

P.B.X. SYSTEMS  
NO. 750A  
TONE, RINGING AND ALARM CIRCUITS  
AND COMMON TIMING CIRCUIT

CHANGES

D. DESCRIPTION OF CIRCUIT CHANGES

D.1 Tracing redrawn because of worn condition.

All other headings under "Changes," no change.

1. PURPOSE OF CIRCUIT

1.1 This circuit provides dial tone, busy tone, audible ringing tone, interrupter ringing current, a timing circuit for the trunk visual signals and audible and visual alarm signals for the 750A P.B.X.

2. WORKING LIMITS

2.1 Maximum conductor resistance of ringing leads to central office 650 ohms.

2.2 Maximum external circuit loop for (BY) relay 430 ohms.

3. FUNCTIONS

3.01 To provide dial tone.

3.02 To provide line busy tone.

3.03 To provide all trunks busy tone.

3.04 To provide all links busy tone.

3.05 To provide audible ringing tone.

3.06 To interrupt continuous ringing current from the central office and to furnish interrupted ringing with silent period battery to the link circuits.

- 3.07 To give an audible and visual alarm when a circuit fuse operates.
- 3.08 To give an audible and visual alarm when there is trouble in the power circuit.
- 3.09 To extend the alarms to the central office when required.
- 3.10 To cut off the audible alarm signal manually.
- 3.11 To provide means to hold the trunk circuit visual signals operated during the silent interval of central office, machine ringing and to release them if the call is abandoned.
- 3.12 Provides for flashing the trunk lamps on incoming calls.

#### 4. CONNECTING CIRCUITS

- 4.1 750A P.B.X. line and link circuit.
- 4.2 750A P.B.X. trunk circuit.
- 4.3 750A P.B.X. station circuit.
- 4.4 750A P.B.X. power circuit.
- 4.5 Alarm circuit at central office.
- 4.6 Central office continuous ringing supply.

#### DESCRIPTION OF OPERATION

#### 5. RINGING AND TIMING CIRCUIT - FIGURE 1

When a link circuit connects ground to the "RS" lead relay (B) operates in series with the (B) and (D) resistances to battery under control of the (A) relay. The same ground also operates relay (R) through break contacts of relays (Z1) and (W2) to provide immediate ringing and audible ringing to the link circuit. Relay (B) operates relay (A). Relay (A) operated reverses the current through the (B) relay releasing it and the cycle is then repeated until the start ground is opened. When the (A) relay first operates it operates relay (W). On the release of relay (A), relay (Z) operates. The second time relay (A) operates it releases the (W) relay which operates the (W1) relay. When the (A) relay releases the second time, it releases the (Z) relay which operates the (Z1) relay. Relay (Z1) releases relay

(R) which opens the ringing from the link and closes tripping battery for the duration of the silent period. The third operation of the (A) relay reoperates the (W) relay. On the third release of relay (A) the (Z) operates and on the fourth operation of relay (A), the (W) relay releases releasing the (W1) relay and operating the (W2) relay which holds the (R) relay circuit open. The fourth release of the (A) relay releases the (Z) and (Z1) relays operating the (Z2) relay. The fifth operation of the (A) relay operates relay (W) and with (Z2) operated (W1) operates. The fifth release of relay (A) operates relay (Z) and (Z1). The sixth operation of relay (A) releases relay (W), relay (W1) and relay (W2). The sixth release of relay (A) releases relay (Z), (Z1) and (Z2). With (Z1) and (W2) released the (R) relay again operates to connect ringing to the link circuit. The same cycle of operation will be repeated, relay (R) operating and releasing to supply interrupted ringing current and audible ringing tone to any link as long as ground is connected to the "RS" lead. If "W" apparatus and wiring is used the operation and releasing of the (A) relay operates and releases the (LF) relay which flashes the trunk lamps on incoming calls. The (AR) vacuum tube is used to provide the audible ringing tone. The function of holding a ground on the "LK" lead to the trunk during the ringing as silent periods of central office machine ringing in order to keep the trunk lamps functioning is accomplished as follows:

During the ringing period ground is connected to the "R" lead by the trunk circuit operating relay (LK). Relay (LK) operated operates subset (B) to indicate that a trunk is being called, connects ringing current to the M & N leads which connects to the trunk circuit, which will, in conjunction with the operation of a relay in the trunk circuit operate the bells associated with that trunk and opens the operating and locking circuit of the (W2) and (W4) relays. Ground is also connected to the "R1" lead by the trunk circuit but this ground is ineffective at this time. Ground is connected to the "ST" lead by the trunk circuit which starts the interrupter circuit relays (A) and (B) which function as previously described. Ground from the back contact of relay (Z4) to the "LK" lead holds the relay and lamp in the trunk locked. At the end of the central office ringing period relay

### 6.3 Trunk Busy

When a station selects a busy trunk ground is connected to the "BT" lead from the trunk circuit to operate the (BY) relay which operates the (T1) relay. The (T1) relay then starts the tone relay and interrupter circuit as described above to supply busy tone through the (A) condenser to the trunk circuit over the "BT" lead.

