

DIAGRAM NOTES

concerning

DIAGRAM GBW.14650

titled

20 LINE P.A.B.X. - CONNECTING CIRCUIT1.0 GENERAL.

The circuit consists of an eight bank uniselector having 25 outlets per bank, used as a final selector, together with an additional uniselector used as a line finder.

On inter-extension calls, the calling line is found by the line finder, and connection is made to the called extension via the bank contacts of the connecting uniselector. On exchange line calls, the connecting circuit routes the call to the exchange line circuit and releases when the exchange line circuit has been seized.

When '0' is dialled the circuit routes the call to the attendants cabinet.

2.0 FACILITY SCHEDULE.

Provision is made for:-

1. Finding and seizing the calling extension.
2. Applying a low resistance earth to the HF lead to guard the extension against intrusion, and to hold the extension line circuit.
3. Busying the connecting circuit start chain.
4. Connecting a start condition to the Ringing Start and Alarm Circuit.
5. Returning dial tone to the calling extension.
6. Stepping the connecting uniselector under control of the dialled impulses.
7. Returning busy tone if the called extension is engaged.
8. Applying ringing to a free called extension and returning ring tone to the calling extension.
9. Extending start conditions to the exchange line circuit when the digit '1' is dialled, and to the Attendant's circuit when the digit '0' is dialled.
10. Release of the connecting circuit when a call is connected via an exchange line circuit.
11. One extension to be parked on an '0' level call, if attendant is already engaged on a similar call.
12. Last party release of the circuit but enabling the first party to completely clear.
13. Any extension to answer an incoming exchange line call by dialling the digit '2', when on night service.
14. Extending an alarm to the attendant if an extension goes P.G.
15. Access to the circuit for testing with Routine Test Set GBW.13290.

3.0 CIRCUIT DESCRIPTION.3.1 Outline.

When an extension lifts his receiver, a start condition is extended to the Pulse circuit, which in turn extends the start condition to a free connecting circuit. The line finder associated with the connecting circuit hunts for, and seizes the extension which is marked by a battery on the HF bank. The extension line circuit CO relay operates when the extension is seized and removes the LS relay from the line. Dial tone is returned from the connecting circuit and the extension may then dial the required number.

If the extension dials another extension, the connecting circuit functions as a final selector.

If the extension requires an exchange call, or the services of the attendant, the selector is stepped to the appropriate bank contact. A start condition is extended to the circuit required. In the case of an exchange line call, when the linefinder associated with that circuit finds the extension, the connection circuit is released, and is available for further use.

3.2 Detail.

3.2.1 Extension to Extension Call.

When an extension lifts his receiver, a start earth is extended from the line circuit via the Pulse circuit to the connecting circuit start chain In lead, which operates relay E via TJ13-14, N3 and K2.

Relay E operating.

- E4 locks relay E to start earth via hold lead against the disconnection of the earth on the start chain In lead.
- E5 operates relay A to 250 ohm battery via N5 contact.
- E7 further disconnects the start chain Out lead.
(The remaining contacts of relay E are ineffective at this stage).

Contact E4 ensures that the E relay is held to the start earth should the earth be disconnected from the start chain In lead.

Relay A operates relay B to the CS magnet battery via CD1 and R3 resistor.

Relay B operating

- B1 prepares an impulsing circuit for the CS switch.
- B2 completes the drive circuit of LF switch and prepares a battery circuit to operate relay K.
- B3 disconnects the ~~release~~ drive circuit via CS1 wiper and bank, lights the 'engaged' lamp LP1, in series with relay P in Pulse Circuit GBW.14710, and prepares a hold circuit for relay N. An alarm is extended to the attendant if the extension remains in the P.G. condition.
- B4 prepares the test circuit of relay FT.
- B5 prepares the test circuit for relay H, and an operate circuit for relay NR.
- B6 prevents premature operation of relay N.

The LF switch drives until the FT relay is operated by the battery marked contact on the HF bank. Relay FT operates, cutting the drive circuit of the LF switch, and removing the short circuiting earth on relay K, thereby allowing it to operate.

Relay K operating.

