

POST OFFICE ENGINEERING DEPARTMENT DIAGRAM NOTES

relating to DIAGRAM SA 8152C

SPECIFICATION S 332

1ST. GROUP SELECTOR FOR P.A.B.X. NO. 3

This diagram shows the circuit of the 1st Group Selector as used for a P.A.B.X. No. 3.

The following diagrams should be considered in conjunction with this diagram:-

SA 8151 EXTENSION LINE AND LINE-FINDER CIRCUIT.
SA 8153 FINAL SELECTOR.
SA 8157 LAMP LIGHTING CIRCUIT.
SA 8158 EXCHANGE LINE CIRCUIT.
SA 8161 INTERSWITCHBOARD LINE CIRCUIT.
SA 8165 RINGING, TONE AND PULSE CIRCUIT CONNEXIONS.
SA 8168 "0" LEVEL CIRCUIT.
SA 8170 RACK COMMON SERVICES.

2. FACILITY SCHEDULE

Provision is made for:

- (1) The start condition from the Pulse circuit to be extended to the next group selector if the selector is busy.
- (2) The associated linefinder to hunt for the calling extension's line when the start condition is extended to a free selector.
- (3) Connecting Dial tone to the calling extension.
- (4) Vertical stepping under the control of the dial impulses.
- (5) Seizing the first free trunk on the level dialled.
- (6) Switching the calling extensions line through to the seized trunk and clearing the line of bridged apparatus.
- (7) Connecting Busy tone if all trunks on the level dialled are engaged.
- (8) Connecting NU tone if an extension which is barred direct access dials the single digit "9".
- (9) Releasing the selector on completion of a call.
- (10) Forced release of the selector under PG conditions.

3. CIRCUIT DESCRIPTION

Outline

When an automatic extension originates a call, an earth is extended from the PS lead to the SP terminal on the Line & Final Selector Rack. This earth causes the Pulse Circuit unselector to apply a start condition via the appropriate start chain to the 1st Group Selectors serving the group of 50 extensions in which the calling line is accommodated.

The connexions of the start chain are shown for explanatory purposes on Diagram SA 8165. A free group selector is allotted and the associated linefinder hunts for the calling extension's line. Dial tone is returned from the group selector. Should all outlets on the level dialled be engaged, Busy Tone is returned to the calling extension when the selector reaches the eleventh step. When a spare level is dialled NU Tone is returned from the spare level circuit, but in the case of an extension barred direct access dialling the digit "9", NU tone is returned from the group selector. The Normal Post Springsets in this case operate on level 9.

Detail

(A) Seizure

An earth is extended from the Pulse Circuit to the Start Chain In lead and if the selector is free relay ST operates.

Relay ST operating,

ST1 provides a holding circuit for relay ST over the hold lead (See Diagram SA 8165).

ST2 prepares the linefinder drive circuit on the DM lead. ST3 operates relay A.

ST4 prepares the cut drive circuit of the linefinder. ST5) prepare a hold circuit for relay FT and an operate ST7) circuit for relay K.

ST6 disconnects relay H.

Relay A operates,

A1 operates relay B.

Relay B operates,

B1 connects dial tone to the tone winding of relay A.

B2 prepares a hold circuit for relay K.

B3 prepares an operate circuit for relay CD and a hold circuit for relay B during impulsing.

B4 prepares the rotary magnet circuit.

B5 connects earth to the ringer start lead.

B6 prepares a circuit for relay BZ.

B7 connects earth to the DM lead and energises the linefinder drive magnet.

The associated linefinder hunts for the calling extension's line circuit which is marked with a 250 ohm battery on the FT lead.

When the line finder steps to the required contact the 250 ohm battery on the FT lead is extended via the 7 ohm coil of relay FT to the B7 earth.

Relay FT operates,

FT 1 disconnects the earth from the DM lead to cut the drive of the linefinder magnet. Relay K operates in series with the 3 ohm winding of relay FT and the battery connected to the FT wiper from the extension line circuit.

Relay K operates,

K1 busies the group selector on the start chain.

K2 connects the extension line through to relay A and. dial

K3 tone is returned to the calling extension.

K4 disconnects the DM lead.

K5 prepares the vertical magnet circuit.

K6 disconnects relay ST.

K7 prepares an operate circuit for the CO relay in the extension line circuit and a holding circuit for relay K.

Relay ST releasing,

ST2 prepares the rotary drive circuit.

ST3 disconnects the original operate circuit of relay A.

ST4 prepares a holding circuit for relay K.

ST5) connects earth through relay K to the HF wiper. The CO

ST7) relay in the extension line circuit operates and relays LS and K hold in series with relay CO. The earth applied to the HF wiper by the group

selector busies the calling extension's line on the final selector multiple.

ST6 prepares an operate circuit for relay H.

Relay A is now held by the calling extension's loop and the group selector is prepared for receiving the first impulse train.

