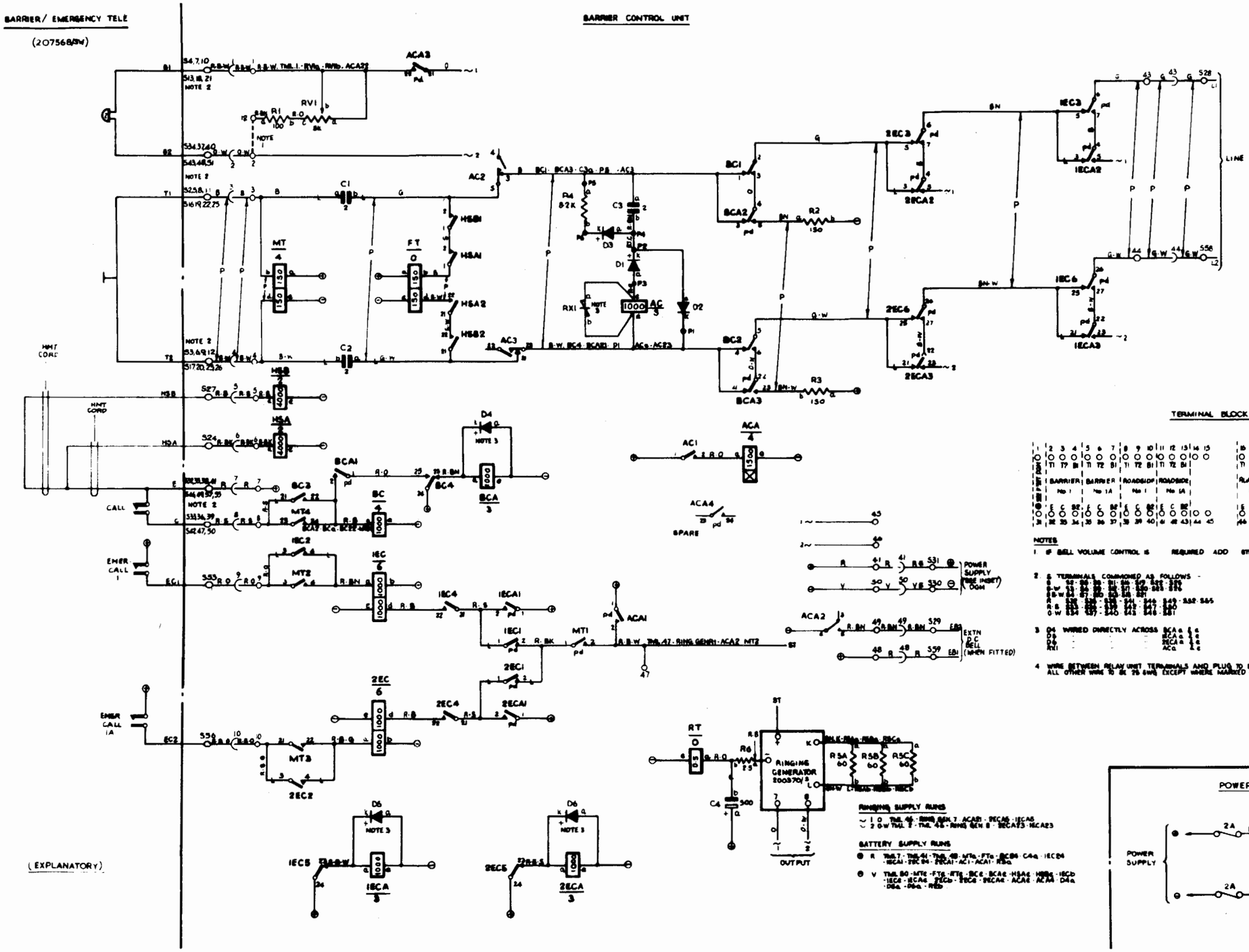
Diagram 1 is placed at the beginning of Section 5 to enable it and diagram 2 to be read with Sections 5, 6 and 7.

1.	Barrier Control Relay Unit (BCRU)	207487	/SW
2.	Signalbox Control Relay Unit (SCRU)	207488	/SW
3.	Connection Diagram	207570	/SW
4.	Signalbox Telephone	207569	/SW
5.	Weatherproof Telephone	207568	/SW
6.	Ringing Generator at level crossing (24V)	200370	/S
7.	Ringing Generator at Signalbox (50V).....	N103520	
8.	Tone Generator	207147	/SW
9.	Ring Tone Interrupter	207656	/SW

BARRIER/ EMERGENCY TELE

(207568/SW)

BARRIER CONTROL UNIT



TERMINAL BLOCK (STMLS)

NOTES

1. IF BELL VOLUME CONTROL IS REQUIRED ADD STRAP BETWEEN RELAY UNIT TERMINALS 2 & 12

2. 6 TERMINALS COMMONED AS FOLLOWS -

B	43	44	45	51	52	53
B-W	43	44	45	51	52	53
G	43	44	45	51	52	53
G-W	43	44	45	51	52	53
R	43	44	45	51	52	53
R-B	43	44	45	51	52	53
O-W	43	44	45	51	52	53