- K1) extend the -ve and +ve lines to the A relay.
- K3))
- K2 opens the hold circuit of relay E from hold lead, thereby releasing relay E, and prepares to extend the start chain to the next selector.
- K4 prepares hold circuit for relays H and F.
- K5 prepares to return dial tone to caller via tone coil of relay A.
- K6 prepares alternative operate circuit for relay E.
- K7 further prepares impulsing circuit for CS switch and operating circuit for relay CD.
- K8 prepares an operate circuit for relays N and G, and a hold circuit for relay NR.

The release of relay E breaks the original operating circuit of relay A, leaving it held to the extension's loop, returns dial tone to the caller, completes the start chain to the next connecting circuit and further disconnects the hold lead.

The extension now dials the first digit and upon the first release of relay A, relay CD operates in series with the CS switch magnet.

Relay CD operating.

- CD1 disconnects 500 ohm operate battery of relay B.
- CD2 prevents premature operation of relay NR.
- CD3 further prepares an operate circuit for relay NR.
- CD4 operates relay N to earth at K8.
- CD5 prevents premature operation of relay E.

Relay N operating.

- N1 further prepares operating circuit for relay E.
- N2 disconnects dial tone circuit.
- N3 closes alternative start chain circuit to next connecting circuit.
- N4 further disconnects drive circuit for LF switch.
- N5 maintains disconnection of the operate circuit for relay A when E relay operates at a later stage.
- N6 locks relay N to earth at B3, extinguishes the engaged lamp and releases relay P in the Pulse Circuit (GBW.14710).

During impulsing, relays B and CD are held to the short circuit applied by contact A1. At the end of the dialled impulsing train relay CD releases.

Relay CD releasing.

- CD1 re-connects the 500 ohm hold battery for relay B.
- CD2 operates relay NR if a "barred direct access" extension dials the digit '1'. (See 3.2.7).
- CD4 applies earth to CS2 wiper thereby operating relay NR if any non-equipped level is dialled, or operates relay DF if the digit '7' is dialled, or drives the CS magnet to operator's "camp on busy" line if the digit '0' is dialled, or operates relay G if the digits '1' or '2' are dialled.
- CD5 operates relay E.

Relay DF operating.

- DF1 prevents premature operation of relay NR.
- DF2 applies an earth to outlets 2 to 13 of CS1 bank.
- DF3 provides locking circuit for relay DF.

If the digit '8' is dialled the CS switch is stepped to outlet 3 and remains there until the second digit is dialled.

If the digit '7' is dialled relay DF operates and the CS switch is stepped to outlet 4 and is then driven, via its self-interrupters, to outlet 14 from earth at B3 via N6, DF2, outlets 2-13 of CS1 bank, CS1 wiper and hence to CS switch, the switch remaining there until the second digit is dialled.

Relay E operating.

- E1 prepares operating circuit for relay NR.
- E2 closes alternative operate circuit for relay CD and CS switch.
- E3 removes short circuit on relay H and further prepares test circuit.
- E6 not effective.
- E7 not effective.

The second digit is now dialled. At the first impulse CD re-operates and at CD3 completes a circuit to operate relay NR.

Relay NR operating.

- NR1 further prepares test circuit of relay H.
- NR2 holds relay E whilst relay CD is operated.

- NR3 prepares to apply busy or ring tone to the tone coil of relay A.
- NR4 earths ring start lead.
- NR5 opens original operating circuit of CD and CS switch, and prepares to short circuit relay CD.
- NR6 locks relay NR to earth on K8, and releases relay DF, the contacts of which perform no function at this stage.

At the end of the impulse train relay CD releases. With relay NR operated and relay CD released, the circuit for relay E is disconnected and it releases slowly. During the release time of relay E, the called extension's H lead is tested. If the line is free, relay H operates from the B5 earth to battery from the called extension's line circuit CO relay.

Relay H operating.

- H1 prepares to lock relay F.
- H2 prepares ring tone circuit to tone coil of A.
- H3 applies ringing to called extension's -ve line via the F relay.
- H4 connects ring return lead to +ve line.
- H5 holds relay H on its holding winding via F6 to earth on K4.
- H6 disconnects the impulsing circuit from the CS switch.
- H7 applies busying earth to called extension 'H' lead.
- H8 opens the self drive circuit of CS switch.