(B) Impulsing and Rotary Stepping (Levels other than '9')

Relay A responds to the dialled impulses. At each release of relay A, the vertical magnet is energised in series with the 4 ohm coil of relay CD. Relay B is short circuited, and with relay CD is retained during impulsing.

Relay CD operated,

CD1 disconnects the 250 ohm battery from the vertical magnet circuit.

CD2 disconnects the rotary magnet circuit.

CD3 disconnects the dial tone from relay A.

CD4 connects relay BZ to the FT lead. (See later paragraph on direct access).

When the selector steps off-normal the mechanical off-normal springs operate.

N1 see release of selector.

N2 prepares the rotary magnet circuit.

N3 disconnects the A pulse.

N4 disconnects the Z pulse.

At the end of the impulse train,

Relay A holds to the calling extension's loop,

A1 short circuits relay CD.

Relay CD releases,

CD1 provides a holding circuit for relay B after the NR springs have operated.

CD2 energises the rotary magnet with the earth applied by contact B7.

CD4 completes a hold circuit for relay BZ. (See later paragraph on direct access).

When the selector takes its first rotary step, the mechanical rotary off-normal springs (NR) operate.

NR1 disconnects the vertical magnet circuit.

Due to the interaction of the rotary magnet and RM1 springs, automatic rotary hunting occurs on the level dialled. Earth via B 7 contact, R1 and 7 ohm coil of relay FT is connected to the H wiper Hunting continues until a free outlet is reached, the free condition being indicated by a 250 ohm battery connected to the H bank contact. When the selector steps to a free outlet, relay FT operates.

Relay FT operates,

FT1 disconnects the drive circuit of the rotary magnet and connects the 30 ohm coil of relay H in series with the 3 ohm coil of relay FT to the battery connected to the H wiper from the free outlet

Relay H operates,

H1 disconnects the rotary magnet independent of relay FT.

H2 disconnect the A relay from the extension line and extend

H3 the calling extension through to the next selector or relay set. An earth is then returned over the H wiper from the seized cutlet.

H4 completes a holding circuit for relays LS and CO (extension line circuit) in series with relay K to the earth on the H wiper

- H5 completes a holding circuit for relay H.
- H6 completes the L wire circuit. This circuit is only used when digit "0" is dialled and individual lamp per line is provided. A resistance battery is returned from the Lamp Lighting Circuit to light the calling lamp on the manual board.

Relay A releases,

- A1 releases relay B.

Relay B releases,

- B2 disconnects the previous hold circuit of relay K.
- B3 disconnects the A1 earth from relay CD.
- B4 prepares the rotary release circuit.
- B5 disconnects the ringer start.
- B7 disconnects relay FT.

Relay FT releases,

The extension line circuit is connected through to the next equipment and relays H and K in the group selector are held by the earth returned over the H wiper:

(C) Direct Access Call to the Public Exchange (Level 9)

On an extension. permitted direct access facilities, the strap between the BD and FT terminals in the extension line circuit is inserted. It will be seen from Diagram SA 8151 that when relay CO operates, an earth is connected to the FT lead. The circuit operation is similar to that described in para. (B), with the exception that the NFA springs operate on level "9" and the operation or non operation of relay BZ determines whether the calling extension should be permitted or barred the direct access facility. Relay CD operates as previously described and assuming the extension is allowed direct access facilities, relay BZ will operate on receipt of the first impulse.

NPA springs operate when the selector shaft steps to level 9.

NPA1 disconnects relay FT from the H wiper.

NPA2 prepares the NU Tone circuit.

Relay BZ operating

- BZ1 provides a holding circuit for relay BZ on the release of relay CO.
- BZ3 disconnects the NU Tone from the tone coil of relay A. connects relay FT through to the H wiper. The selector hunts for a free outlet on level "9" and when a trunk is tested relay FT The operation of relay H extension' s line through set concerned and relays previously described.
- BZ4 free cuts the rotary drive. switches the calling to the exchange line relay A and B release as Relay B releases,
- B 6 releases relay BZ.

In the case of an extension barred direct access facilities the strap between the BD and FT terminals is disconnected. Relay BZ will not operate during the first impulse of relay A and should the digit "9" dialled the NPA springs operate.

NPA springs operating,

NPA1 disconnects relay FT from the H wiper.

NPA2 prepares the NU Tone circuit.

The selector drives to the 11th step and the S springs operate to cut the rotary drive and return NU Tone to t e calling ex tension.

(D) All Outlets Busy

If all the outlets on the level dialled are busy, the selector will continue to step until the 11th step is reached and the S springs will operate.

S springs operating,

S1 operates relay FT to cut the rotary drive circuit.

S2 connects lust' tone to the calling extension.

(E) Normal Release

When the calling extension replaces the telephone instrument, or in the case of an extension to extension call if the called extension is the first to replace the telephone instrument, the earth is removed from the H wiper.

Relays H and K release and the hold circuit for relays LS and c0 in the extension line circuit is disconnected,

Relay K releases,

K1 busies the start chain circuit via N1 springs during the release of the selector.