B	54	55	56	57	58	59
B-W	54	55	56	57	58	59
G	54	55	56	57	58	59
G-W	54	55	56	57	58	59
R	54	55	56	57	58	59
R-B	54	55	56	57	58	59
O-W	54	55	56	57	58	59

3. D4 WIRED DIRECTLY ACROSS BCA a & c
   D5 " " " IECA a & c
   D6 " " " 2ECA a & c
   RX1 " " " ACA " & c

4. WIRE BETWEEN RELAY UNIT TERMINALS AND PLUG TO BE FLEX (14/0076 SW306)
   ALL OTHER WIRE TO BE 25 SWG EXCEPT WHERE MARKED G WHICH IS TO BE 22 SWG

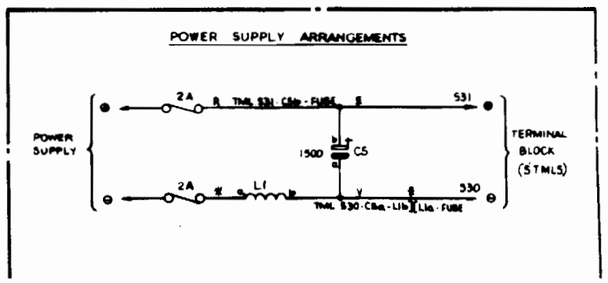
RINGING SUPPLY RUNS

~ 1 O THR 46 - RING GEN 7 ACA21 - 2ECA6 - IECA5
~ 2 O-W THR 2 - THR 45 - RING GEN 8 - IECA23 - IECA23

BATTERY SUPPLY RUNS

- R THR 7 - THR 41 - THR 48 - MT6 - FT6 - BC6 - C4a - IEC84 - IECA1 - 2EC84 - 2ECA1 - AC1 - ACA1 - HSC6
- V THR 50 - MT6 - FT6 - RT6 - BC6 - BCA6 - HSA6 - HSB6 - IEC6 - IECA6 - 2EC6 - 2EC6 - 2ECA6 - ACA6 - ACA6 - D4a - D5a - D6a - RED