Relay E releasing.

- E2 short circuits relay CD.
- E3 short circuits test winding of relay H.
- E5 applies ring tone to the tone coil of relay A.

When the called extension answers relay F operates to the line loop.

Relay F operating.

- F1 removes ring tone from calling extension's line.
- F2) remove ringing and ring return leads, and operate relay D
- F3) to the called extension's loop.
- F4 removes short circuit on locking winding of F.
- F5 disconnects the earth on the ring start lead.
- F6 provides alternative hold circuit for relay F.

Relay D operating.

- D1 completes alternative hold circuit for relay H.
- D2 not effective.
- D3 provides alternative hold circuit for relay N.

Conversation may now take place.

3.2.2 Call to an engaged extension.

The circuit functions are as for "call to a free extension" but when relay H tests an earth will be found on the H lead and relay H will not operate during the release of relay E. Busy tone is therefore connected to the tone winding of relay A via the unoperated contact H2 on release of relay E.

3.2.3 Release.

1. Calling extension clears first.

When the calling extension clears by replacing his receiver the loop holding relay A is disconnected thereby releasing it. Relay A releases relay B.

Relay B releasing.

- B1 disconnects impulsing circuit for CS switch.
- B2 opens holding circuit of relay K thereby releasing it.
- B3 applies an earth to all outlets except home position on CS1 bank, and applies an earth to light the engaged lamp LP1 in series with relay P in GBW.14710. If the called party, after a given time has not cleared an alarm is extended to the attendant.
- B4 opens holding circuit for relay FT thereby releasing the relays and relay CO in calling extension's line circuit.
- B5 not effective.
- B6 ensures that relay N is held operated until the CS switch has "homed".

Relay K releasing.

- K1) disconnect the -ve and +ve lines from the A relay.
- K3)
- K2 not effective.
- K4 disconnects alternative holding circuit for relays F and H.
- K5 disconnects tones from tone winding of relay A.
- K6 further disconnects operating circuit for relay E.
- K7 further disconnects impulsing circuit for CS switch.
- K8 releases relay NR - not effective.

The calling extension's line circuit is now released from the connecting circuit, but the latter is still held as the called extension's loop is holding relay D. When the called extension clears relay D releases and in turn releases relay H. The driving circuit of the CS magnet is now completed at H8 from earth at B3 via wiper and bank of CS1. The CS switch drives to the home position and the connecting circuit is ready for further use.

2. Called Extension clears first.

When the called extension clears first by replacing the receiver the loop holding relay D is disconnected thereby releasing it.

Relay D releasing.

- D1 releases relay H.
- D2 applies an earth to light the engaged lamp LP1, in series with relay P in GBW.14710. If the calling party, after a given time has not cleared an alarm is extended to the attendant.

Relay H releasing removes the earth from the H lead and thus releases the called extension's line circuit CO relay. The line circuit is therefore freed for further use. The connecting circuit is still held by the calling extension's loop holding the A relay. When the calling extension clears, relay A releases followed by B, and at B3 the driving circuit of the CS switch is completed and the switch returns to the home contact.

3.2.4 Extension dials a non-working first digit.

The non-working digits are '9', '6', '5', '4' and '3'. If the extension inadvertently dials any of these numbers as the first digit, a circuit is completed to operate the NR relay from earth at K8 via NR6, DF3, CD4, Wiper and Bank CS2 to relay NR. Relay NR operates and at NR3 connects "busy" tone to the calling extension. When the calling extension clears the circuit is released as described in 3.2.3.

3.2.5 Extension to Main exchange call.

The extension makes an exchange line call by dialling the digit '1'. The circuit operates as described for the first digit in par. 3.2.1. The CS switch is stepped to contact No. 10 and the earth from K8 is fed via relay G, E6, wiper and bank contact No. 10 of CS8 to the AS relay in the Misc. Circuit. Relays G and AS operate. G operating connects an 1150 ohm battery to the J wiper and bank contact of the EF switch. The operation of the AS relay in the Misc. Circuit causes a start circuit to be completed for the exchange line circuit finder, which hunts until the battery marked contact on the J bank of the EF switch is found. The exchange line circuit now returns an earth via the HF bank and wiper of the LF switch which short circuits relay FT and causes it to release. Relay FT releasing short circuits relay K which releases. K relay releasing breaks the loop holding relay A which releases followed by relay B. The release of relay B completes the drive circuit of the CS switch magnet and the switch returns to the home contact leaving the calling extension connected to the exchange line circuit.

