

P.B.X. SYSTEMS
P.B.X. NO. 740A, 740B OR 740C
SELECTOR CONNECTOR CIRCUIT
REGULAR
ARRANGED FOR RESTRICTED SERVICE AND
FOR COMPLETING INCOMING TRUNK CALLS

CHANGES

B. CHANGES IN APPARATUS

B.1	Superseded	Superseded By
	"Z" Apparatus Contact Protection	Network (A) "V" Apparatus

D. DESCRIPTION OF CIRCUIT CHANGES

- D.1 Reissued to show new contact protection network unit.
- D.2 Circuit note 108 has been added.
- D.3 Circuit note 101 has been changed, it formerly read:
"Provide one 2 amp. fuse for each ckt."

All other headings under "Changes", no change.

1. PURPOSE OF CIRCUIT

- 1.1 This circuit is used as a regular selector on certain levels, and as a regular connector on other levels.

2. WORKING LIMITS

- 2.1 Station maximum external circuit loop resistance 400 ohms.
- 2.2 Station minimum insulation resistance 20,000 ohms.

3. FUNCTIONS

- 3.01 Whenever the dial tone or the busy tone is required, to start the common apparatus which develops these tones.
- 3.02 To furnish dial tone to the calling station.
- 3.03 To apply ground to the sleeve lead for holding the line finder through which the call comes.
- 3.04 To operate a permanent signal alarm whenever the switch is seized and dialing does not proceed within a short interval.

- 3.05 To act as a selector on certain levels, so as to select tie lines or trunks associated with these levels.
- 3.06 To furnish an audible busy signal to the calling station if all trunks or tie lines in a group are busy.
- 3.07 To refuse trunk connection and to furnish an audible busy signal to the calling station, if the latter is a restricted line and attempts to dial a trunk wired to a restricted level.
- 3.08 To act as a regular connector on certain levels so as to connect with station lines in those levels.
- 3.09 To furnish an audible busy signal to the calling station if the called line is busy.
- 3.10 To ground the start lead so as to start the ringing interrupter circuit or the ringing machine.
- 3.11 To supply interrupted ringing current to the called station.
- 3.12 To furnish ringing induction tone to the calling station during ringing.
- 3.13 To trip machine ringing when the receiver is removed from the switchhook at the called station.
- 3.14 To provide a talking path and to supply talking battery to the called and the calling station.
- 3.15 To place a busy condition on the sleeve of the called line.
- 3.16 To restore to normal when the receiver is replaced on the switchhook at the calling station.
- 3.17 To discriminate between station-originated and tie line or trunk-originated calls, and in the latter case to remove the battery feed and to cut through the tip and ring when the call is answered.
- 3.18 On connections set up from a trunk which is equipped for night service, to provide means for tripping the ringing over a special lead.

4. CONNECTING CIRCUITS

- 4.1 Line Finder Circuit.
- 4.2 Tone, Ringing and Alarm Circuit.
- 4.3 Test Line Circuit.
- 4.4 Test Set.
- 4.5 Trunk Circuit.

4.6 Tie Line Circuits (740A PBX Only).

4.7 Station Line Circuits.

4.8 Power Ringing Circuit.

DESCRIPTION OF OPERATION

5. STATION TO STATION CALL

5.1 Seizure

When a line finder hunts for a calling line and then cuts through, relay (A) operates over the calling station loop, operating relay (B). Relay (B) grounds lead "S" through the low resistance winding of relay (Z), to hold the line finder, operates relay (D), grounds the start lead "ST" prepares a ground circuit for the permanent signal lead and prepares the vertical pulsing circuit. Relay (D) in operating closes the permanent signal circuit, and extends the pulsing circuit through the winding of relay (C) to the vertical magnet. Relay (Z) operates from battery over the "S" lead and locks to the (B) relay. Relay (Z) opens the ground circuit extending from the sleeve lead to contact 11 of relay (F) "X" wiring and the ground circuit extending to a contact of relay (E), so as to prevent certain operation of the circuit described in section 8.1. The (Z) relay also connects ground to a contact of relay (H) so as to give the latter control over the release trunk lead as described in section 6 and opens ground to contact 11 of relay (F). The purpose of springs 3 and 4 of relay (Z) is described in section 8.2. Relay (Z) is the discriminating relay by which the switch distinguishes between calls originated from stations and those originated from the trunks or tie lines.