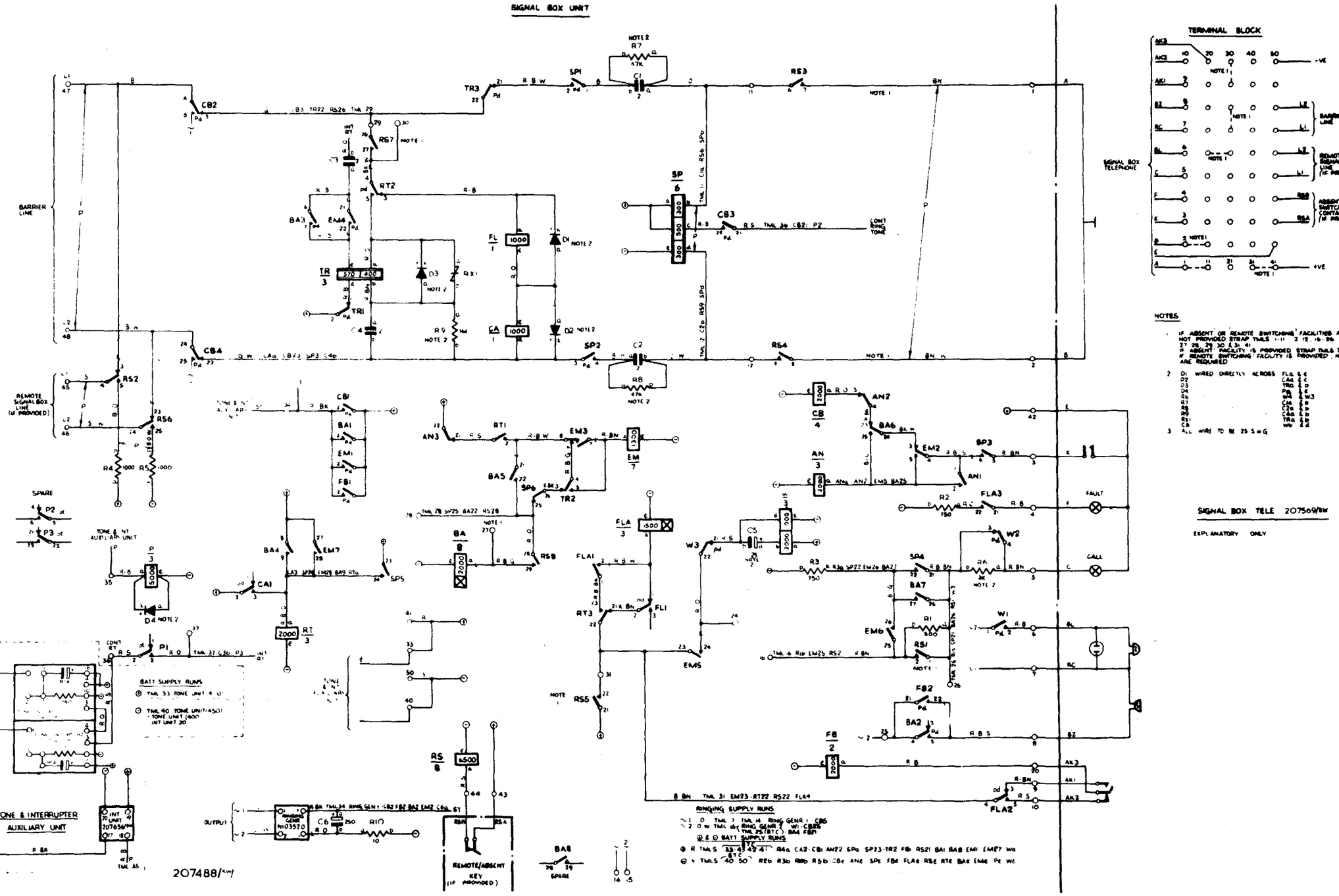
POWER SUPPLY ARRANGEMENTS



(EXPLANATORY)