3.2.6 Exchange line busy.

If the exchange lines are busy, an earth will be found on the line finder ED lead and therefore on CS6 contact No. 10. This earth will operate NR via wiper and bank contact No. 10 of CS6. Busy tone will be connected to the calling extension at NR3. When the extension clears the circuit releases in the manner previously described.

3.2.7 Extension barred direct access.

An extension barred direct access has an earth connected to the ED lead. The circuit therefore operates exactly as described in 3.2.6.

3.2.8 Extension calls attendant.

The extension calls the attendant by dialling '0'. The circuit operation is as described in 3.2.1 for the first digit. The CS switch is stepped to contact No. 11 and a drive circuit is established from earth at K8 via wiper and bank contacts of CS2, wiper lead D of CS1 to the magnet of CS. As the bank contacts 11 to 24 of CS2 are strapped the CS switch drives over its self-interrupters until contact 25 is reached. At the end of dialling relay CD releases and at CD5 completes the circuit to operate relay E. The testing circuit for relay H to the 'OLW' lead on the 25th contact of CS5 bank from the earth at B5 is now complete. Relay E operating also completes a circuit to operate relay NR from earth at K8 via NR6, DF3, CD4, CS2 wiper and bank contact No. 25 and E1 to a-b winding of NR. NR operates and at NR2 breaks the operating circuit of E. Relay H tests the attendant's line circuit during the release time of E. If the attendant's line circuit is free relay H operates in series with the KA relay in the attendant's line circuit and ring tone is returned to the caller. Relay KA completes a circuit which causes the Line lamp to flicker. On the attendant operating the '0' level key (KO) to answer the call, relay SA in the attendant's line circuit is operated. A contact of this relay completes a circuit which returns an earth via the 'DM' lead to the 25th contact of CS7, CS7 wiper, H6, B1 to the CS magnet, causing the magnet to energise. Relay SA operating, causes another relay, relay SB, in the attendant's line circuit to operate. Relay SB breaks the energising circuit of CS switch which immediately steps to contact No. 1. Contacts of the SB relay connect the lines, via wipers and banks of CS3 and CS4 to the attendant's loop and operate relay F which trips the ringing and connects the extension to the attendant.

3.2.9 Attendant busy.

When the attendant is engaged, the circuit operates in the same manner as described in 3.2.8 to the point of operation of relay KA. Relay KA operates, but as the attendant's SA and SB relay are already operated to an existing call, there is no circuit to energise the CS magnet. The operation of H earths the H lead to prevent another connecting circuit testing to the 'OLW' lead. A contact of SB connects flicker to the 'call waiting' lamp via

a contact of relay KA. When the attendant finishes the existing call, the '0' level key (KO) is restored thereby releasing relay SA which releases relay SB. The release of relay SB extinguishes the 'call waiting' lamp and lights the '0' level line lamp. The operator re-operates the '0' level key (KO) and the call proceeds as described in 3.2.8.

3.2.10 Night Service.

A night service call from the main exchange may be answered by any extension, barred or otherwise.

To answer a night service call, an extension lifts his receiver and dials the digit '2'. The connecting circuit is seized as previously described, and the CS switch is stopped to contact No. 9. On bank CS8 this contact is connected to the 'night service start', and in the misc. circuit this lead is connected to the BS relay. Earth from K8 operates relay G and relay BS in series via NR6, DF3, CD4, G relay, E6 (the E relay having operated at the end of dialling, on the release of CD) CS8 wiper and bank contact 9, and the 'night service start' lead. The circuit now proceeds to operate as described in 3.2.5, the BS relay carrying out the same functions as the AS relay.

See GBW.14720 for Night service extension line working.

END