Dial Tone is transmitted to the calling station from the "DT" lead through the grounded winding of relay (A).

5.2 Selection

At each interruption of the dial, relay (A) releases and operates the vertical magnet in series with relay (C), the latter operating on the first impulse. The vertical magnet steps the brushes to the desired level. Relays (B) and (C) are slow in releasing, and hold during dialing. On the first step of the switch the off-normal springs (V.O.N.) substitute direct ground for dial tone on the winding of relay (A) and transfers the pulsing circuit to the locking springs of the (C) relay. When the impulses from relay (A) cease, relay (C) releases and transfers the pulsing circuit from the vertical magnet to the rotary magnet, in parallel with the winding of relay (E). On the next series of interruptions from the dial relay (A) releases and operates

the rotary magnet, relay (E) operating on the first impulse. Relay (E), like relay (C), is slow in releasing so as to hold operated during dialing. The rotary magnet steps the shaft and brushes around to the terminals of the called line. During this time, relay (E) prepares the busy test circuit and short-circuits the contacts of relay (G), through which the rotary circuit extends. This is done so that the operation of relay (G), occurring while the sleeve brush is passing over busy contacts, will not open the rotary magnet circuit.

5.3 Testing - Idle Line

On the completion of the dial interruptions of the last digit, slow release relay (E) remains operated for a short interval after the brushes make contact with the terminals of the called line. During this time a busy test is made by relay (G). If the line is idle, relay (G) remains normal. On the release of relay (D), relay (K) energizes through its "P" winding in series with the cut-off relay of the called line. Relay (K) operates sufficiently to close its 1T and 2T contacts, whereupon the "S" winding is energized and the relay fully operates. Relay (K) having operated, opens the permanent signal circuit, closes the tip and ring of the called line through to relay (F); opens the rotary magnet and (E) relay circuits, closes the circuit of ring back condenser (A), and connects direct ground to the sleeve terminal for the purpose of operating the cut-off relay in the called line. This same ground places a busy condition on the sleeve terminal in the multiple bank.

5.4 Testing - Busy Line

If the called line is busy, a ground from the "S" bank terminal operates relay (G) before the release of relay (E). When relay (E) releases, relay (G) is locked up from ground at relay (B) to battery through the release magnet. Busy tone is now supplied to the calling station over the tip side of the line under control of relay (G). When a ringing machine is not used, the busy tone apparatus is started by battery through the 1300 ohms winding of relay (F), and one of the 200 ohm windings of relay (J). The busy tone start relay is of sufficiently high resistance to prevent operating either relay (J) or (F).

5.5 Ringing

Ringing current is supplied to the called line through the P winding of relay (F). Condenser (A) is provided to bypass tone to the calling subscriber after it passes through the tripping winding of relay (F), and to conduct it to the ring lead. When the called station answers, relay (F) operates sufficiently to close its #2 contact. The relay then

fully operates on its "S" winding, at the same time supplying ground to the "R" winding of relay (J). Relay (F), in operating, disconnects ringing current, short-circuits condenser (A) and closes the talking circuit.

5.6 Talking and Release

Talking battery is now supplied to the calling station thru the windings of relay (A) and to the called station thru the windings of relay (J). The connection is controlled by the station.

When the receiver at the calling station is replaced on the switchhook, relay (A) releases and de-energizes relay (B). Relay (B) next releases, releasing relay (D) which closes the circuit of the release magnet. The latter operates, closing the release magnet alarm circuit and causing the switch to return to normal. When the switch is returned to its normal position, the release magnet circuit is opened by the off normal springs.

6. OUTGOING CALL TO TRUNK

6.1 Seizure and Dialing

When the calling subscriber dials the switch to a trunk level, normal post springs "1L" and "2L" close and operate relay (J) in series with the protecting resistance wound on relay (H). Relay (J) opens the rotary pulsing circuit and causes relay (G) to operate and lock. The release of relay (C) at the end of vertical pulsing closes a rotary stepping path through front contacts of relays (G) and (J) to ground on normal post spring "1L" and "2L". The rotary magnet n. energizes, as usual, and on the first step opens its interrupter springs to release relay (G). The release of relay (G) de-energizes the rotary magnet. If the first trunk is busy, relay (G) reoperates from ground on the sleeve terminal and again closes the energizing path for the rotary magnet. The latter steps the switch in this manner until an idle trunk is reached, whereupon relay (G) fails to reoperate and relay (E), which has been holding in the usual manner during rotary stepping, releases. The release of relay (E) energizes the "P" winding of relay (K) over the sleeve terminal to battery through a resistance in the trunk circuit. Relay (K) now operates and locks in the usual way and performs its customary circuit functions as described in section 5. In addition, relay (K) operates relay (H) with ground supplied from normal post springs "1L" and "2L". Relay (H) having operated, disconnects the ringing current, removes battery feed relay (J) from across the called trunk, disconnects relay (A) from across the calling line, connects the calling station loop directly through to the trunk and grounds lead "S" to hold the connection after relays (A) and (B) release. A relay in the trunk circuit operates over the loop of the