K2&K3 disconnect the calling extension's line from the selector.

Relay H releases,

H1 connects the release earth to the rotary magnet.

The selector returns to its normal position and when this is reached, the N springs restore.

N1 disconnects the busy loop on the start chain.

N2 disconnects the rotary magnet circuit.

The group selector is now available for further calls.

(F) Forced Release of Selector

If the group selector is seized by a faulty line or by an extension that fails to dial, relays A, B and K are operated as described in para. (A). Relay BZ is connected to the 'A' Pulse lead. After a period of up to 29 seconds, relay BZ operates.

Relay BZ operating,

BZ1 provides a holding circuit for relay BZ.

BZ2 connects relay H in series with the Z pulse lead.

The Z pulse appears approximately 30 seconds after the 'A' pulse and if by this time the N springs have not operated, relay H operates,

Relay H operating,

H2 disconnect relay A from the extension line. H`3

H5 holds relay H in parallel with relay K to the earth on B2 contact,

H7 disconnects the vertical magnet from relay CD.

Relay A releasing,

A1 releases relay B.

Relay B releasing,

B2 disconnects the holding circuits of relays K and H and removes the earth from the HF lead to the extension line circuit. The faulty extension line circuit is locked in the PG condition.

B5 disconnects the earth from the ringer start lead.

B6 releases relay BZ.

The group selector is now available: for further calls

(G) Release from the Lamp Lighting Circuit when the Manual Board Operator Answers the Call.

The holding circuit on the H lead from the lamp lighting circuit consists of a 50 ohm earth in parallel with a 300 ohm battery. This combination, together with the network formed by the LS and CC relays in the extension line circuit which is connected to the incoming HF lead, form three arms of a bridge circuit whose detector is the group selector K relay. The K relay holds until the operator plugs into the calling extension's jack. The 70 ohm earth applied by the sleeve of the cord circuit constitutes the fourth arm of the bridge which is now overbalanced. and causes a reversal of current in relay K. Relay K releases and disconnects the holding circuit of relay H. The group selector and lamp lighting circuit are then released from the connexion.

4. FACILITIES NOT COVERED BY THE CIRCUIT DIAGRAM NOTES

(1) Dialling a Spare Level (other than Level 1)

When a spare level is dialled a free testing condition on the "H" lead is indicated by the presence of a 250 ohm battery from the spare level circuit. Relays FT and H operate in the usual way and extend a loop condition into the spare level equipment. An earth is returned from the spare level equipment over the "H" lead to hold relays H and K, and N.U. tone is returned to the caller from the spare level equipment.

The foregoing explanation also applies if the selector is used as an "Incoming Selector" associated with an inter-switchboard line.

(2) Dialling Level 1

Relays FT and H operate to the 250 ohm battery on the "H" lead from the spare level circuit but since the -ve and +ve trunks to the spare level equipment are not connected no holding earth is returned from the spare level equipment to hold relays H and K in the 1st Selector. Relays H and K will release and the selector will self-drive out of level 1 and return to the "Home" position. The vertical magnet is safeguarded against false impulses during the return motion by the release of contact K5.

If an extension caused the selector to step to level 1 then the extension line circuit will revert to the P.G. condition. If the selector is being used as an "Incoming Selector" associated with an Inter-switchboard Line then the caller will revert to dialling tone.

5. DESIGN DETAILS

The reasons for the use of slow to release relays are as follows:

Relay B To enable it to retain during impulsing. The slow release feature is obtained by short-circuiting the relay via the break contact of A1.

Relay CD To enable it to retain during impulsing. (It must also release during the inter-digital pause). The slow release feature is obtained by shunting the relay.

Relay BZ To ensure that relay BZ does not release during the transit time of CO4 contact.

Relay ST To ensure that the operate circuit of relay K is not disconnected before its hold circuit is prepared.

Relay K To ensure that it holds during the release of ST5 and 7 contacts. The slow release feature is obtained by shunting the relay with its 5n0 ohm non-inductive winding.

The reasons for the use of a high speed relay is as follows:

Relay FT To ensure an improved linefinder cut drive circuit. This relay is designed so that if two linefinders should test a calling extension's line simultaneously, the two F'1 relays will not operate in parallel. The linefinders each complete a further revolution and the first linefinder to reach the calling extension's contacts will busy the circuit.

The FT relay is also used to cut the rotary drive of the selector. By using a high speed relay, the selector is positioned on a free outlet and relay H is extended to the 250 ohm battery on the H wiper, before the busying earth' is returned from the seized apparatus.

Resistor R1 limits the current through the operate circuit of relay FT and ensures that it will only operate to a 250 ohm battery. Prevents double switching.

R3 limits the current through relay FT when the S springs operate.

R5 limits the current through the tone winding of relay A.

6.

HISTORY

Issue A. Test Jack 5 shifted.

Issue B. NPA springsets rearranged. C. TJ9-10 Added in "L" lead.

Issue 1

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END OF DIAGRAM NOTES