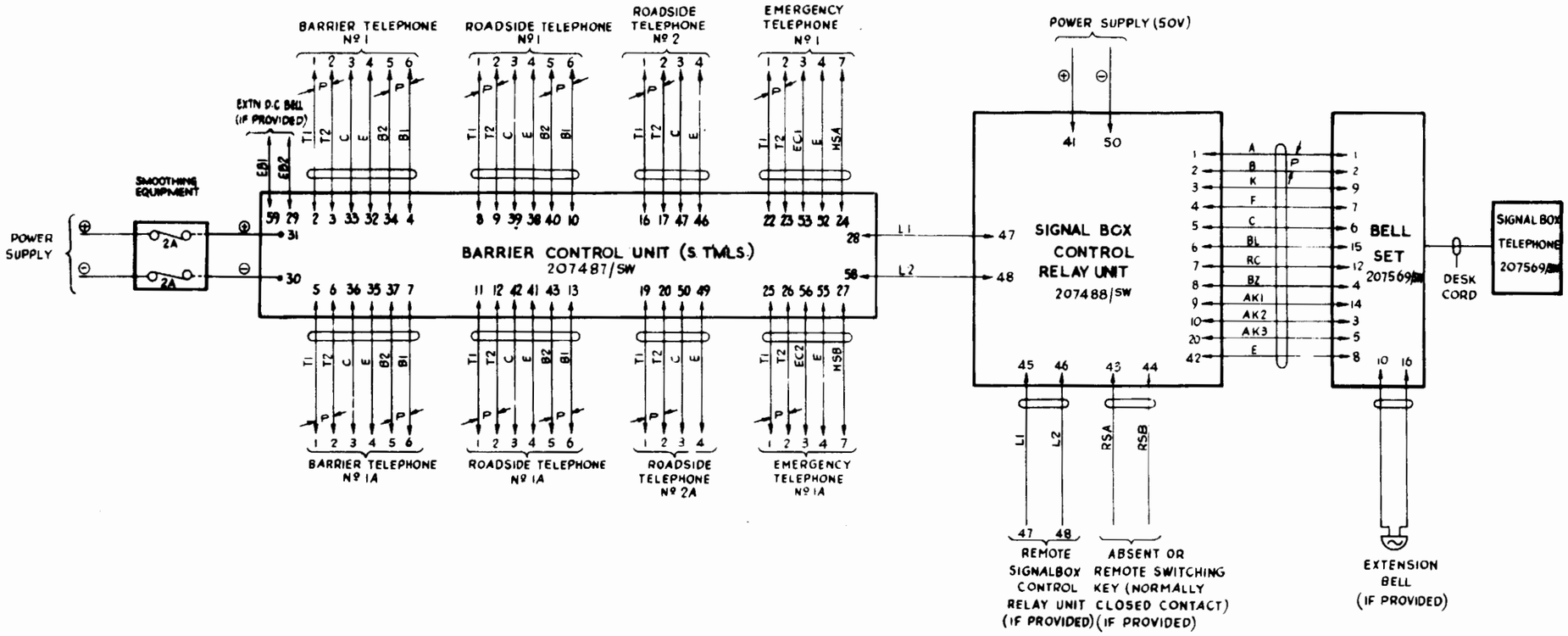
Diagram No. 1
BCRU

207487/SW



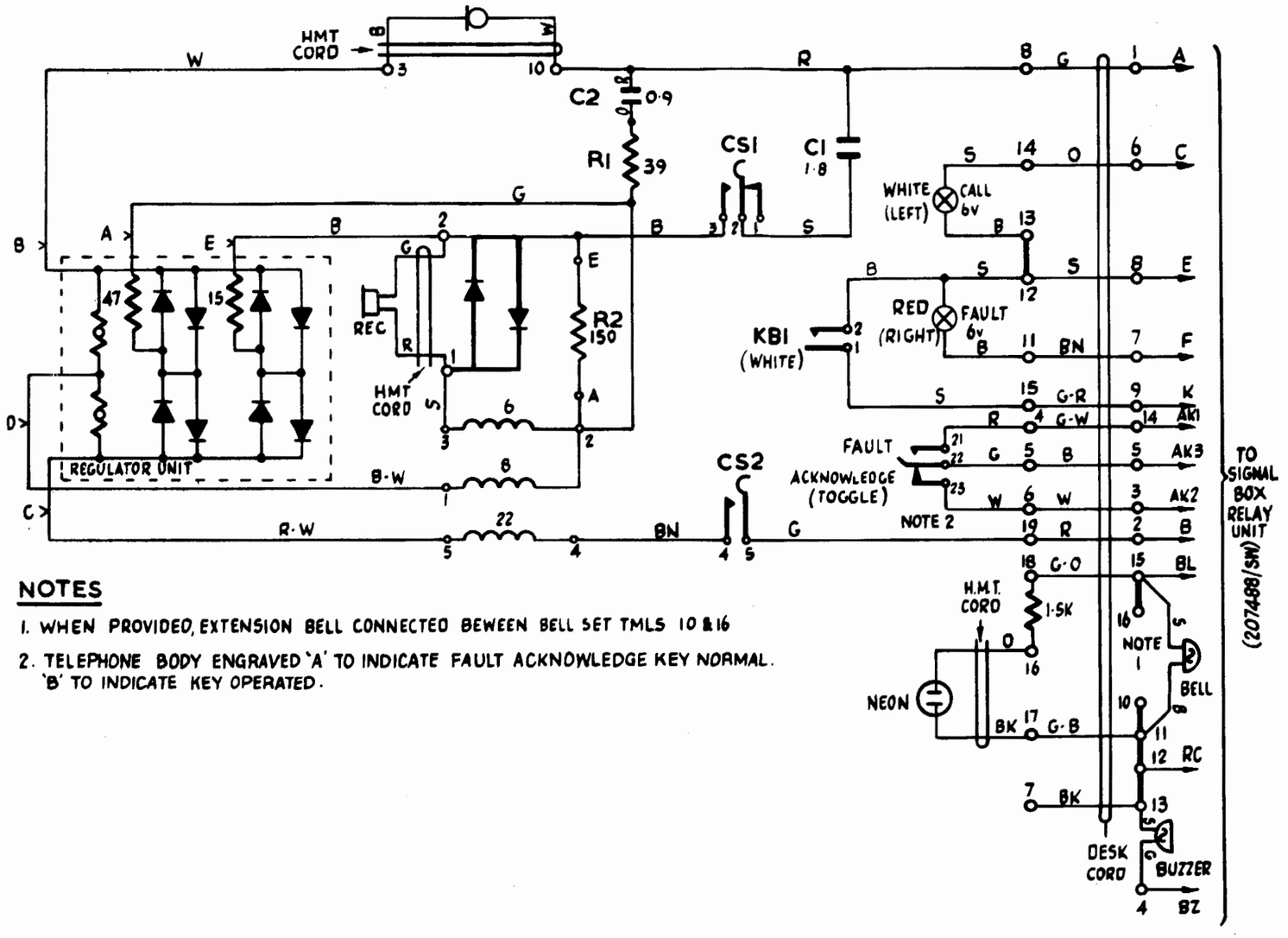
207488/SW

Diagram No. 2
SCRU



207570/SW

Diagram No. 3
Connection diagram