calling station and in turn causes a second relay to operate and ground the sleeve brush "S" so as to hold relay (H) operated after (B) releases. Relay (H) is thus held from the trunk, and it in turn holds the line finder.

6.2 Restoring to Normal After Trunk Call

When the calling subscriber hangs up after a trunk call, certain trunk relays release and remove ground from the sleeve brush. Relay (H) next releases and removes ground from the "S" lead, and relays (D), (K) and (Z) release. The release magnet now energizes and restores the switch to normal.

6.3 All Trunks Busy

When the switch is dialed to a trunk level in which all trunks are busy, the brushes are automatically rotated to the 11th rotary step. In this position a set of springs operate and connect busy tone to the tip of the calling line. The busy tone generating circuit then operates as described above. When the calling subscriber hangs up the switch restores in the usual manner.

6.4 Restricted Service

Contacts "1R" and "2R" of the normal post springs close when the switch is dialed to a restricted level. If the calling line is restricted, its line circuit is specially wired so that ground is connected through the line finder to restricted service lead "RS". This ground, carrier through contacts, "1R" and "2R" of the normal post springs, causes relay (G) to operate at each terminal just as though the terminal were busy. The switch, therefore, passes to the 11th rotary step and connects busy tone to the station as described in section 6.3. The 11th step springs also open the ground supplied to normal post springs "1R" and "2R", so as to prevent further action of the rotary magnet.

7. PERMANENT SIGNAL

The permanent signal circuit is grounded by relays (B) and (D) until relay (K) operates at the end of pulsing. A timing alarm arrangement, which forms part of the Tone, Ringing and Alarm Circuit, is thus started, and if dialing is not completed within the required interval a permanent signal alarm is given.

8. INCOMING CALL FROM TRUNK

8.1 Discrimination

When a line finder hunts for a trunk which is originating a call, ground is fed forward on the "S" lead to prevent the operation of relay (Z) when relay (B) operates. Ground is thus withheld from the contacts of relay (H), which ordinarily

ly serves to ground the release trunk lead following the cut-through. Ground is also connected from the back contacts of relay (Z) to certain make contacts on relays (F and (H). Thus when the trunk called has been dialed by the attendant and ringing is tripped, tripping relay (F) in operating is enabled to operate cut-through relay (H). The latter opens the battery feed bridges and cuts through the talking circuit as usual, and at the same time it feeds ground forward to the sleeve brush so as to hold the line circuit after relays (A) and (B) release. Relay (H), however, does not ground the "S" lead under this condition. The purpose of the cut-through in this case is to supply the called station with battery from the trunk for transmission and supervisory purposes. The entire connection is thus held from the trunk, since lead "S" is grounded in the trunk and serves to control relay (D). Relay (D) in turn controls (F) and (F) controls (H). When the trunk is disconnected ground is disconnected from the "S" lead, releasing relays (D), (H), and (K). The release of relay (D) energizes the release magnet and the switch releases.

8.2 Ringing Trip on Night Connections

When night connections are set up from the trunk and through the line finder and selector-connector to a station, ground is fed forward from the trunk through the line finder to the "RS" lead, then through the contacts of relays (Z) and (K) to the winding of relay (H). Thus when the night connection is set up and the trunk Night Key is operated, ringing is prevented by immediately operating cut-through relay (H).

TEST JACK

The test jack allows the test man access to the switch for the purpose of making routine or other tests.

10. OPERATION WITH TIE LINE - 740A PEX ONLY

This circuit functions with tie lines as well as with trunks. The operation in the two cases is the same except that the tie line is not arranged for night connections.

BELL TELEPHONE LABORATORIES, INC.

DEPT. 3330

ABJ
WLF) JS