### 6.4 All Links Busy

When all links become busy ground is connected to the (LB) relay over lead "LB" operating the relay. Relay (LB) operated connects ground to the (T1) relay and busy tone is supplied as before through the (D) condenser to one winding of the (A) repeating coil. The tone is then induced in the other winding and connected to the line circuits over lead "LC".

## 7. ALARM CIRCUIT - FIGURE 3A

### 7.1 Circuit Fuse Alarm

#### Link Circuits

The link circuit fuses are equipped with separate alarm posts instead of a common alarm bar. When a link fuse operates battery is connected thru a protector to the "F1", "F2", "F3" lead according to which fuse has been operated, in order to operate a relay in the link circuit which will take the link out of service. Battery will be closed through this relay in the link back over the "AL" lead to this circuit to operate the (F) relay. Relay (F) operated lights the (F) lamp to give a visual alarm and operates the alarm bell which connects leads "WCT" and "WCR" together in order to give an alarm to the central office.

If a fuse in lead "F1", "F2" or "F3" operates after the corresponding link fuse, battery will be connected to the (F) relay, operating it and giving an alarm.

The (A) key is provided in order that the alarm bell may be silenced but the alarm lamp will remain lighted and the alarm leads to central office will remain closed until the fuse is replaced. Battery for the lamps and bell are provided from the power circuit over the "BB" lead.

### 6.3 Trunk Busy

When a station selects a busy trunk ground is connected to the "BT" lead from the trunk circuit to operate the (BY) relay which operates the (T1) relay. The (T1) relay then starts the tone relay and interrupter circuit as described above to supply busy tone through the (A) condenser to the trunk circuit over the "BT" lead.

### 6.4 All Links Busy

When all links become busy ground is connected to the (LB) relay over lead "LB" operating the relay. Relay (LB) operated connects ground to the (T1) relay and busy tone is supplied as before through the (D) condenser to one winding of the (A) repeating coil. The tone is then induced in the other winding and connected to the line circuits over lead "LC".

## 7. ALARM CIRCUIT - FIGURE 3A

### 7.1 Circuit Fuse Alarm

#### Link Circuits

The link circuit fuses are equipped with separate alarm posts instead of a common alarm bar. When a link fuse operates battery is connected thru a protector to the "F1", "F2", "F3" lead according to which fuse has been operated, in order to operate a relay in the link circuit which will take the link out of service. Battery will be closed through this relay in the link back over the "AL" lead to this circuit to operate the (F) relay. Relay (F) operated lights the (F) lamp to give a visual alarm and operates the alarm bell which connects leads "WCT" and "WCR" together in order to give an alarm to the central office.

If a fuse in lead "F1", "F2" or "F3" operates after the corresponding link fuse, battery will be connected to the (F) relay, operating it and giving an alarm.

The (A) key is provided in order that the alarm bell may be silenced but the alarm lamp will remain lighted and the alarm leads to central office will remain closed until the fuse is replaced. Battery for the lamps and bell are provided from the power circuit over the "BB" lead.

## Other Circuit Fuses

Other circuit fuses will have a common alarm bar and any of these fuses operated will connect battery to the (F) relay in order to cause an alarm as described in the previous paragraph.

## 7.2 Power Circuit Alarm

When a trouble occurs in the power circuit battery will be connected to the "PG" lead to operate the (P) relay in this circuit. Relay (P) operated lights the (P) lamp, operates the alarm bell and connects the "WCT" and "WCR" leads together to give an audible and visual alarm at the P.B.X. and an alarm at the central office. The bell may be silenced before the trouble is cleared by the operation of the (A) key but the lamp will remain lighted and the central office alarm will stay on until the trouble is corrected in the power circuit.

## 6. ALARM CIRCUIT - FIGURE 3B

When a link fuse operates, battery is connected through the (A), (B) or (C) fuse to the "F1", "F2" or "F3" lead according to which fuse has been operated. Battery will then be connected by the link circuit to the "AL" lead of this circuit, operating the (F) relay. The operation of the (F) relay, (a) lights the (F) lamp to give a visual alarm, (b) operates the (A) subset to give an audible alarm, (c) connects leads "WCT" and "WCR" together in order to give an alarm in the central office and (d) connects ground to the "CT" lead in order to start the ringing machine.

If the (A), (B) or (C) fuse in lead "F1", "F2" or "F3" operates after the corresponding link fuse has operated, battery will be connected to the (F) relay, operating it and giving an alarm.

The (A) key is provided in order that the (A) subset may be silenced. The operation of the (A) key operates the (CO) relay which locks under control of the (F) relay and disconnects ringing current from the subset. The alarm lamp will remain lighted and the alarm leads to central office will remain closed until the operated fuse is removed. Battery for the (F) lamp and the (CO) relay is provided over the "BB" lead.

If a fuse other than a link circuit fuse operates the (F) relay operates and functions as described above. If trouble occurs in the charge and discharge circuit, battery is connected to the "PG" lead and also causes the (F) relay to operate.

If the (D) fuse also operates no alarm is given.

BELL TELEPHONE LABORATORIES, INC.