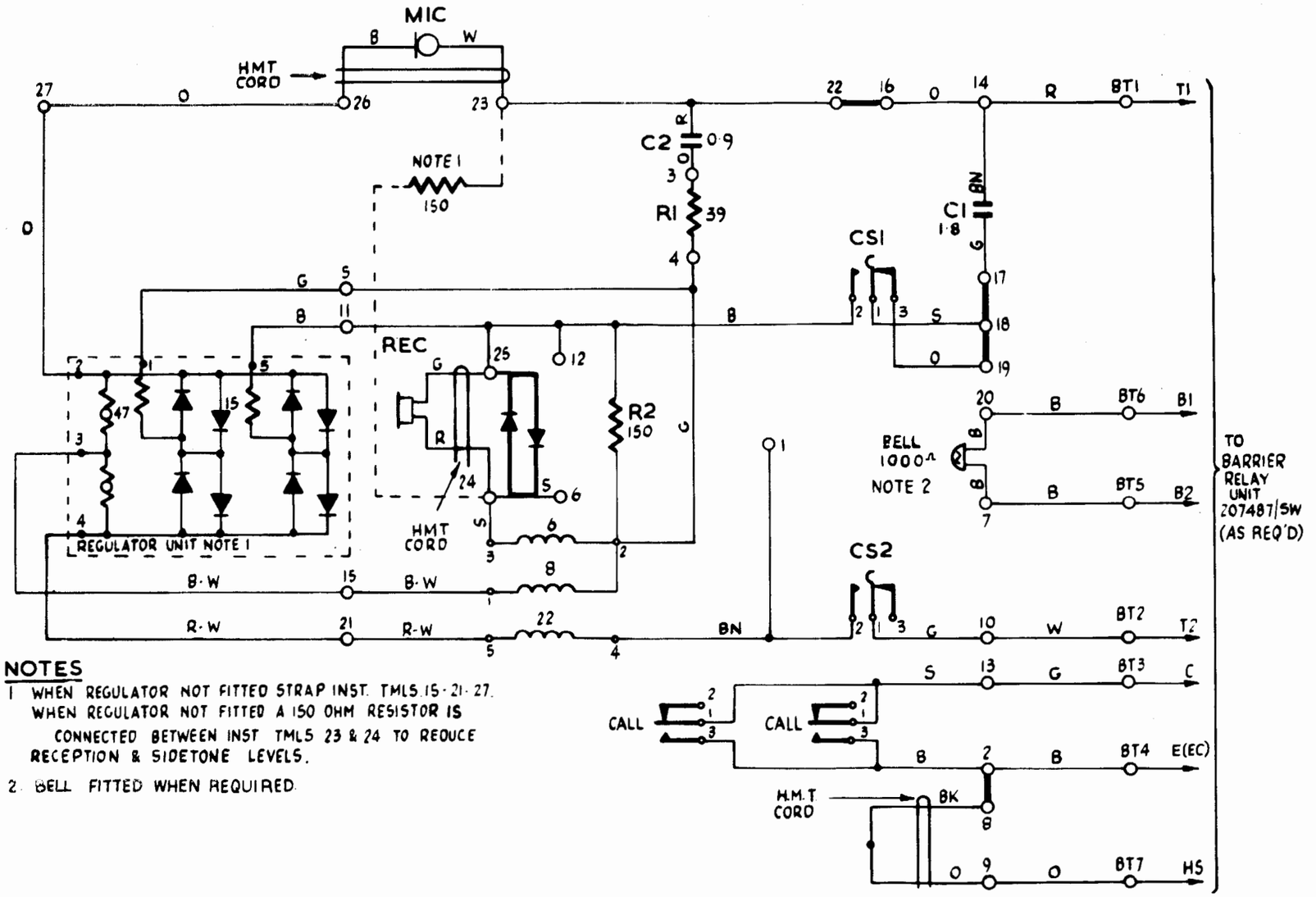


NOTES

1. WHEN PROVIDED, EXTENSION BELL CONNECTED BEWEEN BELL SET TMLS 10 & 16
2. TELEPHONE BODY ENGRAVED 'A' TO INDICATE FAULT ACKNOWLEDGE KEY NORMAL. 'B' TO INDICATE KEY OPERATED.

207569/SW

Diagram No. 4
Signalbox Telephone



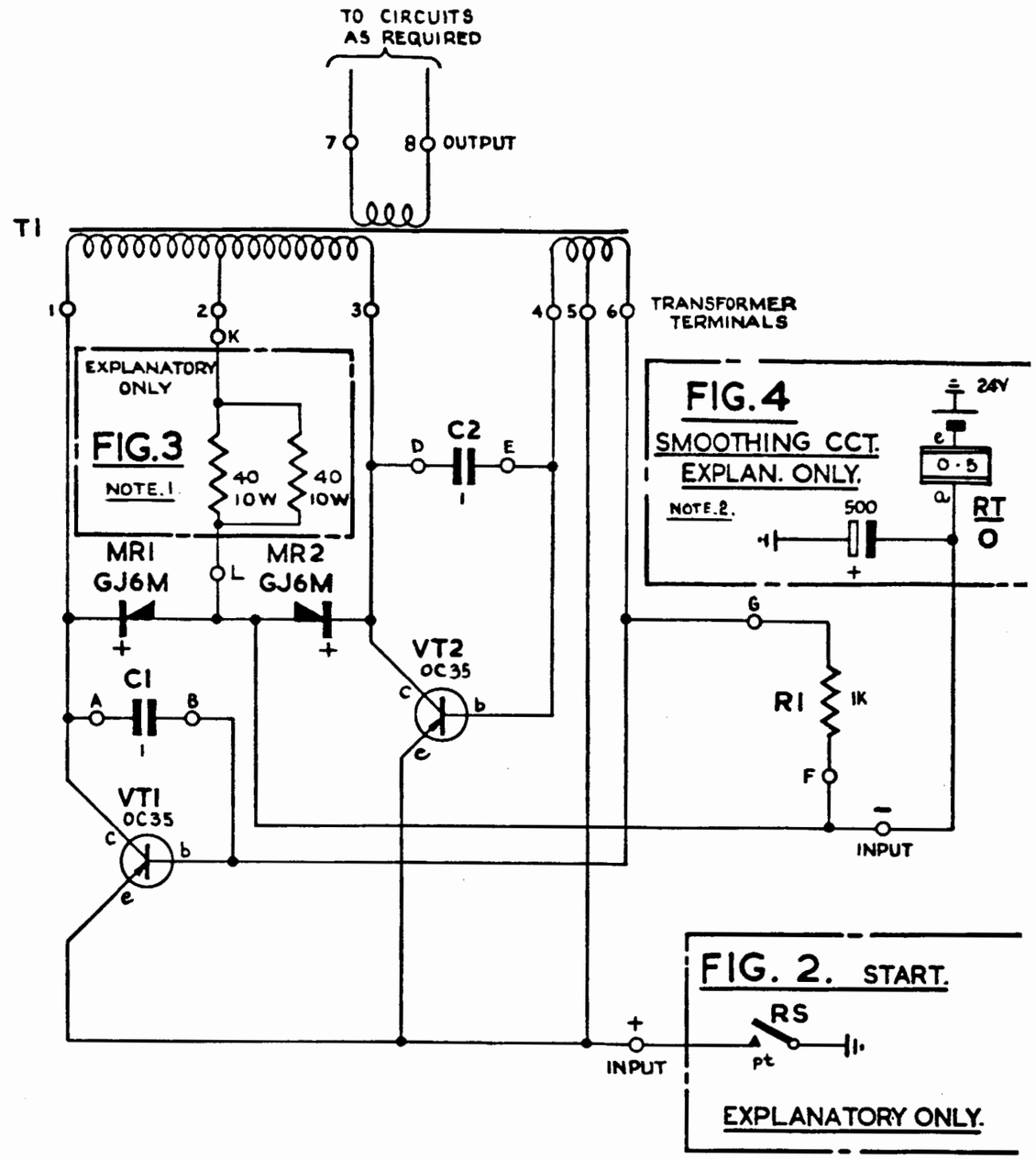
NOTES

1. WHEN REGULATOR NOT FITTED STRAP INST. TMLS 15-21-27. WHEN REGULATOR NOT FITTED A 150 OHM RESISTOR IS CONNECTED BETWEEN INST TMLS 23 & 24 TO REDUCE RECEPTION & SIDETONE LEVELS.
2. BELL FITTED WHEN REQUIRED.

207568/SW

Diagram No. 5
Weatherproof Telephone

FIG.1

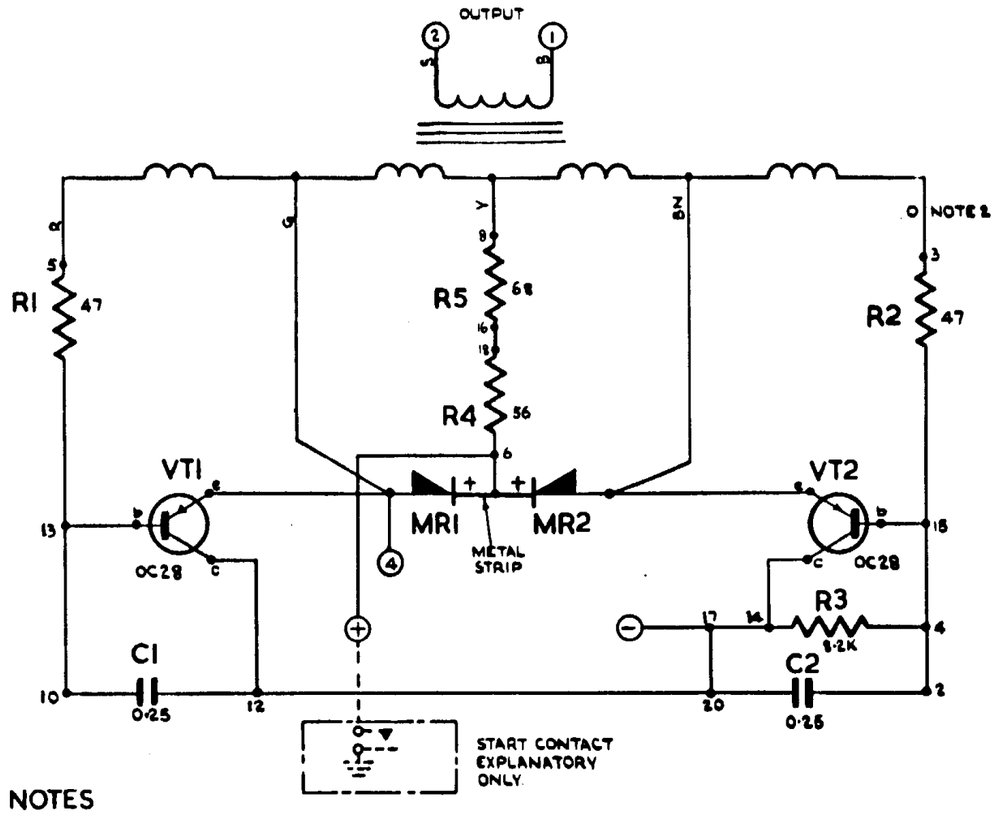


NOTES:-

1. RESISTORS MOUNTED SEPARATELY.
2. FIG 4 IS REQ'D ONLY WHEN SUPPLY IS COMMON TO SPEECH TRANSMISSION CCTS.

200370/SW

Diagram No. 6
24V Ringing Generator

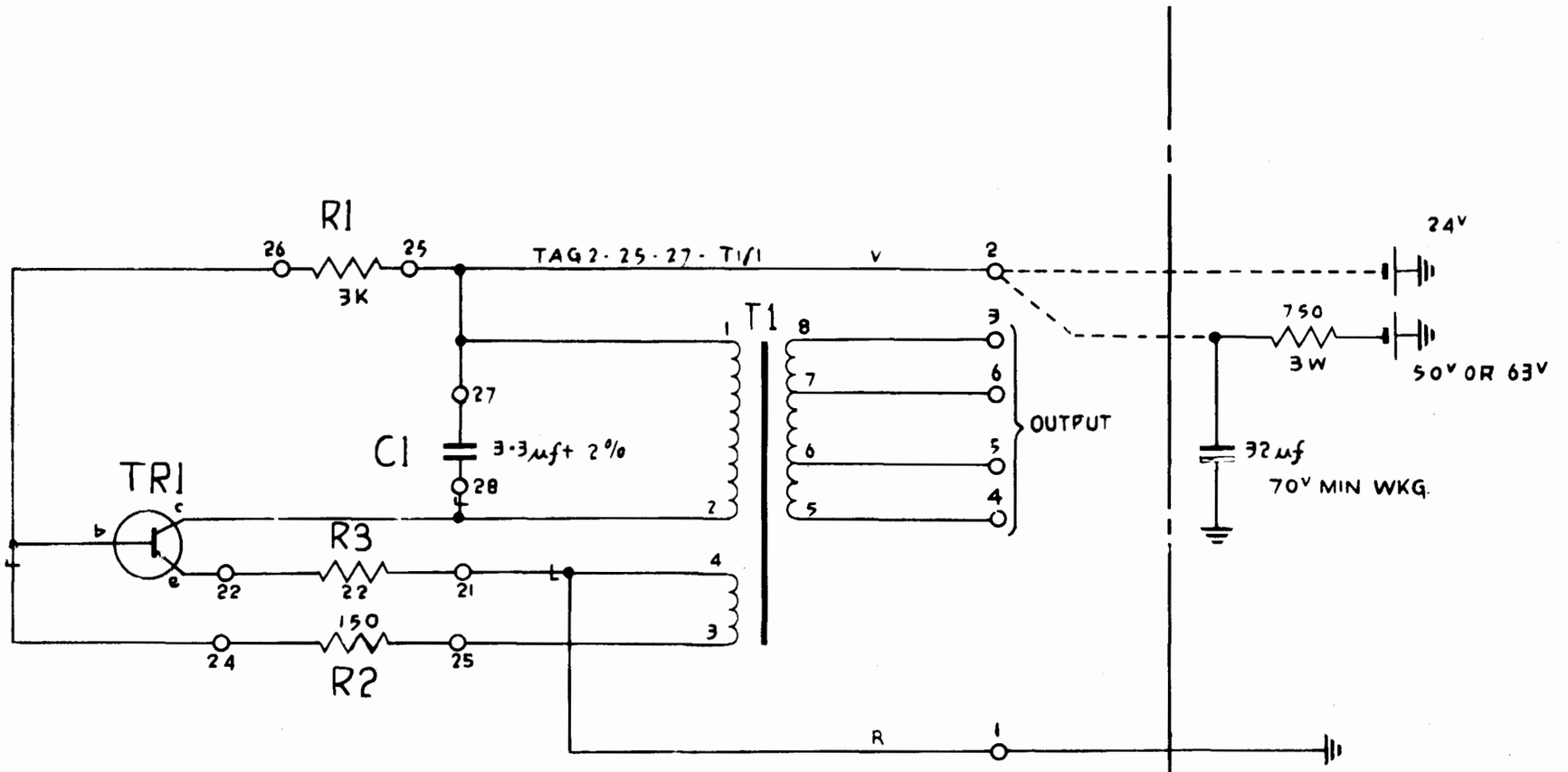


NOTES

1. MAIN TERMINALS SHOWN THUS ◯ ARE LOCATED ON MOUNTING BRACKET.
2. TRANSFORMER LEADS ARE COVERED WITH GREEN SLEEVING.

N103520

Diagram No. 7
50V Ringing Generator



207147/SW

NOTES.

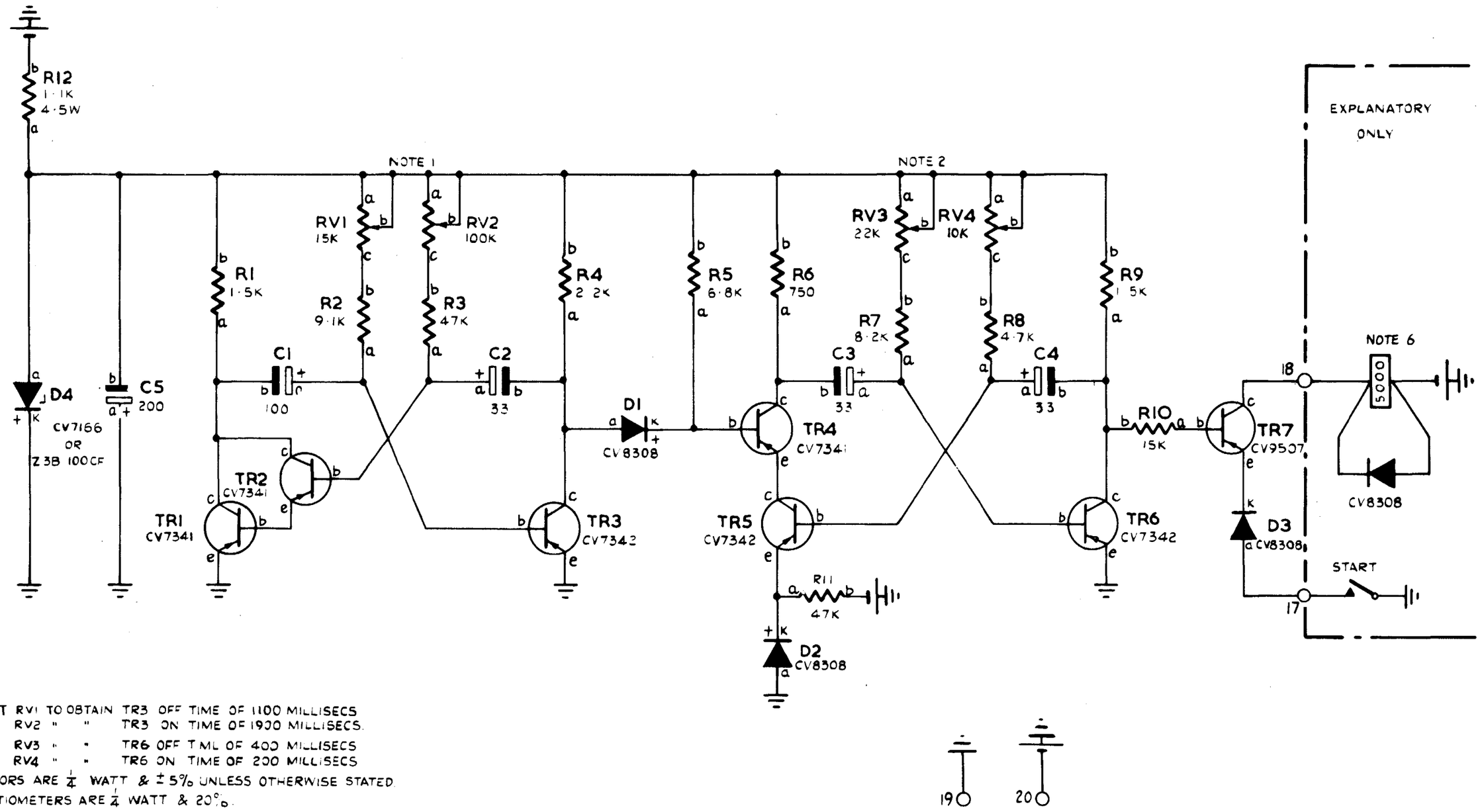
1. THE CODE OF TRANSFORMER VARIES ACCORDING TO THE FREQUENCY REQUIRED. ALSO THE CODE OF TRANSFORMER VARIES WHEN TONES OF MIXED FREQUENCIES ARE REQUIRED. FOR CODES SEE N122146

2. ALL WIRING TO BE 25 SWG UNLESS OTHERWISE SPECIFIED

PART OF 200899/SW OR EQUIV.

EXPLANATORY ONLY

207147/SW
TONE GENERATOR



NOTES

1. ADJUST RV1 TO OBTAIN TR3 OFF TIME OF 1100 MILLISECS
   " RV2 " " TR3 ON TIME OF 1900 MILLISECS.
2. " RV3 " " TR6 OFF TIME OF 400 MILLISECS
   " RV4 " " TR6 ON TIME OF 200 MILLISECS
3. RESISTORS ARE $\frac{1}{4}$ WATT & ± 5% UNLESS OTHERWISE STATED.
4. POTENTIOMETERS ARE $\frac{1}{4}$ WATT & 20%.
5. ELECTROLYTIC CAPACITOR TOLERANCES AS FOLLOWS :-
   C1 - C4 - 20% + 50% MAX.
   C5 - 20% + 100% MAX.
6. RELAY RESISTANCE TO BE NOT LESS THAN 5000 OHMS.

207656/SW

Diagram No. 9
Ring Tone Interrupter